Lower Yakima Valley Groundwater Management Program

Volume IV

Member Contributions

June 20, 2019

LOWER YAKIMA VALLEY
GROUNDWATER ADVISORY COMMITTEE

Member Contributions

Groundwater advisory committee members were given an opportunity to express differing opinions with aspects of this plan. Some members also chose to submit additional recommendations or information to be considered as the implementation phase begins. These are individual contributions and do not necessarily reflect the consensus or the opinion of the GWAC.

Specific questions related to the content or science of a minority report should be directed to the author of the minority report.

Research (Long List) of Health Problems Related to Nitrates

Compiled by Jean Mendoza

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Minority Report

Lower Yakima Valley Groundwater Management Area

Minority Report – December, 2018

Submitted by



To the Reader:

Everywhere in the world alfalfa enriches the soil by fixing and adding nitrogen - Unless you live in Yakima County.

According to the Lower Yakima Valley Groundwater Management Area (LYV GWMA) Report, alfalfa removes an average 236 pounds of nitrogen per acre per year from the soil, in our very special part of the world.

According to the LYV GWMA Advisory Committee (GWAC) the universally accepted laws of science do not apply to us. If the GWAC did not like the data we simply threw it out. The GWAC did not like the fact that nitrate levels in monitoring wells north of Outlook reached 160 mg/L, 180 mg/L or 234 mg/L (safe nitrate for drinking is < 10 mg/L) - so we ignored those samples.

The GWMA Plan, approved by a majority of the GWAC that included three major WA State agencies, is based on half-truths and outright falsehoods. It is a lesson in collusion and corruption.

Please read this Minority Report from the Friends of Toppenish Creek carefully. It is a best effort to relate the six year history of the Lower Yakima Valley Groundwater Management Area and to tell Washingtonians how $2.3 million tax dollars were spent.

Respectfully

The Friends of Toppenish Creek

Executive Summary

Friends of Toppenish Creek is a 501(C) 3 non-profit environmental group that has been part of the Lower Yakima Valley Groundwater Management Area (LYV GWMA) since the beginning in 2012.

> *Friends of Toppenish Creek is dedicated to protecting the rights of rural communities and improving oversight of industrial agriculture. FOTC operates under the simple principle that all people deserve clean air, clean water and protection from abuse that results when profit is favored over people. FOTC works through public education, citizen investigations, research, legislation, special events, and direct action.*

FOTC files this report because the LYV GWMA has failed to deliver on promises to reduce nitrates in groundwater. In 2010, according to *Lower Yakima Valley Groundwater Quality; Preliminary Assessment and Recommendations*, about 12% of wells in the LYV had nitrate levels above the safety standard of 10 mg/L. In the last round of GWMA sampling 20% of wells had nitrate levels above the standard.

Here are more specific reasons for a Minority Report:

1. The GWMA has not complied with the mandates in WAC 173-100-090(1) and WAC 173-100-100(6)

2. The dairy industry has maintained veto power over any and all GWMA actions. Advocates for dairy have controlled the agenda and marginalized other voices on the GWMA advisory committee (GWAC).

3. The GWMA leadership has failed to provide adequate research that is necessary in order for the GWAC to do the work. The GWMA has missed almost every deadline.

4. The GWMA gathered data and then, failed to analyze the data. The GWMA did no analysis of Deep Soil Sampling data, High Risk Well testing results, composting data, sampling of domestic wells and drains, or responses to a survey of public understanding.

5. GWMA contractors have not complied with the terms of their contracts. There were no consequences. A Nitrogen Availability Assessment was supposed to be the center piece of GWMA problem solving. It arrived 18 months late. The authors ignored bio-solids and waste water spray-fields, ignored the GWMA Deep Soil Sampling, ignored inputs from animals on pasture, ignored composting yards, failed to do a promised literature review and incorrectly stated that there is no leaching from alfalfa fields. They ignored nitrogen runoff to surface waters.

6. The GWMA has not addressed the impact of groundwater pollution on the health and well-being of the people who live in the Lower Yakima Valley. The GWAC has ignored Environmental Justice.

7. The GWMA has used up $2.3 million and left the program with no funds for implementation and no road map for how to obtain funds.

Background

In 2008 reporter Leah Beth Ward wrote a series of award winning reports entitled *Hidden Wells, Dirty Water* for the Yakima Herald Republic. Ward interviewed people who were afraid to drink water from their domestic wells and encountered difficulties when they went to authorities for information and assistance. She asked the U.S. Environmental Protection Agency (EPA) to investigate.

The EPA began sampling water in the area and convened meetings where residents and other stakeholders discussed ways to address the emerging problems. That group recommended formation of a GWMA and Yakima County asked to be designated as the lead agency in a 2011 *Request for Identification Lower Yakima Valley Groundwater Management Area.* Very few of the Goals and Objectives in that document have been achieved.

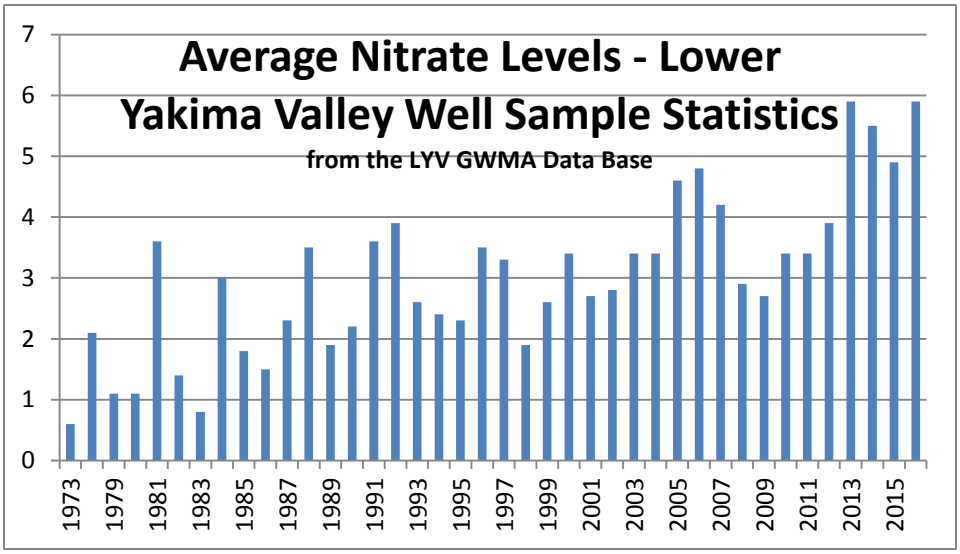
The Nitrate Problem

Nitrate contamination of groundwater is a world-wide problem that has grown over the last century due to an increasing population; man-made changes to the nitrogen cycle due to manufacture of chemical fertilizers; and an increase in confined animal feeding

operations. Washington State ranks 12th in the nation for the percentage of the land surface with groundwater nitrates > 5 mg/L. Nitrates pose a health risk to animals and to people, especially babies.

California, with severe water quality problems, spends millions of dollars every year on groundwater. There is no end in sight. In 2008 that state commissioned the University of California at Davis to study nitrates in drinking water. The LYV GWMA relied heavily on data from this comprehensive study while, at the same time, acknowledging that conditions in California and other impacted areas are different from those in the Yakima Valley.

In the Lower Yakima Valley the number of contaminated wells is increasing and the level of contamination is increasing. Here is a chart adapted from the GWMA Data Base that illustrates the trends:



(Since those readings are missing from the data base this graph does not include 2014 – 2016 well testing from a "dairy cluster" where 61% of domestic wells one mile down gradient had nitrate levels above the safety standard of 10 mg/L. and the highest reading was 234 mg/L.)

GWMA Actions

Early in the process the GWAC agreed upon the need for foundational work in order to analyze local issues. There was consensus on the importance of education and public outreach, a baseline survey of public understanding, an early Area Characterization, Deep

Soil Sampling, a Network of Groundwater Monitoring Wells, and a Nitrogen Loading Assessment.

Public Outreach: In 2013 Education and Public Outreach (EPO) created a public survey that was carried out by students from Heritage University. The EPO group worked with EPA's Pediatric Environmental Health Services Unit (PEHSU) on a program to inform new mothers in the valley about the risks from using well water to mix baby formula. The EPO group facilitated free well water testing for 460 homes, presented bi-lingual material at five health fairs, supported radio presentations in English and Spanish and purchased billboard space that advised people to have their well water tested.

Deep Soil Sampling: Deep Soil Sampling was performed in fall 2014, spring 2015, fall 2015 and spring 2016. Both Ecology and FOTC analyzed the data in 2017-2018 but these analyses were never shared with or accepted by the GWAC. For this data set FOTC found:

- There are differences between spring and fall deep soil testing results
- The range of values for alfalfa is huge and suggests a need for further study
- The range of values for hops is large and suggests a need for further study
- Over half of the fields planted in triticale are at medium to high risk for leaching nitrate to the groundwater
- Double cropping is associated with higher nitrate levels
- In this data set rill irrigation was more protective of the groundwater than sprinkler irrigation
- Application of liquid manure is significantly more likely to result in high nitrate levels than application of solid manures or commercial fertilizer.

High Risk Well Assessment: Between 2013 and 2016, on behalf of the GWMA, the Yakima Health District tested 460 domestic wells in order to better understand the prevalence of nitrate contamination of the aquifer. This High Risk Well study found:

- 59% of wells had nitrates from 0 to 5.0 mg/L
- 26% of wells had nitrates from 5.01 to 9.99 mg/L
- 15% of wells had nitrates from 10.0 to 35.0 mg/L

A survey of conditions at well sites that was supposed to accompany the High Risk Well Assessment was not completed.

Network of Monitoring Wells: Since 2013 the GWAC has studied plans for a network of purpose built monitoring wells. In January, 2017 the Pacific Groundwater Group signed a contract to oversee the installation of these wells. The county did not sign the contract until January, 2018. In early 2017 the U.S. Geological Survey signed a contract to sample those wells and test for nitrates. The terms of that contract have expired. As of October, 2018 there were no wells, no network and no plans for how to analyze the data if/when samples are collected. The GWAC discussed this topic over eight times during the past six years and repeatedly approved plans for groundwater monitoring.

Nitrogen Loading Assessment: The GWAC agreed on the need for a Nitrogen Loading Assessment, a mathematical approach to nitrogen balance in the target area, in order to determine the contribution from various sources and to prioritize response strategies. The Washington State Department of Agriculture (WSDA) and Yakima County agreed to complete an NLA for the GWMA with a due date of December, 2015.

The NLA did not arrive until April, 2017. By then it was renamed a Nitrogen Availability Assessment (NAA). WSDA and Yakima County did not follow the Scope of Work (SOW) for the study. Nitrogen inputs were missing for alfalfa fields, industrial spray fields, bio-solids and compost yards. Nitrogen runoff to the surface waters was ignored.

2017 Testing of Domestic Wells: Every two months during 2017 the USGS tested about 156 domestic wells and 24 agricultural drains in the target area on behalf of the GWMA. The data was shared with the GWAC but there was no evaluation. FOTC performed an analysis but our work was never discussed or approved by the GWAC.

Here are average nitrate levels for five areas in the GWMA:

- North of Wapato – 0.50 mg/L
- Wapato to Granger – 4.00 mg/L
- Granger to Sunnyside – 8.62 mg/L
- Sunnyside to Mabton – 5.11 mg/L

- South of Mabton – 6.45 mg/L

Proposed Solutions: In mid-2017 the GWMA leadership introduced over 250 proposed solutions to the nitrate problem, in spite of the fact that there was: no Area Characterization, no analysis of High Risk Well Testing, no analysis of the Deep Soil Sampling, no Nitrogen Loading Assessment and no Network of Monitoring Wells. Throughout the last half of 2017 the GWAC focused on refining this list.

FOTC finds the process to be very flawed. For example, the initial list contained seven strategies that target domestic septic systems but no strategies that targeted composting operations or atmospheric deposition of nitrogen.

GWMA Plan: The most recent GWMA timeline called for an approved plan by June, 2018. This would allow time for a State Environmental Policy Act (SEPA) review and public hearings on the plan before the GWMA contract expires in December, 2018. Once again, the deadline has passed.

For these reasons FOTC now offers an alternate GWMA Plan based on the last six years of work and our participation. We have included an important section entitled, *What Will Happen If We Do Nothing?* This is required by WAC 173-100-100(2). We suggest measureable goals and objectives along with a draft plan for evaluation. Please understand the limitations involved when a small group with few resources undertakes this work

Problem Definition

Between 12% and 20% of wells in the Lower Yakima Valley have nitrate levels > 10 mg/L. The problem is not evenly distributed across the valley. More wells in the southern portion of the GWMA target area are contaminated than those in the northwestern area. The highest groundwater nitrate concentrations are down gradient from dairies.

Contributing factors are groundwater flow, depth to groundwater, soil characteristics, weather patterns, housing density, disposal of industrial and municipal wastes, and agricultural practices including: crop types, irrigation practices, fertilization, maintenance of lagoons/ponds, volatilization from production areas and cropland.

In recent years the problem has expanded from shallow and aging domestic wells to deeper municipal wells. Since the early 2000's the City of Grandview has monitored nitrate levels in its municipal wells closely and has blended water from several wells in order to deliver safe drinking water. In 2013 the City of Mabton drilled a new $1.85 million well to replace older wells that were troubled with decreasing water pressure and elevated nitrates.

FOTC Analysis of the Problem

Area Characterization: The GWMA target area extends along the Yakima River Valley from Union Gap in the north to the Yakima/Benton County line in the east. The western border is the Yakima River/eastern boundary of the Yakama Reservation. The outermost occupied parcels, down gradient from the Rattlesnake Hills and the Horse Heaven Hills form the northern and southern borders.

Soil is mostly composed of rich sediments that include Touchet Beds, loess and thick alluvial sands and gravels, and significant thickness of Ellensburg Formation. Half of the target area lies in the Toppenish Sedimentary Basin and half in the Benton Sedimentary Basin. Rainfall averages seven inches per year.

Agriculture is the driving force behind the local economy. Irrigation from the Sunnyside and Roza Irrigation Districts serves about 96,000 acres of rich farmland. Major crops are apples, corn, triticale, grapes, alfalfa, cherries, mint, hops, wheat and asparagus. Since the late 1980's dairying has assumed an ever increasing importance in the agricultural community. Over the past twenty five years the number of milk cows has increased at a rate of almost 3,000 per year. Increases in land planted in corn and forage have accompanied this trend.

The population is about 70% Latino and is much younger than average for Yakima County or for the state. Many people are recent immigrants who speak English less than well. About 20% of the population lives below the poverty level and slightly over half have a high school diploma. Because the population is often non-mainstream and because pollution issues are prominent the potential for Environmental Injustice is high in the GWMA.

The Yakama Nation has highlighted the impact of climate change on the valley. The USGS has documented declining water tables in the basalt aquifers. Groundwater from shallow aquifers in the LYV flows toward the Yakima River and is a major contributor to instream flows that are protected by treaties. The Yakima River Basin Integrated Water Resource Management Plan is intensely involved in seeking solutions to problems caused by over-allocation of this precious and limited resource.

Knowledge Gaps: Based on GWMA discussions over the past five years, FOTC perceives the following knowledge gaps:

- Insufficient understanding and recognition of local public health issues
- Insufficient understanding of nitrogen volatilization from animal agriculture and cropland that leads to poorly characterized atmospheric deposition of reactive nitrogen and an unquantified impact on the nitrogen balance.
- Uncertainty about market impacts on agricultural practices in the area
- Insufficient understanding of the percentage of dairy manure that is composted and exported from the area
- Insufficient information about the amount of commercial fertilizer that is applied to GWMA cropland
- Uncertainty about the rate of nitrate leaching from pens, corrals and compost areas
- Insufficient education regarding movement of groundwater in the vadose zone
- Poor understanding surrounding the meaning of Environmental Justice

Regulatory Gaps: Based on GWMA discussions over the past five years, FOTC perceives the following regulatory gaps:

- The Dairy Nutrient Management Act does not authorize the WSDA Dairy Nutrient Management Program (DNMP) to enforce compliance with Dairy Nutrient Management Plans (NMPs)
- Washington State's Non-point Source Pollution Prevention Plan has not yet been approved by the EPA

- Yakima County's Voluntary Stewardship Program relies on the GWMA plan for data gathering and evaluation of agriculture in the LYV. If the GWMA plan is weak this will weaken our VSP.
- WAC 173-201A-020 requires Ecology to approve and list BMPs that protect waters of the state. This has not been done.
- There are no Total Maximum Daily Loads (TMDLs) for nutrients for the Lower Yakima River, in spite of the fact that nitrogen and phosphorous concentrations in agricultural drains have not declined in recent years.
- Environmental groups believe that the 2017 NPDES General Permit for Concentrated Animal Feeding Operations (CAFOs) is weak and does not protect waters of the state. Industry believes the permits are too costly for producers.
- WAC 173-350-220 is poorly enforced. As a result manure composting operations pollute the groundwater
- Under WAC 16-06-210 (29) reporting of the number of cows on a facility is so broad that efforts to control pollution from animal agriculture are impaired
- WAC 173-224-040 imposes lower fees on dairy CAFOs than it does on beef or other CAFOs
- There is no reporting of nitrogenous and other potentially toxic emissions from CAFOs
- There is no regulation of manure applications on non-dairy cropland
- Yakima County with 35% of all Washington milk cows has no CAFO ordinance.

What Will Happen If We Do Nothing? Groundwater quality in the LYV GWMA is worsening. Current efforts to address the problem are not working. If we do nothing different the future will bring falling aquifers with increasingly polluted water. Costs to future tax payers, our children, will escalate.

Goals & Objectives

FOTC believes that GWMA Goals and Objectives must be framed so that change can be measured. With this in mind we suggest the following:

Overarching Goal: Reduce Nitrates in Lower Yakima Valley Groundwater to Safe Levels of < 10 mg/L

Pollution prevention will be a guiding principle

1. Everyone who lives in the LYV will have access to safe and affordable drinking water. No one will pay more than 2% of their income for bottled water.

2. People who live in the Lower Yakima Valley will be engaged and involved in programs to reduce nitrates in groundwater

3. There will be no more "bureaucratic runaround". When people call authorities they will receive accurate and helpful information.

4. The LYV aquifers will show decreasing nitrate levels beginning in 2020. The aquifers will reach safe levels by 2040

5. Soil nitrate levels below the root zone on LYV cropland will be < 15 ppm

6. There will be no leaching of nitrate below animal pens & corrals, lagoons & ponds, or compost yards

7. Volatilization of nitrogen from production areas and cropland will be quantified and controlled

8. Costs for cleanup of the LYV aquifers will be borne by those who pollute

Summary

Agencies and stakeholders have attempted to turn around the trend toward increasing nitrates in LYV groundwater since the 1990's. Efforts to date, including the work of the LYV GWMA, have failed.

The largest contributor to groundwater nitrates in the LYV is animal agriculture, namely CAFO dairies. FOTC firmly believes that the most cost effective way to solve the nitrate problem is to control the number of cows in the area.

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Reasons for a Minority Report

1. The GWMA has not complied with the mandates in WAC 173-100-1090(1) or WAC 173-100-100(6).

2. The dairy industry has maintained veto power over any and all GWMA actions. Advocates for dairy have controlled the agenda and marginalized other voices on the GWAC

3. The GWMA leadership has failed to provide adequate research that is necessary in order for the GWAC to do the work. The GWMA has missed almost every deadline.

4. The GWMA gathered data and then, failed to analyze the data. The GWMA did no analysis of Deep Soil Sampling data, High Risk Well testing results, composting data, sampling of domestic wells and drains, or responses to a survey of public understanding.

5. GWMA contractors have not complied with the terms of their contracts. There were no consequences. A Nitrogen Availability Assessment, the center piece of the GWMA problem solving, ignored bio-solids and waste water spray-fields, ignored the GWMA Deep Soil Sampling, ignored inputs from beef feedlots and animals on pasture, ignored composting yards, failed to do a promised literature review and incorrectly stated that there is no leaching from alfalfa fields. The NAA ignored runoff to surface waters.

6. The GWMA has not addressed the impact of groundwater pollution on the health and well-being of the people who live in the Lower Yakima Valley. The GWAC has ignored Environmental Justice.

7. The GWMA has used up $2.3 million and left a program with no funds for implementation and no road map for how to obtain funds.

For documentation that supports these statements and further explanation, please go to page 193 of this report.

Nitrate Contamination of Groundwater, a World Wide Problem

Water is life. Groundwater is the source of drinking water for much of the world's population. Groundwater is essential for agriculture and industry. And groundwater has been and continues to be contaminated across the globe by human activity.

The most pervasive and most studied groundwater contaminant is a highly soluble compound with the chemical formula $-NO_3$, also called nitrate. Nitrate levels in groundwater have increased dramatically over the past century due, in large part, to advances in the manufacture of chemical fertilizers and changes in management of animal agriculture. (EPA, 2018c; Sutton et al, 2011)

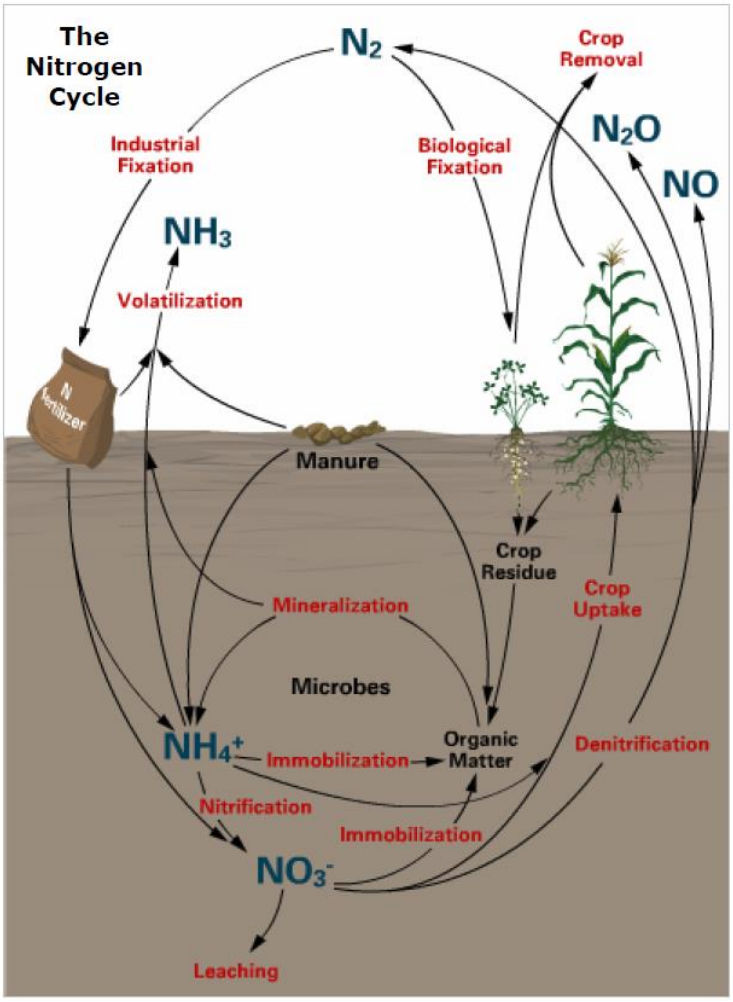
Fertilizer: Farmers have known for millennia that crops such as legumes and alfalfa enrich the soils and make it more productive. This happens because micro-organisms in the plant roots convert inert nitrogen, N_2, into nitrate that feeds plant growth.

Early in the 20th century two chemists, Fritz Haber and Carl Bosch, discovered a way to do this in the laboratory. Industrialization of the process led to production of nitrate ammunitions that supported World Wars I and II. During peace time munitions factories were converted into fertilizer plants that support the dramatic growth of agriculture we see today. (Sutton et al, 2011)

As a result of human conversion of atmospheric N_2 into chemically and biologically reactive nitrogen the nitrogen cycle has been altered. We now have much more ammonia (NH_3), ammonium (NH_4), Nitrous Oxide (N_2O), Nitrite ($-NO_2$) and Nitrate ($-NO_3$) in the world than ever before. This leads to water pollution, especially where fertilizers are applied to the cropland. (EPA, 2011; Sutton et al, 2011)

To better understand the nitrogen cycle, please see the excellent Fact Sheet, *Nitrogen Basics – The Nitrogen Cycle*, from Cornell University Extension Service. (Attachment 31) The diagram below shows the many pathways involved in the Nitrogen Cycle.

Diagram 1. The Nitrogen Cycle



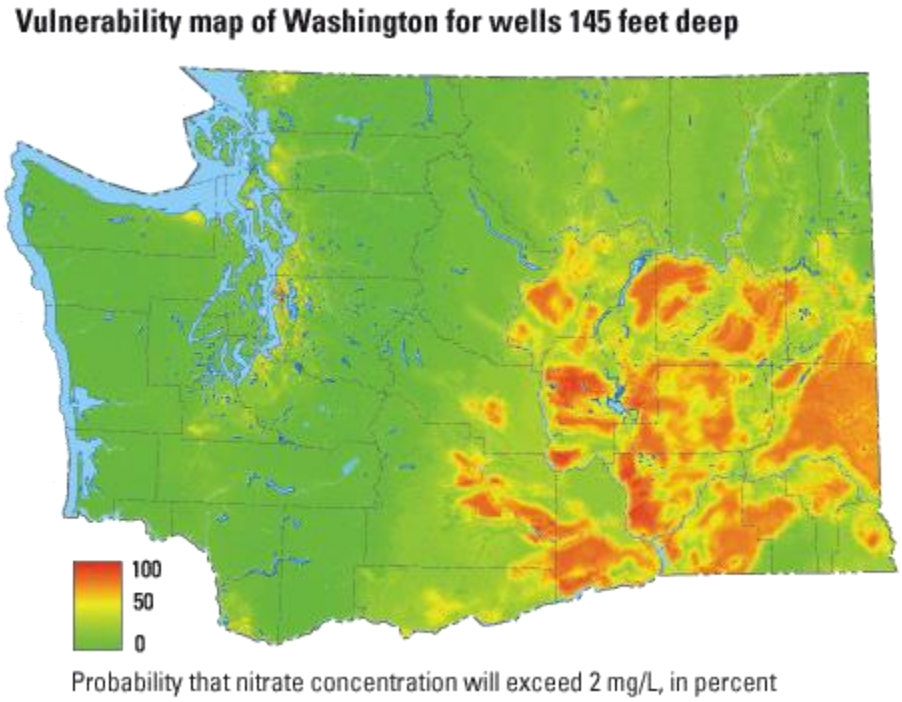
From Cornell University Extension Service: *Nitrogen Basics – The Nitrogen Cycle*

Animal Agriculture: Over the last 50 - 70 years agriculture has changed from a system of small family farms with multiple crops into a network of vertically integrated industries that supply the world with food. Many animals that supply meat, milk and fiber are now raised in concentrated animal feeding operations (CAFOs) where thousands are maintained on small acreages. This means that feed is delivered to the animals and waste products must be mechanically removed. This can be costly. Accumulation of hard to transport manures often leads to contamination of groundwaters. (PEW Commission, 2008; Kellogg et al, 2000) The frequent result is leaching of nitrates to groundwater in areas with intense agriculture. (Harter et al, 2012)

Nitrate Contamination of Groundwater in Washington State

Nitrate concentrations in the groundwater are elevated above background levels for much of Washington State. The USGS map below shows that most areas with elevated nitrates are east of the Cascades. Note that > 2 mg/L shows nitrate above background levels but it does not indicate a danger to human health. The EPA currently states that drinking water with N > 10 mg/L is unsafe for humans.

Map 1. At Risk Aquifers in Washington State



(Frans, 2008)

The WA State Dept. of Ecology has studied nitrates in groundwater since at least 1988 when the agency initiated the Agricultural Chemicals Pilot Study that included collection of nitrate data in Yakima County. (Erickson, 1990) Interest was high during this period and a number of studies followed soon after:

- Protecting Groundwater: A Strategy for Managing Agricultural Pesticides and Nutrients (Ecology, 1992)

- Effects of Leakage from Four Dairy Waste Storage Ponds on Ground Water Quality, Final Report (Erickson, 1994)
- Irrigation management practices to protect ground water and surface water quality State of Washington (Canessa & Hermanson, 1995)
- An Examination of Methemoglobinemia in Washington State (Shields, 1996)
- Creation of the Columbia Basin Groundwater Management Area in 1998

Ecology continued to work on the problem, mostly with studies in Whatcom County. (See Attachment 74 for a listing of Ecology Groundwater Studies) In 2014 the agency launched a *Nitrate Prioritization Project* that may create an easily accessible data base for groundwater nitrates in the state. (Morgan, 2014) The proposed goals of this project are to:

1. Delineate areas where high nitrates in groundwater occur.
2. Prioritize those areas by potential impact to people and resources.
3. Make information available to everyone.

At the current time there is no strategy in place for statewide nitrate surveillance. However the project has multiple conclusions and recommendations for refining and improving Washington's approach to the problem. (Morgan, 2014, pages 29 & 51)

On a national scale Washington and Kansas are tied for 12th place when looking at the percentage of state land surface with groundwater nitrates > 5 mg/L. Here is data for seriously impacted states (EPA, 2018e) (Also see Attachment 46)

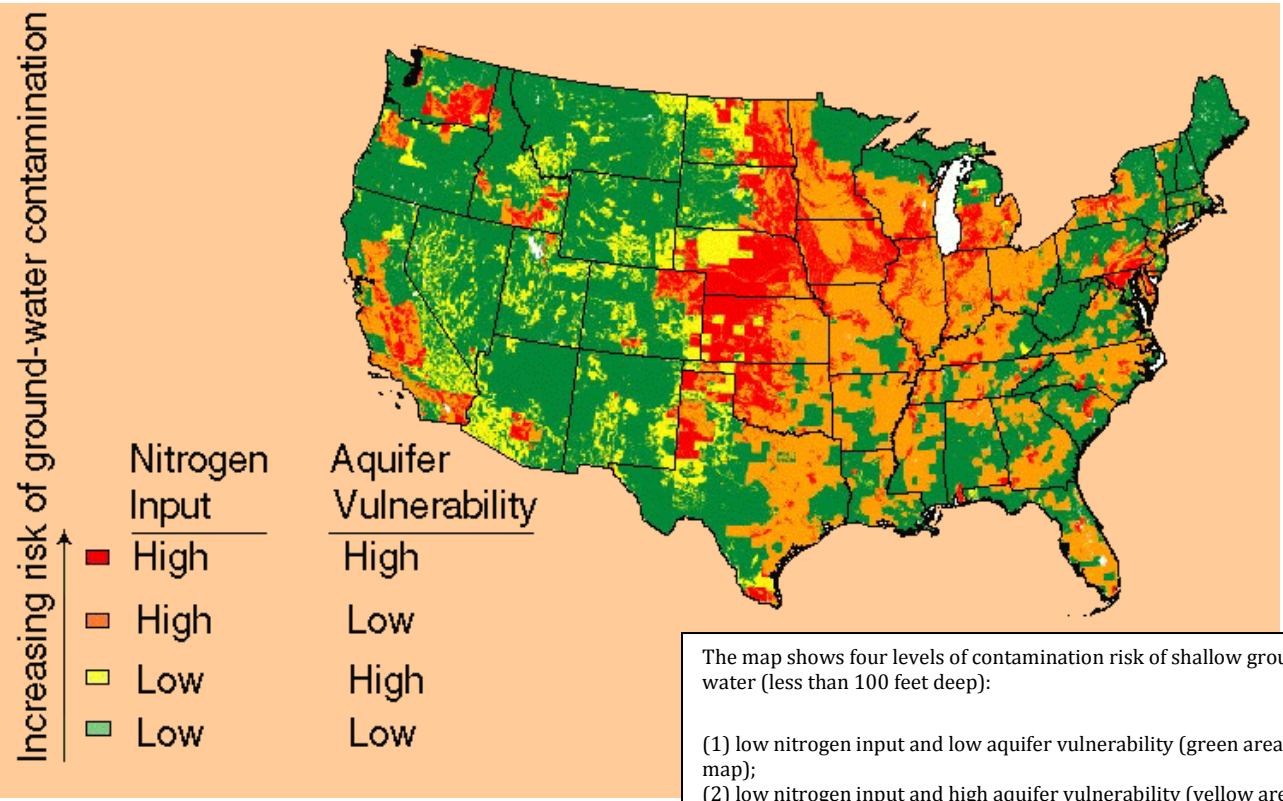
Table 1. Nitrate Pollution by State

State	Estimated Area in Square Miles with Nitrate > 5 mg/L	Estimated % of State Land Area with N > 5 mg/L	% of Population that Uses Groundwater for Drinking
Delaware	975.68	53%	10%
Maryland	2,673.76	28%	17%
Nebraska	13,417.82	17%	18%
Rhode Island	168.34	16%	8%
Louisiana	6,530.15	15%	12%
Massachusetts	950.97	12%	8%
Arizona	12,763.38	12%	4%
California	15,003.54	10%	7%

North Carolina	4,580.33	9%	26%
Florida	4,975.31	9%	10%
New Jersey	642.47	9%	11%
Washington	**5,325.51**	**8%**	**14%**
Kansas	6,306.98	8%	5%
Vermont	2,628.97	7%	30%
Pennsylvania	2,982.64	7%	20%
Texas	15,818.61	6%	10%
Michigan	3,253.68	6%	29%
Connecticut	275.68	6%	24%
Illinois	3,132.06	6%	9%
Idaho	4,256.00	5%	30%
Ohio	2,005.41	5%	17%

Another way to visualize the severity of the problem in Washington, compared to the rest of the nation is by mapping. Here is the situation in 1998, according to the USGS (Nolan et al, 1998)

Map 2. Nitrate Pollution across the Nation



The map shows four levels of contamination risk of shallow ground water (less than 100 feet deep):

(1) low nitrogen input and low aquifer vulnerability (green area on the map);
(2) low nitrogen input and high aquifer vulnerability (yellow area);
(3) high nitrogen input and low aquifer vulnerability (orange area); and
(4) high nitrogen input and high aquifer vulnerability (red area).

Impact on Human Health from Nitrates in Drinking Water

The EPA's Integrated Risk Information System is re-evaluating the current assessment of health risks due to nitrate and nitrite. The safety standard of 10 mg/L nitrate in drinking water may soon be lowered as a result. (U.S. EPA, 2017a: U.S. EPA 2017b; Walton, 2018)

This re-evaluation is due to more recent ongoing and evolving research that looks more closely at the ways that nitrate and nitrite impact physiology and body chemistry. Some studies have found significant effects from drinking water with nitrate levels between 5 and 10 mg/L. (Ward et al, 2005; WHO, 2016).

Health impacts from nitrates are interwoven with a series of bio-chemical reactions in the body. In brief: varying portions of ingested nitrate (NO_3) from food and water convert into nitrite (NO_2). When nitrite binds with hemoglobin in the blood stream the hemoglobin is less able to carry oxygen. Under certain conditions nitrite in the stomach converts into N-nitrosoamines which produce cancer. (ATSDR, 2017; IARC, 2010) Some studies show a positive relation between nitrate intake and certain cancers while others do not. (Ward et al, 2005; Walton, 2018)

Most of the nitrate that people take into our bodies comes from food, especially from leafy vegetables. Vitamin C in these vegetables reduces the conversion of nitrate to nitrite and N-nitroso amines. Vitamin C is a mitigating factor. (ATSDR, 2017; IARC, 2010)

ATSDR (2017) has established a Minimum Risk Level (MRL) of 4 mg/kg body wt. /day for nitrate. This means that a 220 pound adult (100 kg) should consume less than 400 mg (.014 ounces) of nitrate per day. This intake could come from a typical vegetarian diet that is high in leafy vegetables. (Note: 10 ppm nitrate-N/L = 45 ppm nitrate/L)

If an average adult drinks 2 liters of water per day here is the amount of nitrate intake:

- If nitrate N is 10 ppm (the safe standard) then nitrate in 2 liters = 90 mg
- If nitrate N is 20 ppm (double the safe standard) then nitrate in 2 liters = 180 mg
- If nitrate N is 30 ppm (triple the safe standard) then nitrate in 2 liters = 270 mg

Nitrate poisoning from food is rare, although very young children who have been fed large amounts of vegetables, such as carrot soup, have developed methemoglobinemia or blue baby syndrome. (Sanchez-Echaniz et al, 2001; Savino et al, 2006; Sernia et al, 1984)

Children under the age of six months are less able to tolerate nitrate and are susceptible to methemoglobinemia which may be life threatening. Health care providers have been aware of this problem since the 1940's. (Bosch, 1950; Walton, 1951; Comley, 1945; Comley 1987; Knobeloch et al, 2000) This occurs most often when formula is reconstituted using well water with high nitrate levels. Methemoglobinemia in babies may be confused with heart failure. The symptoms are the same.

There are case studies that relate spontaneous abortion to well water with high nitrates. (Manassaram et al, 2005; CDC, 1996). There is research that links birth defects to well water with high nitrates (Brender et al, 2004; Brender et al, 2013; Cedergren et al, 2002; Bukowski et al, 2001; Croen et al, 2001; Tabacova et al, 1993; Tabacova et al, 1998; Arbuckle et al, 1988; Dorsch et al, 1984).

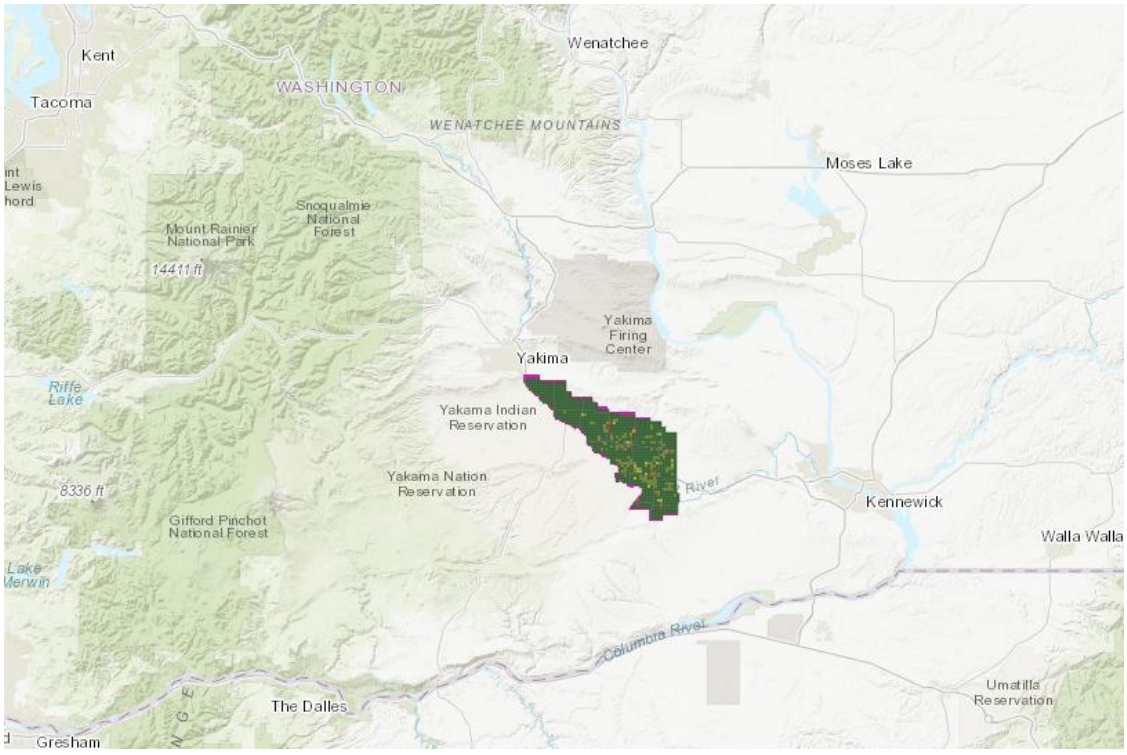
There is research that shows a positive relationship between elevated nitrates in drinking water and a number of chronic illnesses including thyroid disease, heart disease and diabetes. There is contradictory research. (Ward et al, 2004)

A study of healthy volunteers showed a significant increase in heart rate and a drop in blood pressure when the subjects received one time doses of sodium nitrite. (ATSDR, 2017) While this may or may not be beneficial, the point is that nitrate in drinking water has a physiological impact on humans.

GWMA History

The Lower Yakima Valley Groundwater Management Area (LYV GWMA) was formed in 2012 to address nitrate pollution in the highly productive and intensely farmed Lower Yakima Basin. The current boundaries for the LYV GWMA are shown in the map below; also available at http://arcg.is/1ie9mP

Map 3. Lower Yakima Valley GWMA



The southwestern boundary of the GWMA is the Yakima River and the coincident northeastern border of the Yakama Nation. The eastern boundary of the GWMA is the Yakima – Benton County line. The northern border and the short southern border were created by including parcels of land with wells that lie down gradient from the Rattlesnake Hills and the Horse Heaven Hills. (Yakima County, 2011b)

Brief Background

1990: Concerns about elevated nitrates and other contaminates in Eastern Washington groundwater date back to the 1980's. In 1990 the Washington State Dept. of Ecology

published the *Washington State Agricultural Chemicals Pilot Study*, available at https://fortress.wa.gov/ecy/publications/documents/9046.pdf that found high nitrate levels in Whatcom County and Franklin County but low levels in Yakima County. This study and others led to the 1998 designation of the Columbia Basin Groundwater Management Area for Franklin, Adams, Grant and Lincoln Counties.

1995: In 1995, with funding from the Clean Water Act Section 319, agricultural scientists Peter Canessa and Ronald Hermanson published research entitled *Irrigation Management Practices to Protect Groundwater and Surface Water Quality: State of Washington.* (Canessa & Hermanson, 1995) This document created a foundation for major improvement in irrigation management. Most of the best management practices (BMPs) from that study are still recommended today. In fact 39 of the 85 BMPs recommended by the GWMA Irrigated Ag Work Group came from this document.

1990 – 2002: Throughout the 1990's Yakima environmentalists led by the Community Association for the Restoration of the Environment (CARE) sounded the alarm regarding pollution of ground and surface waters from a growing dairy industry that was migrating from California to the Yakima Valley.

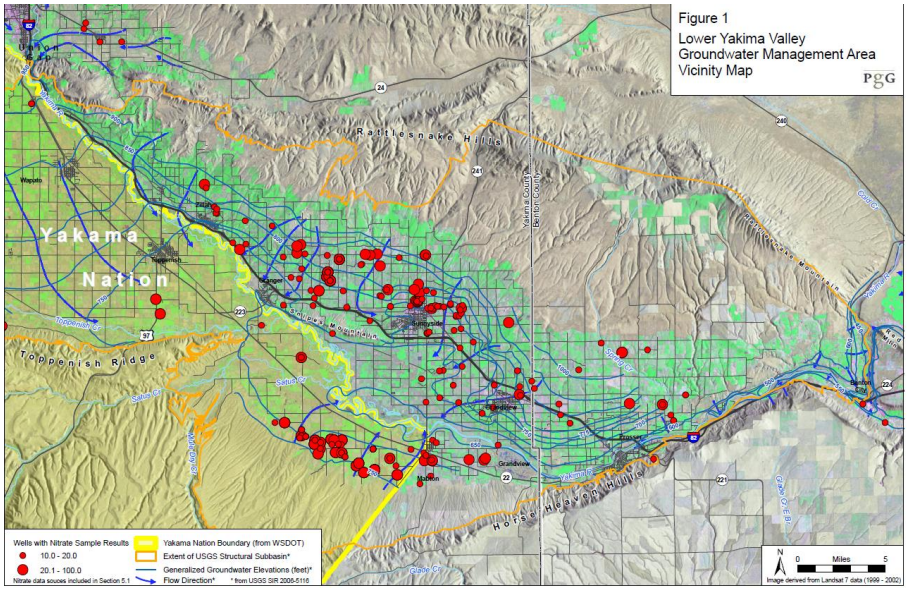
As the result of a court settlement, CARE and Henry Bosma funded a study entitled *Quality of Ground Water in Private Wells in the Lower Yakima Valley, 2001-02,* available at https://fortress.wa.gov/ecy/publications/documents/0210074.pdf This research, also known as the VIRE Study (Sell & Knutson, 2002), divided the LYV into Region I - the northwest and Region II - the southeast. A total of 249 domestic wells were tested. The VIRE study found no nitrates > 10 mg/L in wells from Region I. But 21% of the tested wells in Region II exceeded the standard. Mean values for chloride, ammonia and specific conductivity were significantly higher in Region II. Subsequent well water surveys find a similar pattern.

2008: In 2008 Leah Ward from the Yakima Herald Republic wrote an award winning series of articles entitled *Hidden Wells, Dirty Water* (Attachment 36) that cast a bright light on the problem. Ward asked for an investigation by the Environmental Protection Agency (EPA).

2010: In 2010 the EPA began studying Yakima groundwater contamination. The EPA studies are available at https://www.epa.gov/wa/lower-yakima-valley-groundwater The EPA initiated a collaborative process in which state and local agencies, EPA and the community looked at possible solutions. The result was a report, *Lower Yakima Valley Groundwater Quality: Preliminary Assessment and Recommendations,* available at https://fortress.wa.gov/ecy/publications/documents/1010009.pdf

The map below describes the results of well testing for nitrates that were available in 2010. Note that some of the wells had readings up to 100 mg/L nitrate.

Map 4. Nitrates in Wells – Lower Yakima Valley - 2010

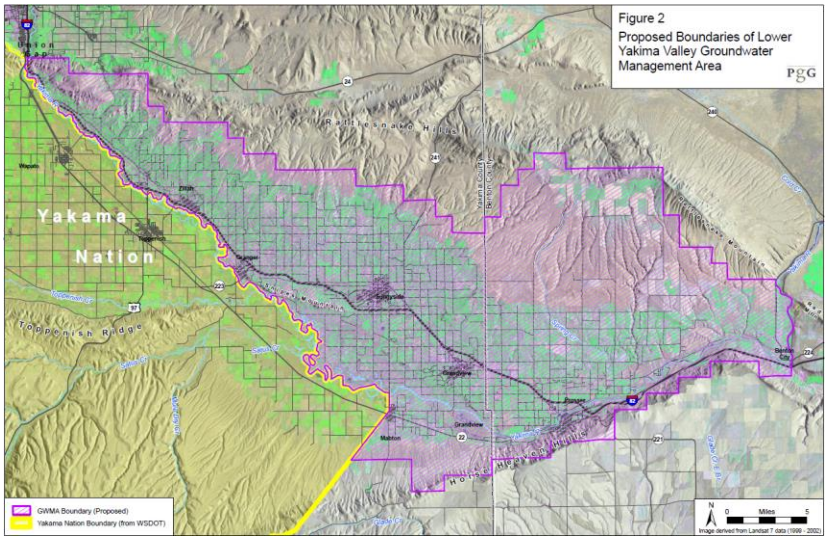


From LYV GWMA Request for Identification 201

The stakeholders recommended creation of a groundwater management area to address water quality problems in the valley. In 2011, as authorized by WAC 173-100-050, Yakima County submitted a *Request for Identification: Lower Yakima Valley Groundwater Area,* available at https://www.yakimacounty.us/DocumentCenter/View/2359/2011-Request-for-Identification-Lower-Yakima-Valley-Groundwater-Management-Area-PDF

2012: The LYV GWMA began meeting in mid-2012. At that time the target area included large parts of Benton County but excluded reservation lands. The Yakama Nation decided to pursue a reservation only project to address groundwater contamination.

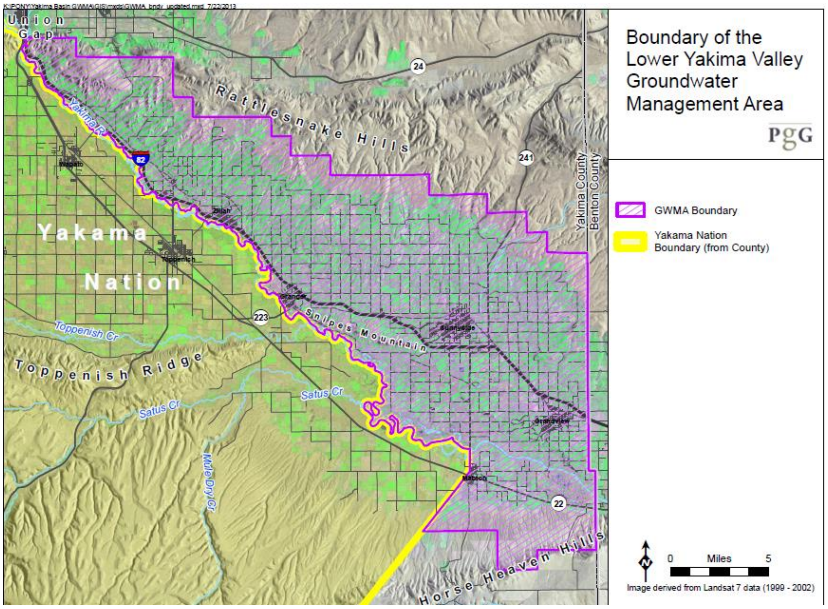
Map 5. The official map of the LYV GWMA in 2011-2012



From LYV GWMA Request for Identification 2011

2013: On April 10, 2013, Benton County filed a letter asking to withdraw from the LYV GWMA. On June 7, 2013 Ecology formally accepted this withdrawal. The GWMA boundaries were re-drawn as described in the map below.

Map 6.



Boundary of the Lower Yakima Valley Groundwater Management Area at
https://www.yakimacounty.us/DocumentCenter/View/1893/Groundwater-Management-Area-Boundary-Map-PDF

Highlights of GWMA Actions

2012: The first two meetings of the Groundwater Management Area Advisory committee (GWAC) in June and July of 2012 were devoted to familiarization with the prescribed processes, getting to know each other and development of guidelines for the work to follow.

2012-2013: The GWAC crafted a Work Plan between July 2012 and February 2013 that was then submitted to Ecology for approval. The submission included a projected budget for the GWMA and a plan for Education and Public Outreach.

2013: The GWAC discussed Goals and Objectives at five of the twelve 2013 meetings but the group did not progress beyond the measures described in the Work Plan. That plan identified objectives and related tasks for each of the seven work groups – Data Collection, Irrigated Agriculture, CAFO/Livestock, Residential Commercial, Industrial & Municipal (RCIM), Education & Public Outreach (EPO), Regulatory Framework, and Funding. The Work Plan is available at http://www.yakimacounty.us/598/Work-Plans

There was general agreement on the need for:

1. A survey of the public to assess understanding of the nitrate problem
2. A nitrogen loading assessment
3. A network of wells for groundwater monitoring
4. Deep soil sampling to evaluate the impact of various cropping practices.

Suggestions for a broader study of environmental impact and the impact on public health were rejected.

2013: Yakima County commissioned a study of Best Management Practices (BMPs) and a study of the relevant Regulatory Framework. Heritage University surveyed 130 homes in the valley to assess public awareness. These were all completed and presented to the GWAC in the last half of 2013. Data and Reports are available at http://www.yakimacounty.us/DocumentCenter/Home/View/8453 and http://www.yakimacounty.us/DocumentCenter/Home/View/8454

2014 – 2016: In the fall of 2014 the EPA presented to the GWAC the first round of results from their work with a cluster of five dairies in the LYV. The results are available at https://www.epa.gov/sites/production/files/2017-12/documents/lower-yakima-valley-groundwater-fact-sheet-december-2014.pdf

The GWAC and the Irrigated Agriculture Work Group (IAWG) spent nearly a year developing a plan for Deep Soil Sampling (DSS) that provided confidentiality for participants. DSS began with sampling in the fall of 2014, continued in the spring of 2015, fall of 2015 and ended in the spring of 2016. Results and FOTC analysis are attached. (Attachment 16, Attachment 17, Attachment 18, Attachment 23 & Attachment 24 (Data from DSS Spring 2016 is available at http://www.yakimacounty.us/541/Groundwater-Management-Area in Volume II))

2013 – 2017: Discussion and planning for a Nitrogen Loading Assessment (NLA) began in late 2013 and culminated in a plan designed to deliver a report in December 2015. WSDA accepted responsibility for the agricultural portion and Yakima County accepted responsibility for the RCIM portion. The report was delayed for nearly two years. The GWAC saw the first draft in April 2017. Members of the GWAC disagreed with the methods and conclusions. Comments were submitted and a responsive second draft was delivered in June 2018. The first and second drafts are attached as well as FOTC analysis. (Attachment 27, Attachment 30 & Attachment 32) As of July, 2018 WSDA has "finalized" and posted the report without GWAC approval.

2013 – 2017: In December 2013, the GWAC began the long process of developing a network of wells for groundwater monitoring. Over the next five plus years the GWAC discussed the project eleven times. In early 2017 the Pacific Groundwater Group signed a contract with Yakima County to oversee the installation of wells but the county did not sign the contract until January 2018. In early 2017 the United States Geological Survey (USGS) signed a contract with Yakima County to draw samples from the purpose built wells during 2017 but the wells were never drilled. As of October 2018 there was no network of purpose built monitoring wells. There is a 2017 project in which USGS sampled 156 domestic wells every two months. In that study 19.8% of the wells had nitrate levels above

10 mg/L. Results and FOTC analysis are attached. (Attachment 28) The numbers suggest, but do not prove, that the nitrate problem in the LYV may be worsening.

2014 – 2017: In June, 2014 Yakima County contracted with attorney Jim Davenport to advise the GWMA project. In July, 2017, based on his observations and participation, Mr. Davenport compiled a list of 260 potential Alternative Management Strategies for GWAC consideration. The GWAC met to discuss, edit and screen this list 10 times in 2017 and 4 times in 2018.

2015 – 2017: In July 2015 Ecology and Yakima County signed an interagency agreement modification that extended the GWMA deadline to September 2015. In November/December 2015 Ecology and Yakima County signed an interagency agreement that extended the GWMA deadline to December 2017. In January 2018 Ecology and Yakima County signed an amendment that extended the GWMA deadline to December 2018.

2018: In June 2018 Mr. Davenport presented to the GWAC a draft GWMA plan that included 54 Recommended Alternative Management strategies. FOTC dissatisfaction with the plan is the reason for this Minority Report. FOTC analysis of the selection process and the final product is attached. (Attachment 62, Attachment 63, Attachment 82)

Here is a tabular summary of the GWAC discussions.

Table 2. Topics from GWMA Meeting Agendas

Topic	2012	2013	2014	2015	2016	2017	2018
GWMA Programming							
Guidelines	2	2					
Time Frames/ Deliverables	1		2	3			
GWMA SOW/ Work Plan	6	4					
Budget		3	3		1		
Goals & Objectives		5				2	
Review Contracts & Agreements		1	5	1	3		2
Area Characterization					1	1	1
Inform the GWAC							
Informational Needs	2						

Yakima County Pilot Program		1					
Oregon GWMAs		1					
Overview of DNMP			1				
Nitrate Standards (EPA)			1				
Overview of Regulations			1		1		
Potential Requests to Legislature					2		
International Water Conference					1		
Alternative Management Strategies						1	
GIS Applications						3	1
Education & Outreach							
EPO Work Plan	3						
GWMA Outreach Materials		2					
Standardize Talking Points		1					
Billboards					1		
Research							
EPA Study	1	1					
USGS Research		1		1			
Heritage University Survey		1					
High Risk Well Assessment				1			
Nutrient Budget/NAA		2		2		4	
Deep Soil Testing		2	2	1			
BMP Study		1					
Data Collection/Modeling			1		2		
Groundwater Monitoring Plan			3	2	2	1	2
Solutions							
Alternative Strategies						10	4
Number of Meetings	7	12	8	5	6	14	4

Goals and Objectives for the GWMA

From Request for Identification Lower Yakima Valley Groundwater Management Area – June 2011

The primary long-term goal of the GWMA is to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards. Reductions in nitrogen loading will be demonstrated within 5 years. Progress towards identifying and reducing the sources of groundwater contamination will be evaluated by 2013 and shared with the public. Specific objectives are listed below.

DATA AND MONITORING

• Collect and incorporate existing nitrate and nitrogen data into a shared data management system or data sharing site to improve understanding of the sources and extent of contamination.

• Establish a monitoring program to identify sources of nitrate contamination and their relative importance.

• Establish and conduct long-term groundwater quality monitoring program and evaluate progress.

PROBLEM IDENTIFICATION

• Characterize the nature and extent of nitrate concentrations in Lower Yakima Valley groundwater.

• Identify and rank the sources of elevated nitrate in groundwater, with site-specific characteristics developed for "hot spots" as appropriate.

• Identify and describe activities contributing to groundwater contamination based on scientific data and evaluation. Scientific and other data will be shared among the partners to facilitate development of effective programs and strategies.

MEASURES TO REDUCE GROUNDWATER CONTAMINATION

• Develop effective and coordinated best management practices (BMPs) to address specific nitrate sources.

• Develop strategies for implementing best management practices such as technical assistance, education, ordinances and coordination with other regulatory and nonregulatory programs.

• Support enforcement of new and existing laws and ordinances.

EDUCATION

• Establish educational programs to promote the protection of groundwater quality and provide a forum for stakeholders to discuss nitrate reduction methods and improvement of groundwater quality. This will include culturally-appropriate education and outreach.

• Establish a clearinghouse for pertinent public health, environmental, and business information.

• Educate private well owners on water quality testing methods, frequencies, interpretation of results, and funding sources.

DRINKING WATER SYSTEMS

• Provide water quality and hydrogeologic data to assess needs and methods of expanding public water supplies, and provide a forum for initiation of these plans.

• Consider options to encourage appropriate expansion of public water supplies to areas that are currently dealing with contaminated private supplies.

• Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications.

GENERAL

• Pollution prevention will be a guiding principle for all work done by the GWMA.

• Participation by the Yakama Nation will be requested and encouraged in a way that is consistent with their sovereignty.

• Participating agencies will maintain their regulatory authority using their own discretion as appropriate. They will also seek opportunities to coordinate actions and address regulatory gaps.

• The GWMA will seek sustainable funding sources to carry out its mission

Summary of Nitrate Water Studies in the Lower Yakima Valley

Yakama Reservation – Surface and Groundwater

Fretwell, M.O. & Yakama Tribal Council (1974) *Quality of Surface Water and Ground Waters, Yakama Indian Reservation.* United States Geological Survey, Report 77-128.

Nitrate concentrations >10 mg/l were observed in the Ellensburg formation of Ahtanum Creek; the Alluvium of the Toppenish Creek Basin. However, the conc. did not exceed 20 mg/l. High conc. were found in Satus Creek (Alluvium 170 mg/l) and 67 mg/l in the Ellensburg formation.

Agricultural Chemicals Study

Erickson, D., & Norton, D. E. (1990). *Washington State Agricultural Chemicals Pilot Study*. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Toxics Investigations/Ground Water Monitoring Section. Available at https://fortress.wa.gov/ecy/publications/documents/9046.pdf

Eight wells of the 27 wells (30%) sampled in the Yakima County study area showed detectable concentrations of nitrate/nitrite-N. The concentrations ranged from less than 0.01 to 6.2 mg/L with a mean concentration of 0.7 mg/L. No wells exceeded the MCL of 10 mg1L.

The Hornby Lagoon Study

Erickson, D. (1992). *Ground Water Quality Assessment, Hornby Dairy Lagoon, Sunnyside, Washington*. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Toxics, Compliance, and Ground Water Investigations Section. Available at http://yakimaco.us/GWMA/documents/library/92e23.pdf

Chloride concentrations in all wells downgradient of the main lagoon increased after the second and third quarters of monitoring (between four and ten months after the main lagoon received wastewater) probably due to leakage from the lagoon.

Yakama Reservation – Toppenish Creek

Payne, K. L., & Sumioka, S. S. (1994). *Selected water-quality data for the Toppenish Creek Basin, Yakima Indian Reservation, Washington, 1989* (No. 93-486). US Geological Survey; USGS Earth Science Information Center, Open-File Reports Section. Available at https://pubs.usgs.gov/of/1993/0486/report.pdf

> *Nitrite + nitrate nitrogen conc. Ranged from <0.1 mg/L to 9.3 mg/L in GW; and from <0.1 mg/L to 6.0 mg/L in SW samples.*

VIRE Study

Sell, R., & Knutson, L. (2002). *Quality of ground water in private wells in the Lower Yakima Valley, 2001-02*. Valley Institute for Research and Education. Available at https://fortress.wa.gov/ecy/publications/documents/0210074.pdf

> *A statistical analysis of the results of the chemical tests showed that the quality of groundwater was significantly better ($p<0.05$) in the northern portion of the study area (Region 1) than in the southern portion (Region 2). The communities of Buena, Parker, Toppenish, Wapato and Zillah are located in Region 1 and the communities of Granger, Grandview, Outlook, Mabton and Sunnyside are located in Region 2. None of the wells sampled in Region 1 exceeded the U.S. Environmental Protection Agency's maximum contaminant level (MCL) for nitrate+nitrite of 10 milligrams per liter whereas 21% of the wells in Region 2 exceeded this standard. Mean values for ammonia, chloride and specific conductivity were also significantly higher in Region 2*

EPA Study on the "Dairy Cluster"

Environmental Protection Agency (2016) Yakima Valley Dairies Consent Order. Available at https://www.epa.gov/wa/lower-yakima-valley-groundwater

> *Since the fall of 2013, the dairies have been collecting groundwater data each quarter from a network of 26 groundwater monitoring wells. The purpose of the monitoring well network is to assess the effect of nitrate source control actions taken by the dairies on nitrate concentrations in the groundwater.*

In the third quarter of 2013, the first quarter that the dairies conducted groundwater sampling, nitrate concentrations in seven of the downgradient wells were less than the MCL of 10 ppm; nitrate concentrations in 15 of the wells exceeded the MCL. The nitrate concentrations in the wells that exceeded the MCL ranged from 12 ppm to 166 ppm.

(EPA, 2014)

Two years later, in the third quarter of 2015, nitrate concentrations in seven of the downgradient monitoring wells were less than the MCL; nitrate concentrations in 14 of the wells exceeded the MCL; no sample could be taken from one groundwater monitoring well. The nitrate concentrations in the downgradient wells that exceeded the MCL ranged from 14 ppm to 180 ppm.

(EPA 2016)

Methemoglobinemia and Nitrates in South Central WA

VanDerslice, J. (2009). Final Report: Dose-Response of Nitrate and Other Methemoglobin Inducers on Methemoglobin Levels of Infants. National Center for Environmental Research WA State Department of Health. Olympia, WA. Retrieved from http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/5379/report/F

The results of this study provide evidence that exposure to nitrate from drinking water significantly and substantially increases the risk of an infant having physiologically elevated levels of methemoglobin. Furthermore, this risk is associated with intake levels above 0.5 mg NO3-N/kg day, approximately one-third of the RfD value.

CARE and Center for Food Safety (CFS) versus Cow Palace

All the important court documents from this landmark case are available at http://charlietebbutt.com/cases.html

In conclusion, this Court finds no genuine issue of material fact that Defendants' application, storage, and management of manure at Cow Palace Dairy violated RCRA's

substantial and imminent endangerment and open dumping provisions and that all Defendants are responsible parties under RCRA.

USGS Particle Tracking in LYV Groundwater

Bachmann, M.P. (2015) Particle tracking for selected groundwater wells in the lower Yakima River Basin, Washington: U.S. Geological Survey Scientific Investigations Report 2015-5149, 33 p., http://dx.doi.org/10.3133/sir20155149. Available at https://pubs.er.usgs.gov/publication/sir20155149

The U.S. Geological Survey (USGS) recently completed a regional scale transient three-dimensional groundwater-flow model of the Yakima River Basin using MODFLOW-2000. . . . Of the 2,403 particles, the simulated path lines for 2,080 reached the water table within the 42-year simulation period, thus identifying the predicted recharge areas for those particles. The median horizontal straight-line distance was 13,194 feet between starting and ending locations for these particles and the median time-of-travel for particles that intersected the water table was 984 days. Well to water-table travel times for 75.4 percent of the particles were less than the average travel time of 3,749 days. Predicted recharge locations for all particles, including those that did not reach the water table in 42 years, were between 50 feet and 34 miles horizontal distance from their starting locations, with a median distance of less than 3 miles away.

GWMA Research

Heritage University Survey:

In 2013 the GWMA contracted with Heritage University to survey the people of the GWMA target area in order to learn how well this population understands problems associated with nitrates in groundwater and the GWMA process.

Results:

1. 69% of households were aware of potential health risks related to drinking water with high levels of nitrate
2. Slightly over half of those surveyed had their well water tested
3. 4% believed that someone in their home had become ill from drinking their well water
4. 42% had heard of the GWMA
5. 33% were interested in participating in a more in-depth well assessment survey
6. There was a high correlation between being aware of nitrate issues and having well water tested for nitrates.
7. There was a statistical difference between home owners and renters regarding awareness of nitrate issues with drinking water. Renters are not as well informed as home owners.
8. 71% of renters were comfortable asking landlords to test well water and 29% were not.
9. There was a statistical difference between home owners and renters regarding awareness of the Lower Yakima Valley Ground Water Management Area. Renters are not as well informed as home owners.
10. 43% of those with Spanish surnames purchase bottled water compared to 15% of those with non-Spanish surnames. There was no statistical difference in risks for those with Spanish surnames and those without.

(See Third Quarterly Report, 2013 and Attachment 20)

Survey of Health Care Providers:

In 2013 the GWMA contracted with the Yakima Health District to survey 600 health care providers in Yakima County regarding their understanding of nitrates in drinking water and associated health risks.

Results: No surveys were returned

PgG Summary of Water Studies in the GWMA Target Area

In 2013, on behalf of the GWMA, the Pacific Groundwater Group accessed all known well testing in the GWMA target area and summarized the results. PgG created a data base with 7,790 locations for public and private wells. PgG found sampling results for 2,532 of the wells since 1978 and calculated a mean nitrate level of 5.8 and a median level of 4.7 for all tests.

On page 7 this report summarized the results of all known well testing in the Lower Yakima Valley between 1975 and 2014. It appears that nitrate levels are increasing. The Pacific Groundwater Group notes that the high numbers from 2010 may be due to an increase in testing of shallower wells.

Table 3. Nitrate Levels in GWMA Target Area by Year: 1975-2014

Date Range of Well Samples	Number of Wells (n)	Mean Nitrate[1]	Median Nitrate[1]	Standard Deviation[1]
1975 to 1979	4	1.45	1.10	1.66
1980 to 1984	51	3.48	1.70	4.10
1985 to 1989	40	3.33	1.80	3.63
1990 to 1994	76	3.52	2.60	3.89
1995 to 1999	69	4.06	3.90	3.29
2000 to 2004	295	6.36	4.00	8.56
2005 to 2009	90	4.74	4.44	3.60
2010 to 2014	323	13.51	11.50	11.17

[1] nitrate mg/L

PgG looked at trends by year and by well depth and then looked at trends for 46 wells that had more than 10 samples. Because many of these are public wells they tend to be deeper wells. Using the Mann-Kendall trend test the study found 7 wells with increasing nitrate levels and 9 with decreasing nitrate levels. All seven worsening wells are in the VIRE

Region II. (Note: FOTC disagrees with the selection of the Mann-Kendall test and believes that the Seasonal Mann-Kendall test is more appropriate).

See Pacific Groundwater Group (2013) *Potential groundwater monitoring stations Yakima groundwater management area.* LYV GWMA Fourth Quarterly Report 2013, page 200. Available at http://www.yakimacounty.us/DocumentCenter/Home/View/8454

Deep Soil Sampling: Between the fall of 2014 and the spring of 2016 the South Yakima Conservation District (SYCD) and Landau Associates conducted Deep Soil Sampling on 175 properties in order to evaluate the extent of nitrate leaching up to 6 ft below the land surface. The survey gathered data about cropping patterns, fertilization history and irrigation practices.

Table 4. Results: Averages for Spring and Fall Soil Sampling, LYV GWMA, 2014 - 2016

Seasonal Averages	1 Ft #N/Acre	2 Ft #N/Acre	3 Ft #N/Acre	4 Ft #N/Acre	5 Ft #N/Acre	6 Ft #N/Acre	Total #N/Acre	Ammonia #N/Acre	Organic Matter
Fall (N = 93)	135.33	89.55	107.95	78.75	101.52	87.26	531.78	22.7	2.01%
Spring (N = 82)	68.39	104.7	114.94	95.57	96	64.92	448.41	23.8	2.13%

1. According to Ecology's Adaptive Management Plan (page 23) in the 2017 National Pollutant Discharge General Permit for Concentrated Animal Feeding operations risks for nitrate leaching are:
    a. Low risk = 15 parts per million or 55 lbs/acre at the 2 foot level
    b. Medium risk = 15 – 30 ppm or 55 to 110 lbs/acre at the 2 foot level
    c. High risk = 30 – 45 ppm or 110 to 165 lbs/acre at the 2 foot level
    d. Very high risk = > 45 ppm or 165 lbs/acre at the 2 foot level
2. There is significant leaching of nitrate below the root zone on cropland in the GWMA target area
3. There are differences between spring and fall deep soil testing results

4. There was unequal coverage of the various combinations of irrigation practices, crop types and leaching factors.
5. Sixty five of 175 samples or 37% fell into the category of sprinkler irrigation, 2.5 ft to 4 ft crops and moderately high to high Ksat
6. There were fields with extreme values that would ideally be re-tested.
7. The range of values for alfalfa is huge and suggests a need for further study
8. The range of values for hops is large and suggests a need for further study
9. Over half of the fields planted in triticale are at medium to high risk for leaching nitrate to the groundwater
10. Double cropping is associated with higher nitrate levels
11. In this data set rill irrigation is more protective of the groundwater than sprinkler
12. Application of liquid manure is significantly more likely to result in high nitrate levels than application of solid manures or commercial fertilizers.

(See Attachments 16, Attachment 17, Attachment 18 & Attachment 24)

High Risk Well Sampling: Between 2013 and 2016 the Yakima Health District tested 460 domestic wells in the GWMA target area in order to better understand the prevalence of nitrate contamination of the aquifer.

Table 5. Results of High Risk Well Testing

Nitrate Ranges	Count: Phase I + Phase II	Percent
0 to 5.0 mg/L	100 + 172 = 272	59%
5.01 to 9.99 mg/L	44 + 76 = 120	26%
10.0 to 35.0 mg/L	28 + 40 = 68	15%
Total	172 + 288 = 460	100%

(See Third Quarterly Report 2013, page 128 & First Quarterly Report 2016, page 139)

A survey of well heads and site conditions should have accompanied the water testing. FOTC submitted a public records request for that data in 2018. There were no completed surveys.

Nitrate Levels in Lagoon Effluent: In 2010 the EPA tested lagoon effluent for nitrogen content as part of research on the dairy cluster. At a later date the SYCD calculated nitrogen concentrations for this source based on owner testing from about 20 LYV dairies.

Results: Nitrogen concentrations in Yakima Valley lagoon effluent were higher than concentrations published for dairies in the UC Davis report (Viers et al, 2011).

Table 6. Comparison of Lagoon Nitrogen Concentrations

	EPA	SYCD	Combined
Sample Size	15	23	38
Minimum mg/L	290	180	180
Q1 mg/L	1000	355	455
Median mg/L	1400	768	1028
Mean mg/L	1212	949	1054
Mode mg/L	1200	336	1200
Q3 mg/L	1600	1092	1401
Maximum mg/L	1800	3633	3632
Standard Deviation	492	802	702

(See Attachment 32, *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area,* Appendix B, page 85)

Nitrates below Pens, Corrals and Compost Yards: In 2015 a local team performed deep soil testing beneath pens, corrals and compost yards on several LYV operations. Although the methods lacked QA/QC protocols the results are helpful. (mg/kg = parts per million)

Table 7. Results of DSS in Pens & Corrals

Depth in pen (ft)	0	1	2	3	4	5	6
Minimum (mg/kg NO_3-N)	22.6	21.8	10.6	8.3	6.1	6.5	3.8
Maximum (mg/kg NO_3-N)	962.6	409.7	199.2	186.5	109.6	93.4	124.7
Average (mg/kg NO_3-N)	273.3	165.9	98.5	71.2	45.7	36.7	36.4
Median (mg/kg NO_3-N)	118.6	153.8	89.9	63.6	38	29.6	17.1
Standard Deviation (mg/kg NO_3-N)	308.6	115.3	54.5	45.9	31.1	26.4	36.8

(See Attachment 32, *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area,* page 18; Attachment 13, Attachment 14, & Attachment 15)

Table 8. Results of DSS in Compost Yards

Site	Surface	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft
1C1	364.0	116.3	95.6	82.6	31.1	15.4	15.6
1C2	292.7	49.8	24.5	28.6	27.1	21.0	19.8
5C1	159.0	118.8	133.8	225.0	153.9	116.7	28.0
2Cl	139.0	1.3	6.3	1.0	3.2	1.9	8.5
2Cu	649.4	30.0	2.2	36.9	150.0	175.1	151.5
4C1	48.3	164.5	226.1	216.9	222.5	132.1	59.1
6C	123.2	73.5	34.7	24.7	17.7	9.1	
Ave (ppm)	253.7	79.2	74.7	88.0	86.5	67.3	47.1
Range	48.3-649.4	1.3-164.5	2.2-226.1	1-216.9	3.2-222.5	1.9-175.1	8.5-151.5

(See Attachment 32, *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area,* page 18; Attachment 13, Attachment 14, & Attachment 15)

Nitrate Loading Assessment/Nitrogen Availability Assessment: In 2015 the GWMA approved research to compile a Nitrogen Loading Assessment for the GWMA target area. The final product, delivered in 2018, was a Nitrogen Availability Assessment. (Note: The Friends of Toppenish Creek and others question the validity of some conclusions from that study. The NAA has not been approved by the GWAC)

These are the estimated contributions from major nitrate sources at the medium range according to the NAA.

1. Irrigated Agriculture – 64%
2. Lagoons – 19%
3. Pens – 12%
4. All Septic Systems – 2%
5. Atmospheric Deposition – 2%
6. Residential Fertilizer – 1%
7. Small Farms – 0%

(See Attachment 32, *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area,* page 72 & Attachment 27)

These are the estimated contributions from major nitrate sources at the medium range according to an FOTC refinement of the data. (See Attachment 61)

1. Irrigated Agriculture: 61%
2. Lagoons: 17%
3. Pens: 11%
4. Atmospheric Deposition: 4%
5. Compost 3%
6. Septics: 2%
7. Bio-solids: 1%

2017 Sampling of Wells and Drains: In 2017 the United States Geological Survey (USGS) sampled 156 domestic wells and 24 drains for the LYV GWMA. According to Huffman, (2018)

> *The average nitrate concentration for groundwater samples was 6.1 mg/L as nitrogen. Concentrations of nitrate averaged 5.5 mg/L in drain site samples. The 10 mg/L maximum contaminant level (MCL) established by the EPA for drinking water was exceeded by 20 percent of samples from wells*

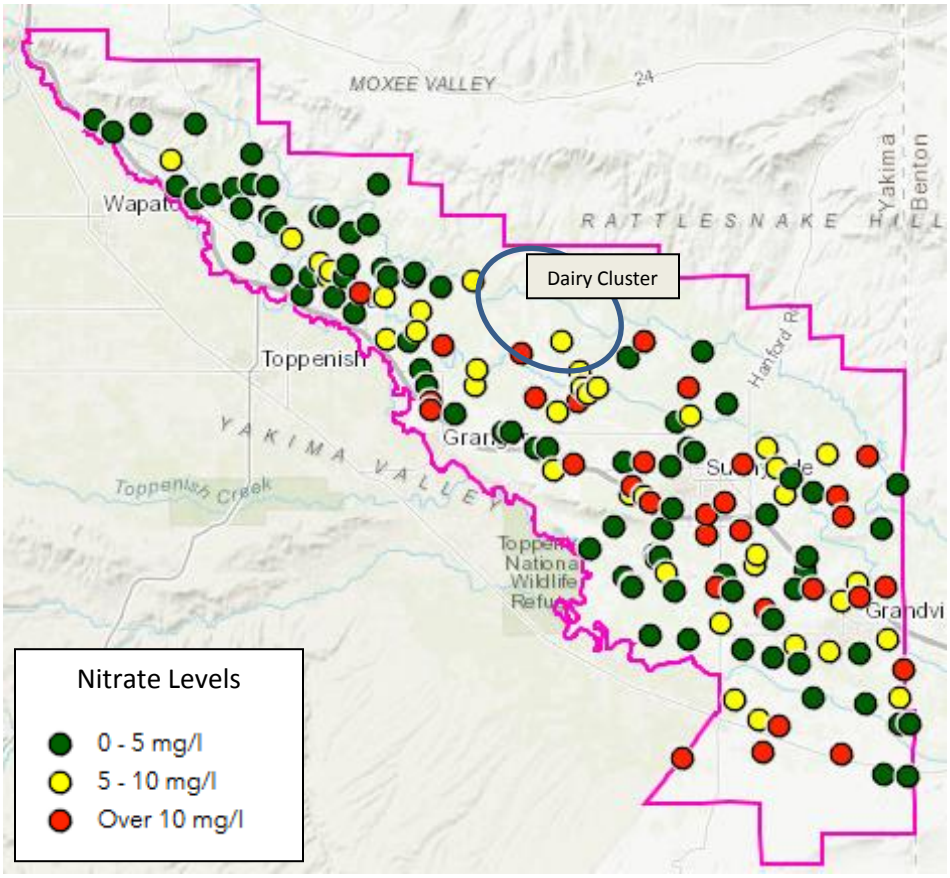
Here is a summary of FOTC analysis of the data gathered by USGS

1. Average nitrate levels for five well groupings are:
    A. North of Wapato – 0.50 mg/L
    B. Wapato to Granger – 4.00 mg/L
    C. Granger to Sunnyside – 8.62 mg/L
    D. Sunnyside to Mabton – 5.11 mg/L
    E. South of Mabton – 6.45 mg/L
2. Wells near the Yakima River had lower nitrate levels than those farther from the river
3. Wells in the area studied by the WA Agricultural Chemicals Pilot Project continue to have low nitrate levels

4. There was no overall correlation between well depth and nitrate levels
5. Drains in the northwestern study area had low nitrate levels
6. The highest drain nitrate levels were found in the area between Sunnyside and Mabton
7. Average nitrate levels in drains ranged from 0.01 mg/L to 13.07 mg/L

(See Attachment 28)

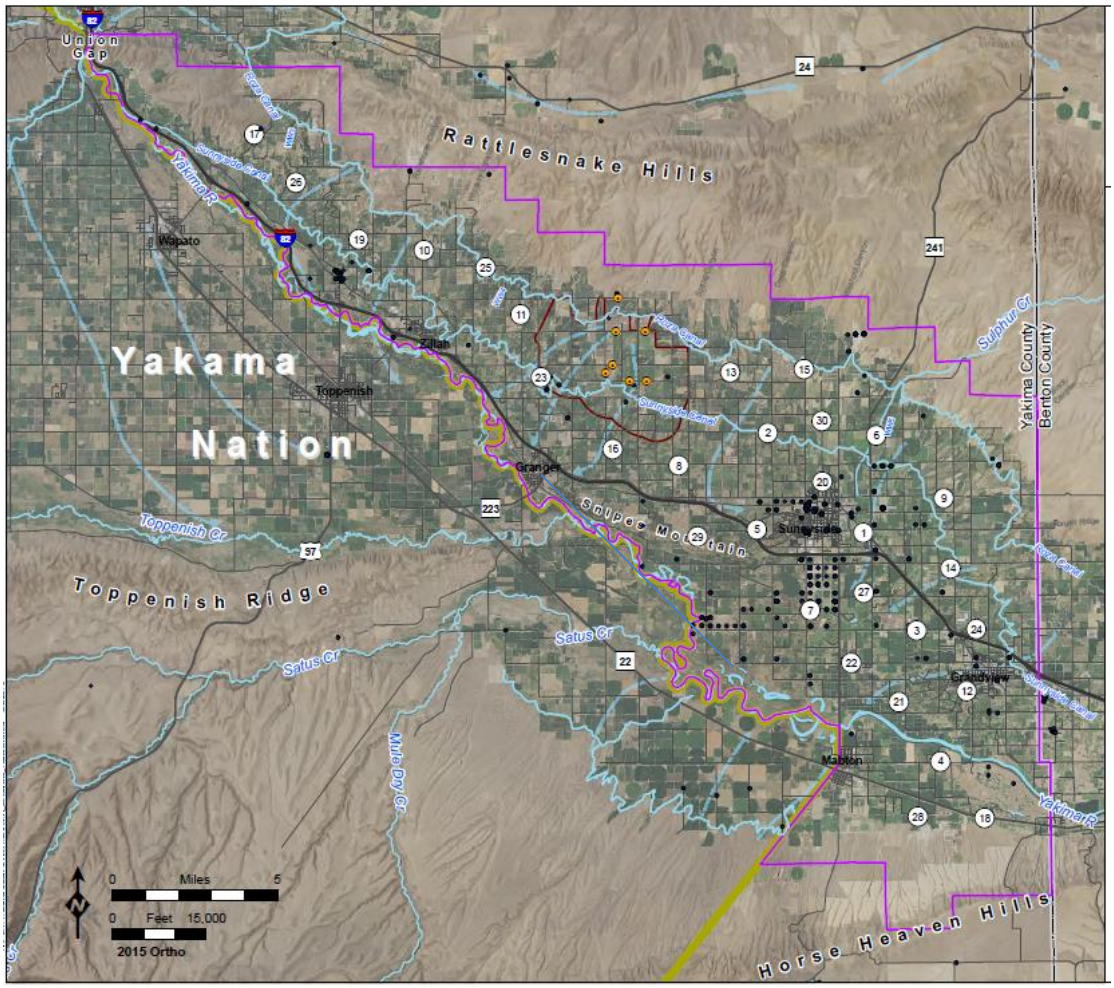
Map 7. Results of the 2017 USGS Domestic Well Testing



Source: Yakima County GIS mapping for the GWMA at http://arcg.is/1ie9mP

Planning a Network of Monitoring Wells: Since 2013 the GWAC has studied plans for a network of purpose built monitoring wells. The GWAC has approved a network of 30 purpose-built monitoring wells that capture "first waters" to be evenly spaced across the GWMA target area. See the map below for proposed well locations.

Map 8. Proposed Network of Purpose Built Wells - 2016



Pacific Groundwater Monitoring Group (2016) Ambient Monitoring Network Report in Fourth Quarterly GWMA Report 2016. Available at http://www.yakimacounty.us/DocumentCenter/Home/View/13094

Both the GWAC and the Data Work Group spent much time on this study. The original approved 2013 plan (Pacific Groundwater Group, 2013g) listed these monitoring objectives:

1. *Fill spatial data gaps*
2. *Monitor hot spots*
3. *Track increasing concentration trends*
4. *Measure basin-wide average concentration*
5. *Monitor common water supply aquifers*
6. *Measure effects of current and future practices*
7. *Address health risks*

At their October 12, 2016 meeting the Data Work Group was told that not all objectives could be met with existing funds. The work group narrowed down the list to "basin wide average concentrations" and "hot spots". The largest known hot spot is the dairy cluster.

The most recent proposed network addresses only one of these objectives - to measure basin wide average concentrations. As of October 2018 there were no monitoring wells and no plan for analysis. There are no proposed monitoring wells on the dairy cluster.

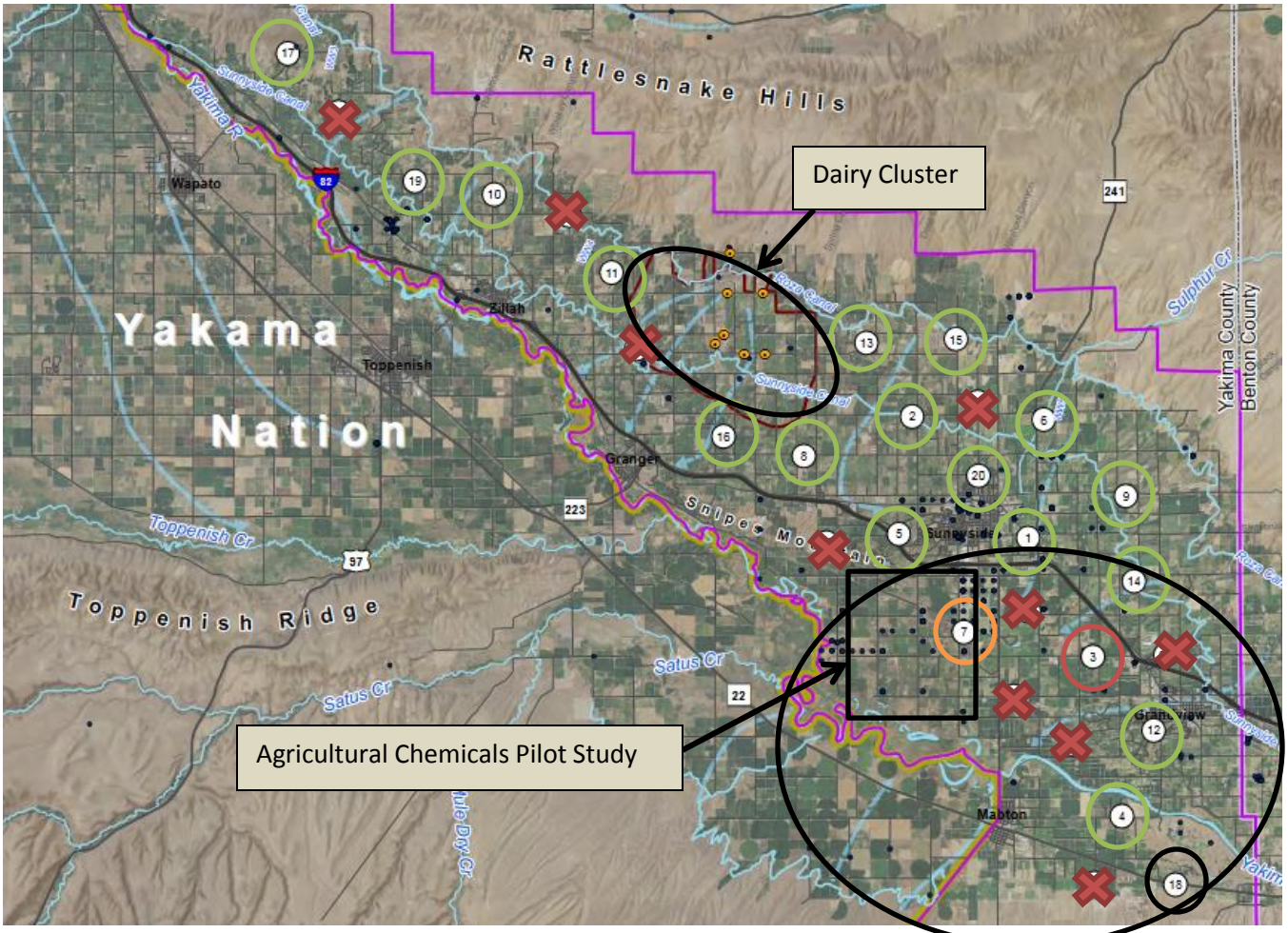
Recent contracts and requests for bidding indicate that the network will contain < 20 wells. (First Quarterly Report, 2018; Yakima County, 2018e) This is insufficient to adequately monitor water quality in the 273 square mile GWMA target area. For comparison, Ecology utilized a network of 28 monitoring wells in the 150 square mile Sumas Blaine aquifer. (Carey, 2017; Redding, 2011)

The only criteria for site selection in the planned GWMA network is equidistance on a two dimensional map. (LYV GWMA, 2014 ff) There was no selection based on elevation, geology, soil types, depth to groundwater, proximity to the river, hydrologic class, drainage class, proximity to cities, or proximity to various sources of pollution.

To illustrate the difficulties when there are too few wells, consider the 100 square mile southern section of the GWMA target area. In the original plan there would have been 11 monitoring wells. The reduction in number leaves 6 monitoring wells for an area that is not homogeneous. 1 site is somewhat well drained, 3 sites are well drained, 1 site is excessively well drained, 1 site is somewhat well drained/well drained. Only one site (#7) lies near the

area where the Agricultural Chemicals Pilot Study was performed. FOTC has repeatedly requested re-testing in this area.

Map 9. Soil Drainage Categories for Purpose Built Wells



GWMA Education and Outreach

Goals: The Education and Public Outreach Work Group began early in the GWMA process with an ambitious plan for engaging stakeholders and the community.

EPO Goals and Objectives

The GWMA Education and Public Outreach Plan will inform and educate the public about nitrate groundwater contamination and its health and environmental impacts, promote GWMA activities, and encourage engagement in the process by the community and key stakeholders.

Overarching Objectives

The overarching objectives developed to carry out the plan goals include:

1. Educating at-risk audiences about the risks of elevated nitrate to human health and how to protect themselves from that risk;

2. Informing audiences about the GWAC planning process; and

3. Inviting participation in the development of the GWMA program

(See Fourth Quarterly GWMA Report, 2012, page 113)

Actions: In 2017 the EPO group presented a list of the work group accomplishments, paraphrased here:

2013

1. Created a logo for the GWMA
2. Public Awareness Survey conducted by students from Heritage University – 136 completed surveys
3. Sent nitrate information to healthcare providers
4. Presentation to the Central Washington Family Residency program
5. Presentation on Spanish language radio, "Connect with your Government"
6. Presentation to the Community Advisory Board for El Proyecto Bienestar
7. Launched website

2014

1. News Release about GWMA accomplishments
2. Launched Phase I of the High Risk Well Assessments
3. Partners with the University of Washington/EPA Pediatric Environmental Health Services Unit to create a "New Moms" campaign that provides information to local maternity units
4. Created a Power Point with standardized information for presentations about the GWMA (English only)
5. Created a two year budget for EPO:
    a. Abandoned Wells and Septic System Maintenance $76,000
    b. Educational Outreach Campaigns $54,000
    c. Wellhead Risk Assessment Surveys-Phase 2 $100,000
    d. Redesign and Maintain GWMA Website $12,000
    e. Community Outreach Surveys $25,000

    (A request to hire a community outreach worker was rejected by the GWAC)
6. Released results of High Risk Well Assessments
7. Distributed 2,000 "New Mom" Flyers

2015

1. Rebuilt GWMA web site
2. Launched Phase II of the High Risk Well Assessments

2016

1. January and March Press Releases re High Risk Well Assessments
2. Completion of Phase II High Risk Well Assessments
3. Bi-lingual presentations to Sunnyside Work Force Clients
4. Talk Show participation on English and Spanish radio shows
5. Paid advertisements on English and Spanish radio
6. Editorial by Chairman Rand Elliott in English and Spanish newspapers
7. EPO participates in five Health Fairs – bilingual. Distributed nitrate test strips

8. First bilingual “Test Your Well” Billboard goes live

2017

1. Second bilingual billboard
2. “What You Can Do To Protect Your Well Water” campaign
    a. 12,000 flyers in Sunnyside Daily Sun News
    b. 10,700 flyers in El Sol
    c. March KIT radio interview with Commissioner Rand Elliott
    d. April KDNA radio presentation with Andres Cervantes and Ignacio Marquez

Early in the GWMA process the EPO developed a list of evaluation tools to determine success of the work

1. Number of new participating agencies
2. Number of face to face meetings
3. Number of Fact Sheets developed
4. Number of Talking Points/Presentations developed
5. Number of outreach recommendations received and implemented
6. Amount/character of audience feedback
7. Number of e-mail contacts received
8. Number of updates sent via e-mail
9. Number and character of comments, suggestions and praise
10. Number of agency/organization requests to be involved in GWMA
11. Structured interviews with key stakeholders to measure understanding of issues, involvement with GWMA

This evaluation has not been done.

Deficiencies: Efforts to inform the public about the risks of nitrates in well water have been thorough and ongoing. Efforts to tell people about the causes of groundwater contamination and proposed actions to remediate the problem were minimal.

There is no doubt that dairies are one leading cause of the pollution. Because other potential sources are not well characterized the industry successfully argued that dairy should not be the only target. Because EPO was cautioned not to talk about dairies information has been deliberately vague. This is not conducive to problem solving.

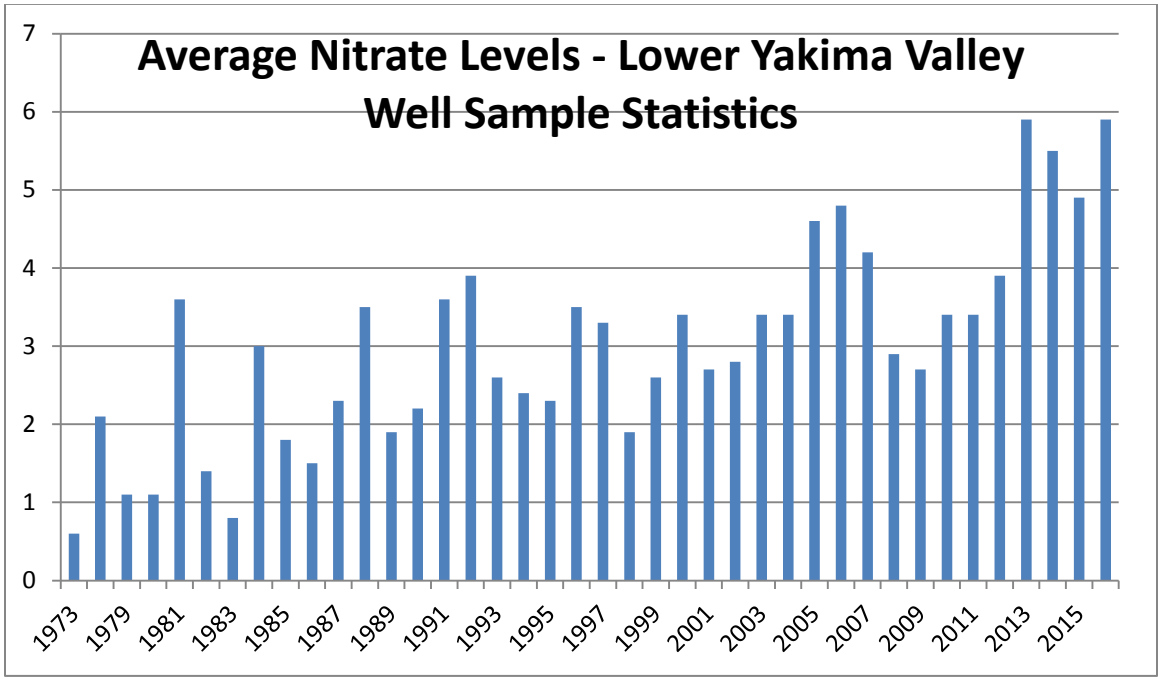
Two women of color from Radio KDNA volunteered to serve on the EPO work group. They spent a great deal of time working with a professor from the University Of Washington School Of Public Health on a project that would bring ten graduate students to the valley to assist the GWMA with public outreach. A dairywoman on the GWAC organized resistance to the plan and defeated the project. Why? She did not like the text book for the class, *Fresh Fruit, Broken Bodies,* which chronicled the experience of a physician and anthropologist who traveled with a group of Oaxacan farmworkers on their journeys from California to Washington.

There is a huge knowledge gap in the community. Many of the terms used in GWMA discussions are acronyms based on technical or legal language. It will be difficult for the community to evaluate the GWMA plan without some preliminary education. FOTC has asked the GWMA to develop a campaign to teach people the meaning of terms such as agronomic rates, vadose zone, and groundwater flow. In 2017 FOTC put together some short suggested bilingual flyers to help with this effort. The suggestion never made it to the EPO work group agenda.

Problem Definition – Nitrate Contamination of Groundwater in the LYV

Studies of nitrates in LYV groundwater over the past decades demonstrate an increase in the percentage of nitrate contaminated wells and levels of contamination. Studies vary in size and design so they cannot be directly compared with any accuracy. However, Yakima County has provided a summary of well sampling since 1973 from the GWMA Data Base. This is one way to look at the LYV groundwater nitrate trends.

Chart 1. Average Nitrate Levels in the Lower Yakima Valley - 1973 to 2015



From Appendix N: Lower Yakima Valley Groundwater Program, August, 2018

(Since the readings are missing from the data base this graph does not include 2014 – 2016 well testing from a "dairy cluster" where 61% of domestic wells one mile down gradient had nitrate levels above the safety standard of 10 mg/L. and the highest reading was 234 mg/L.)

Local Impact: Nitrate in Municipal Wells

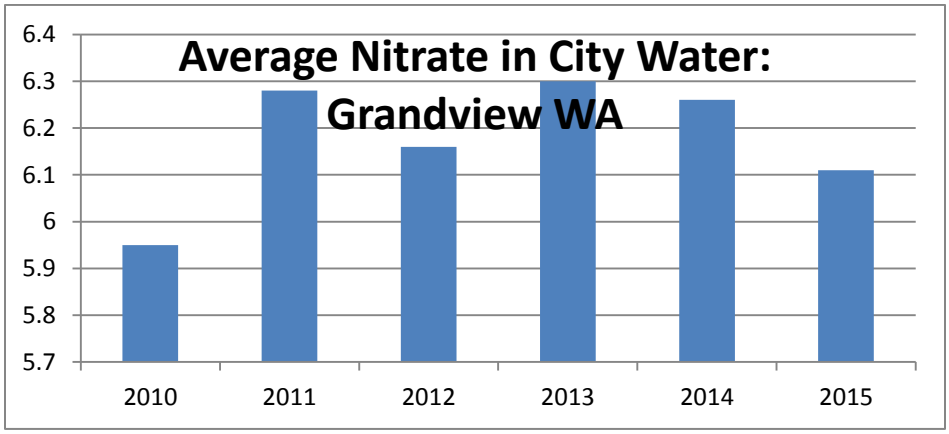
1. ***Rural home owners:*** If all impacted homeowners with contaminated wells purchase bottled water at a cost of $1.20 per gallon per day per person the total is over $1 to $1.75 million per year. (Approximately 20,000 people live outside the cities and towns and 12% to 20% of wells are contaminated or at risk). (Attachment 26 & Attachment 67)

2. ***In 2008 the Outlook Elementary School*** spent $48,000 to drill one new well and then another in order to provide nitrate free drinking water for the students. (Attachment 36)

3. ***In 2013 the City of Mabton*** began drilling a new well at a projected cost of $1,850,000. Two of the city's old wells were no longer producing at high enough pressures due to age and a falling aquifer. A third well had very high nitrate levels and the water from that well had to be blended with water from others in order to meet safety standards for human use. (Attachment 57 & Attachment 64)

4. ***The City of Grandview*** has deep municipal wells. Their wells tap the basalt aquifer. (Grandview, 2016) Water from a nitrate contaminated well is blended with water from the others in order to achieve safe nitrate concentrations. The average nitrate level in samples taken from Grandview municipal wells has been around 6 ppm since at least 2010. (WA State Dept. of Health, 2018b; Environmental Working Group, 2018)

Chart 2. Average Nitrate Levels in Grandview City Water



From the Environmental Work Group Tap Water Data Base at https://www.ewg.org/tapwater/system-contaminant.php?pws=WA5328970&contamcode=1040#.W2W4msIh2M8

5. ***In 2010-2011 Yakima County*** provided water treatment systems for 161 LYV households in a Nitrate Treatment Pilot Program. The WA State Dept of Health provided $395,200 in funding. The county spent $264,085 and returned the remainder. (Yakima County, 2011c)

6*.* ***In November 2014*** the WA State Dept. of Health offered Yakima County $148,000 to deliver water treatment for LYV residents. Yakima County declined the opportunity.

7**.** ***Since 2014 dairies under a consent order with the EPA*** have provided reverse osmosis to homes with elevated nitrates one mile down gradient from their operations. (EPA, 2014)

8**.** ***Since 2015 dairies under a consent decree from the Ninth Circuit Court*** have provided reverse osmosis to homes with elevated nitrates three miles down gradient from their operations. (See CARE and CFS versus Cow Palace, Tebbutt Law, 2015)

One Confirmed Source – Groundwater Pollution from Dairies:

More intense monitoring: The GWMA studies have not clearly determined the relative contribution from various sectors of the agricultural community. Because concentrated animal feeding operations face well-known challenges in managing manures there are regulations in place to protect the waters of the state from this potential source of pollution. (RCW 90.64 – Dairy Nutrient Management Act). There is monitoring in place that makes it easier to pinpoint leaching of nitrates from fields controlled by dairies. This source is significant.

Dairies in Washington State are required to have nutrient management plans (NMPs). There is no requirement for them to follow their plans but they are required to keep records. (WSDA DNMP, 2016 & 2017) One of the underpinnings of the dairy nutrient management program is twice annual soil sampling to determine 1. How much nitrogen is already available in the soil prior to application of fertilizers and manures, and 2. How much of the available nitrogen was taken up by plants during the growing season and how much remains with a potential for leaching to groundwater.

Agronomic Rates & Soil Testing: When manures and fertilizers are applied only in amounts needed by the crops they are applied at agronomic rates. This is a legal term that is used to distinguish acceptable agricultural practices from actions that pollute and violate state and federal rules and regulations.

Soil testing is often used to decide whether or not applications are agronomic. (WA State Dept of Ecology, 2017a & 2017b) However, Ecology also states:

> *In excessively drained soils with irrigation or high precipitation, soil nitrate testing is not likely to be informative, either as an indicator of overloading, or as an indicator of risk of groundwater contamination, due to the rapid removal of potential nitrate contamination from the root zone.* (Morgan, 2014)

Agronomic Rates in the Yakima Valley: In 2016 WSDA sent a report to the legislature entitled, *Implementation of Nutrient Management Training Program for Farmers.* (WSDA DNMP, 2016) The agency stated that dairies in Yakima County control over 28,000 acres of cropland. In 2014 there were problems with excess nutrients on 11.9% of those acres. In 2016 there were problems on 6.6% of those acres. Much, probably most, of this improvement can be attributed to the remediation work that was done by the "dairy cluster" in cooperation with the EPA. The 11.9% rate for Yakima County in 2014 was over three times worse than the state average and the 6.6% rate for 2016 was twice the state average. (WSDA DNMP 2016, p. 9)

EPA Consent Agreement: Since 2013 the EPA has been working with a cluster of Yakima dairies where 61% of down-gradient domestic wells have nitrate levels > 10 mg/L. EPA's 2016 report, *Yakima Valley Dairies Consent Order Update,* says:

> *The Consent Order states that the three dairies must maintain soil nitrate at the 2–foot (12' – 24") depth below 45 parts per million (PPM). This level was selected because at the time the Consent Order was signed, it was consistent with the level that was used by the State of Washington with regard to dairies in the context of their Nutrient Management Plans.*

> *In accordance with the Consent Order, the three dairies have sampled soil in their 34 application fields twice a year: post-harvest sampling is done at the 1-foot, 2-foot, and 3-foot depths in the fall, and pre-plant sampling is done at the 1-foot and 2-foot depths each spring. In fall 2013, 20 of the dairies' 34 application fields exceeded 45 ppm at the 2–foot depth. Two years later, in fall 2015, the number of fields exceeding 45 ppm at the 2-foot depth was reduced to nine.* (EPA, 2016, page 2)

Litigation: In 2015, in CARE and Center for Food Safety versus Cow Palace, Judge Thomas Rice from the 9th Circuit Court of Appeals found that dairies in the cluster had failed to follow their NMP's and that:

> *Defendants' application, storage, and management of manure at Cow Palace Dairy violated RCRA's substantial and imminent endangerment and open dumping provisions and that all Defendants are parties under RCRA.*
>
> (Tebbutt Law, 2015)

Testimony in that case revealed that the dairies:

1. Applied manures to cropland at greater than agronomic rates
2. Ignored weather conditions when applying manures and calculating application rates
3. Did not take post-harvest samples in the spring time when double cropping
4. Failed to take into account post-harvest nitrogen residuals when calculating application rates
5. Failed to calculate application rates based on realistic crop yields
6. Failed to take samples from applied manures and greatly underestimated the nitrogen content of applied manures
7. Over-estimated volatilization rates
8. Failed to keep records of irrigation practices
9. Set unreasonably high crop yield and removal goals
10. Allowed manure seals in lagoons to dry and crack
11. Failed to maintain compacted clay liners for lagoons

(Expert Testimony of Dr. Byron Shaw, Expert Testimony of David Erickson, at http://charlietebbutt.com/cases.html)

Relevant National and Worldwide Research:

The ability to produce nitrogen fertilizers on an industrial scale has transformed agriculture worldwide and made it possible to feed a world population that has grown from 1 billion in 1804 to 3 billion in 1960 to 6 billion in 1999. The current population is about 7.5 billion and that number is expected to reach 9 billion in 2054. (United Nations, 1999)

This major advance has changed the nitrogen cycle. Major consequences are:

1. *Approximately doubled the rate of nitrogen input into the terrestrial nitrogen cycle, with these rates still increasing;*
2. *Increased concentrations of the potent greenhouse gas N_2O globally, and increased concentrations of other oxides of nitrogen that drive the formation of photochemical smog over large regions of Earth;*
3. *Caused losses of soil nutrients, such as calcium and potassium, that are essential for the long-term maintenance of soil fertility;*
4. *Contributed substantially to the acidification of soils, streams, and lakes in several regions*
5. *Greatly increased the transfer of nitrogen through rivers to estuaries and coastal oceans.*
6. *Increased the quantity of organic carbon stored within terrestrial ecosystems;*
7. *Accelerated losses of biological diversity, especially losses of plants adapted to efficient use of nitrogen, and losses of the animals and microorganisms that depend on them; and*
8. *Caused changes in the composition and functioning of estuarine and nearshore ecosystems, and contributed to long-term declines in coastal marine fisheries.*

(Vitousek et al, 1997)

Sources of nitrogen emissions are combustion and burning of fossil fuels, agriculture and biological nitrogen fixation. Agriculture is the largest source and animal agriculture is the largest component within that category. Transformation of organic nitrogen from manures into ammonia and nitrate takes years and differs from the more rapid utilization of nitrogen from chemical fertilizers. (Reis et al, 2016; Sutton et al, 2011, EPA, 2011; Gruber & Galloway, 2008; Liu et al, 2010).

There are parts of the world with an excess of nitrogen and parts of the world such as sub-Saharan Africa with insufficient nitrogen. This situation provides an opportunity for developing countries and areas that have only been farmed in recent times to proactively manage the nitrogen balance. (Reis et al, 2016) The Yakima Valley has been intensively farmed for just over 100 years.

How much reactive nitrogen can the world handle in a sustainable manner? Stefan et al (2015) have estimated that we currently produce 2 ½ times the amount of reactive nitrogen that would allow us to continue to live as we are accustomed. International policy changes are recommended to avoid environmental crises that will force change upon us. (Sutton et al, 2011; Vitousek et al, 1997)

Animal agriculture is a major part of farming in the Yakima Valley and is enmeshed in the global economy (Ryan Dumas, 2018a; Ryan Dumas, 2018b). Policy changes across the globe will impact our local economies. FOTC believes that analysis of potential and likely environmental regulations, evolving markets and externalization of costs should be part of the GWMA analysis. (See Paulot & Jacob, 2014)

GWMA Conclusions:

In general the LYV GWMA advisory committee agrees that agriculture is the leading cause of nitrate pollution. The group agrees that the largest potential source is leaching of nitrate from cropland when fertilizers and manures are applied in amounts that exceed the needs of plants, or when unforeseen events inhibit plant uptake.

The GWAC agrees that other sources are manure lagoons, pens and corrals, composting yards, industrial waste management, application of bio-solids to cropland, atmospheric

deposition, commercial and residential septic systems, small and hobby farms and application of residential fertilizers. The GWAC has not officially ranked these sources. There is a big difference between potential nitrogen inputs and actual leaching to groundwater. For example, 100 tons of nitrogen on 500 acres is more likely to reach the groundwater than 100 tons of nitrogen on 5,000 acres.

The 2018 Nitrogen Availability Assessment, *Nitrogen Available for Transport, Yakima Valley GWMA,* provides estimates of the potential amounts of N from each source (page 72) and FOTC has refined those estimates as seen below (Attachment 30 & Attachment 61)

Table 9. Available Contribution to Nitrate Pollution by Source

Nitrogen Availability Assessment	**Friends of Toppenish Creek**
Irrigated Agriculture – 64%	Irrigated Agriculture - 61%
Lagoons – 19%	Lagoons - 17%
Pens – 12%	Pens - 11%
All Septic Systems – 2%	Atmospheric Deposition - 4%
Atmospheric Deposition – 2%	Compost - 3%
Residential Fertilizer – 1%	Septics - 2%
Small Scale Farms – 0%	Bio-solids - 1%

An appropriate plan to address nitrate leaching will allocate resources and target efforts to those sources that cause the most pollution. The NAA estimate is a reasonable starting point with a few qualifiers. FOTC believes:

1. Atmospheric deposition causes over 4% of the problem because this source applies nitrogen to all 175,000 acres of the GWMA target area and not just the 74,000 designated for atmospheric deposition in WSDA calculations.
2. Lagoons and ponds with synthetic liners do not pose the same risk to the groundwater as those with clay liners.

3. NAA estimated risk from residential fertilizer is inappropriately high because the authors assumed that all applied residential fertilizer is available for leaching. We disagree. The fact that lawns are green demonstrates plant uptake of fertilizers.
4. The NAA estimate of nitrogen available for transport attributed to some crops is inaccurate.
5. Loss of nitrogen in runoff to surface waters should be addressed.
   (Attachment 61)

The GWAC agrees that agricultural practices are the leading cause of nitrates in LYV groundwater. To date those practices are not well characterized except for dairy.

Human Behavior:

A next step in describing the problem requires answers to the question, "Why do people do what they do?" Possible answers include:

1. Ignorance – most people have historically been unaware of the problem

2. Peer pressure – people imitate the action of those around them

3. Economics – well fertilized fields produce larger crops. Fertilizer is expensive.

4. Lack of regulation - no laws prevent excessive application of fertilizers/manures

And this leads to several interrelated approaches for influencing decision-making:

1. Education and Outreach

2. Influence Public Opinion

3. Analyze the Market Place – profit and loss

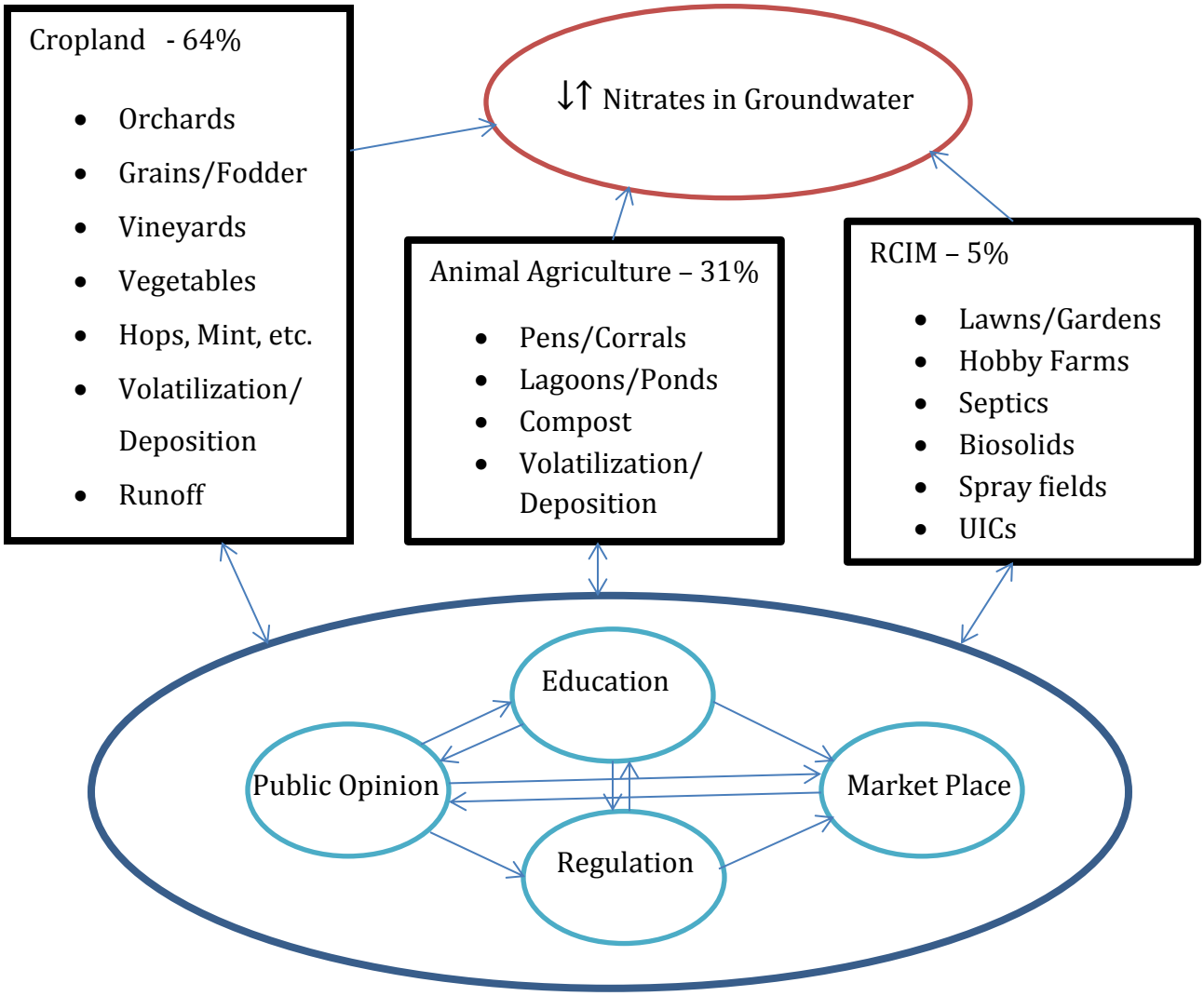
4. Implement appropriate regulation – incentives and penalties

(These hypotheses are based on discussions within the GWMA Irrigated Agriculture Work Group)

The conceptual framework below maps connections between human motivators, behaviors and the resulting impact on nitrates in groundwater.

Relationships between actions, sources of pollution, & nitrate levels in groundwater

Diagram 2.



Analysis of the Problem

Area Characterization

Here is an overview of the Lower Yakima Valley GWMA target area and Yakima County.

Hydrogeology from *Lower Yakima Valley GWMA Request for Identification (2011)*:

> *Lower Yakima Valley is the valley surrounding the Yakima River between Union Gap and Benton City. On the north it is bounded by the Rattlesnake Hills, and on the south it is bounded by the Horse Heaven Hills and Toppenish Ridge. Politically it is composed of unincorporated Yakima County, the Yakama Nation reservation, and the Cities of Benton City, Prosser, Grandview, Mabton, Sunnyside, Granger, Zillah, Toppenish and Wapato. Land and water use is dominated by agriculture on and off the reservation.*
>
> *Groundwater in the LYV originates as precipitation, infiltration from streams, and from irrigation and stock water that infiltrates into the ground from canals, fields and spray fields. Infiltration of septic tank effluent and stock water overflow also recycles water locally and results in groundwater recharge. Annual precipitation ranges from about 6 to 9 inches, while groundwater recharge is estimated to range from 7 to over 25 inches per year in irrigated areas and an inch or less in unirrigated areas (Vaccaro and Olsen, 2007,). With much of the land in the LYV used for irrigated agriculture, local recharge rates are significantly higher than precipitation due to the application and leakage of irrigation water.*
>
> *Recharge water may be contaminated by human activities. After recharge, the groundwater and possible contaminants move laterally and vertically toward wells, drainage ditches, and the Yakima River and its tributaries. The US Geological Survey has mapped shallow groundwater flow paths.*
>
> *If not intercepted by wells, shallow groundwater generally moves toward the Yakima River and its tributaries from the uplands on both sides of the valley. Where the river water level is lower than the adjacent groundwater elevation, groundwater will flow*

into the river from both sides. In these cases the river is a hydrologic boundary for shallow groundwater and shallow groundwater does not pass to the other side of the river. However, the boundary effect depends on the relative elevations of the river and groundwater; therefore, changes in recharge, pumping, river level changes, and the basin-and-ridge geology of the valley affect the boundary relationship. USGS research suggests that in some river reaches in some seasons, the groundwater level is lower than the river and the river therefore loses flow to the ground. In those cases the river may not be a regional hydrologic boundary (groundwater may move laterally below the river). Finally, deeper aquifers are less influenced by the river than are shallow aquifers.

Drinking water supplies in LYV are met primarily by wells that pump groundwater. Individual domestic wells tap permeable portions of a surficial sedimentary aquifer, while most municipal wells tap deeper aquifers in basalt (lava bedrock) and sedimentary inter bed layers that underlay the sediments.

Shallow layers of the sedimentary aquifer (less than ~100 ft below ground) may not be overlain by protective (low permeability) layers (ie: they may be "unconfined") whereas deeper layers of the sedimentary aquifer and the basalt aquifers are usually overlain by protective layers (ie: they are "confined"). Confined aquifers are usually deeper and are more protected by low permeable layers than are unconfined aquifers; however, they may nonetheless be subject to contamination by human activities. In the case of LYV, the Preliminary Assessment Report of 2010 identified that wells up to 300 feet deep were much more likely to contain groundwater with nitrate concentration above the MCL of 10 mg/L than were deeper wells. Because of the slow movement of groundwater, deeper aquifers may become contaminated in the future, and take more time to recover after reductions in nitrogen loads.

Deeper wells in the area are generally completed in lower portions of the sediments and in the Columbia River Basalts (bedrock aquifer) and interbed layers. Some wells completed in basalt are shallower than wells completed in sediments due to differences

in sediment thickness. The basalt aquifer is generally semi-confined and is composed of numerous distinct aquifers present in zones between the basalt flows. The extent of connection between the basalt aquifers at different interflow zones is documented in recent and pending published reports (Vaccaro et al, 2009) by the USGS. Most municipal and irrigation wells are completed in the deeper sedimentary and bedrock aquifers.

Map 10: **Map of the Yakima Basin from Hydrogeologic Framework of Sedimentary Deposits in Six Structural Basins, Yakima River Basin, Washington by Jones, Vaccaro & Watkins, 2006**

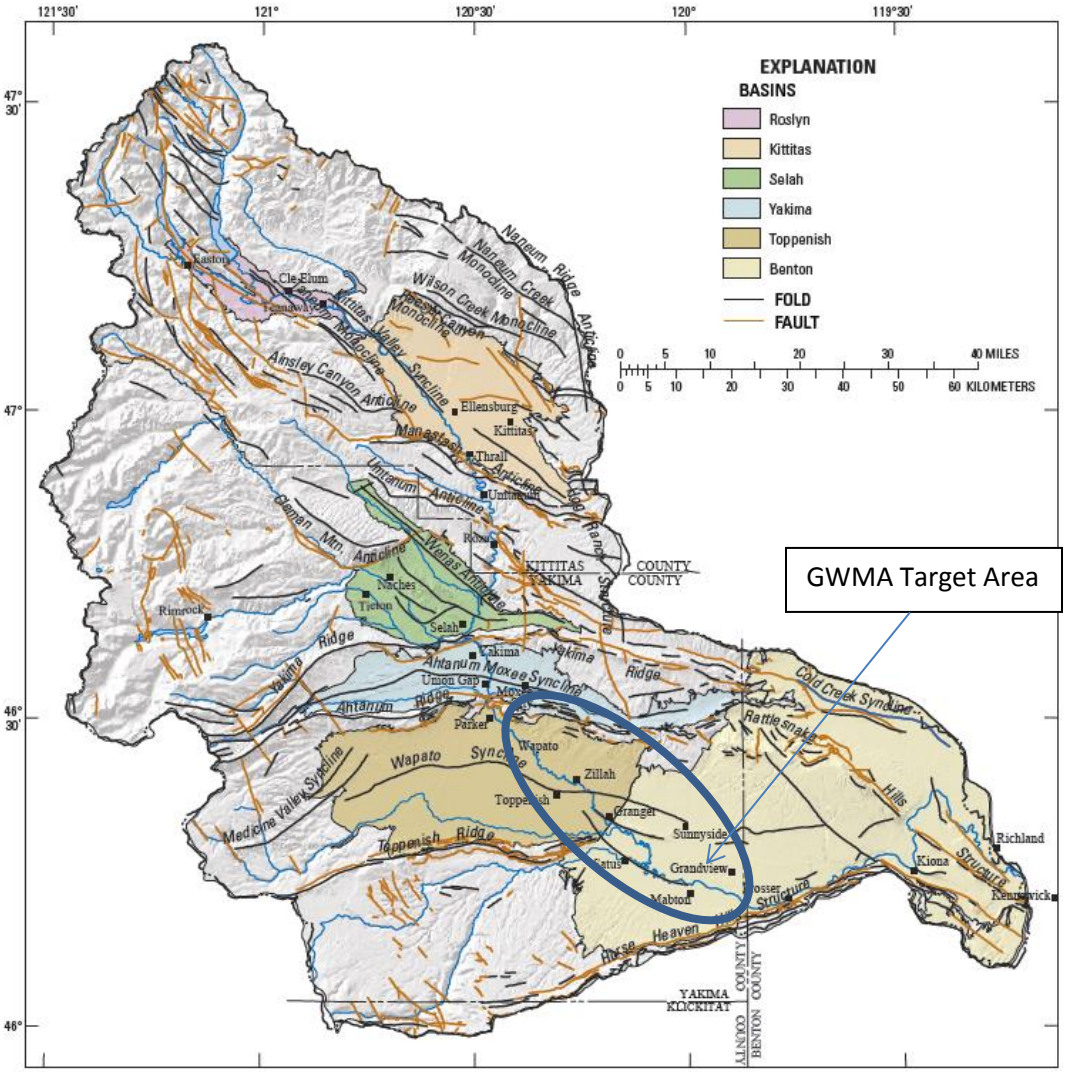


Figure 7. Structure delineating six sedimentary basins, Yakima River Basin, Washington.

Geology from the EPA study, *Relation between Nitrate in Water Wells and Potential Sources in the Yakima Valley, WA (2013)*

The Toppenish and Benton Basins consist of fine- and coarse-grained sediments overlying a sequence of three major basalt flows. The structural setting for the study area is created by bounding ridges such as the Rattlesnake Mountains, Ahtanum Ridge, Toppenish Ridge, and Horse Heaven Hills. The uppermost basalts of the Saddle Mountain Unit of the Columbia River Basalt Group are typically exposed in these upland ridges. This unit averages more than 500 feet thick. The underlying Wanapum unit averages 600 feet thick. These units are separated by the Mabton Interbed, with an average thickness of 70 feet.

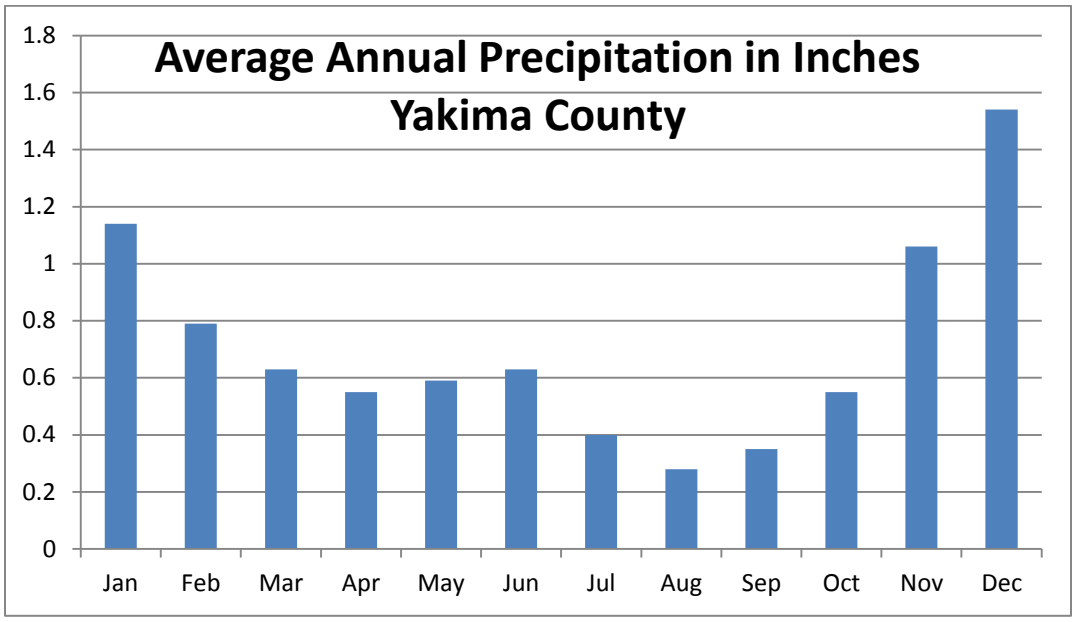
The valley is filled with a variety of sediments that pinch out along the flanks of the ridges. These sediments include Touchet Beds, loess and thick alluvial sands and gravels, and significant thickness of Ellensburg Formation. The thickness of these sedimentary units decreases from an average of more than 500 feet in the Toppenish Basin to less than 200 feet in the lower Benton Basin.

Water is found in fractures and interbeds formed of clinkers, permeable lava, lake deposits or paleo-soils and may occur at significant depths in the upland ridges, such as Horse Heaven Hills, and especially in the basalts. The water table is found at shallower depths as the valley is approached from these ridges. Near the Yakima River, it may be less than 10 feet to water, especially during the irrigation season.

The Lower Yakima Valley is filled with sediments shed by the ridges at the margins of the study area and those deposited in the valley bottom by the Yakima River. These sediments have an internal structure that strongly controls groundwater movement. As the water moves through these sediments, it tends to follow preferential flow paths composed of coarser sediments.

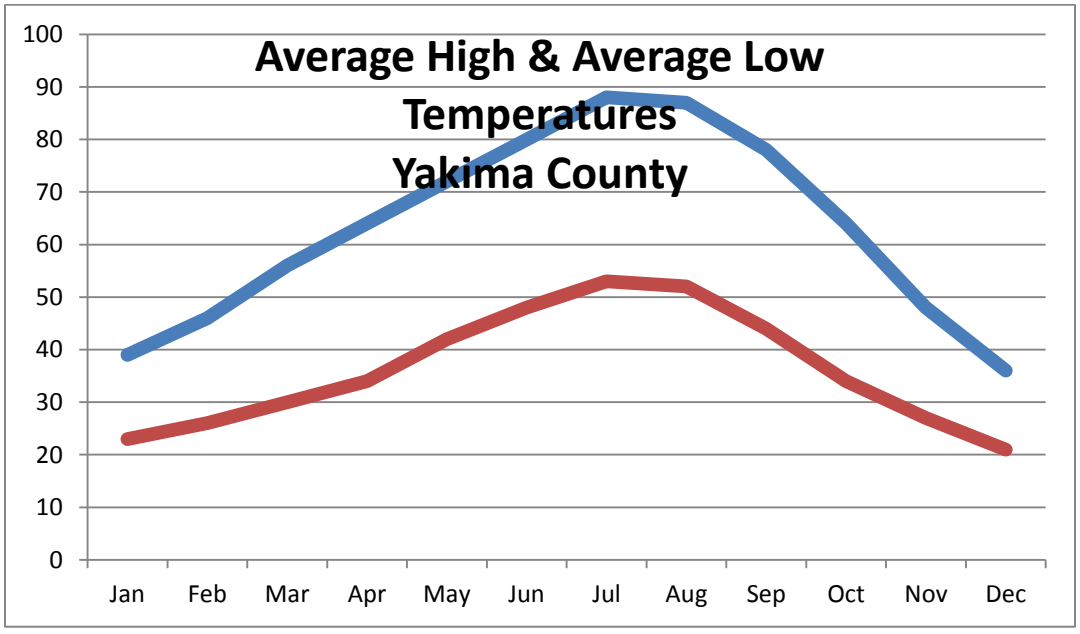
. **Climate and Weather from *U.S. Climate Data- 2018***

Chart 3.



Temperatures for Yakima County

Chart 4.



Soils and Land Use from the Natural Resources Conservation Service (2018)

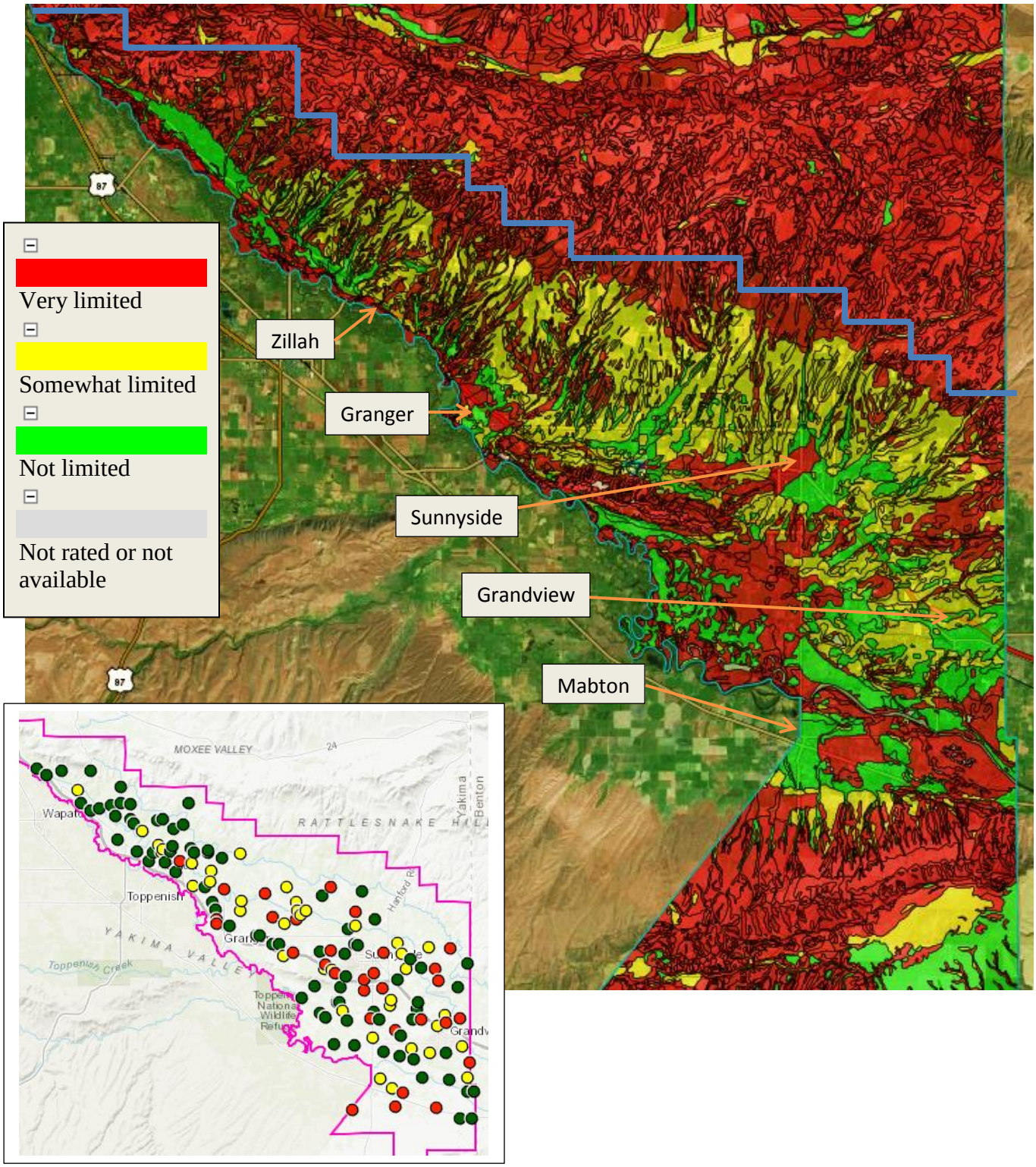
Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

Soil surveys can be used for general farm, local, and wider area planning. Onsite investigation is needed in some cases, such as soil quality assessments and certain conservation and engineering applications
https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

The Natural Resource Conservation Service has mapped and described the soils in the LYV. As an example consider mapping of risks for application of manures, food wastes, bio-solids and irrigation waste water to the land. Criteria for ratings include: depth to saturated zone, filtering capacity, adsorption, drought, slow water movement, strongly contrasting textural stratification, depth to bedrock, slope, cobble content, large stones on the surface, runoff, acidity, depth to cemented pan, sodium content, leaching, salinity, and flooding.

The NRCS map of the LYV below shows areas that are appropriate for land application of waste water by irrigation and contiguous areas that are very limited. *Results of the Recent 2017 USGS Domestic Well Testing,* Map 7, are superimposed on the NRCS map to facilitate discussion of the implications for the GWMA target area. Further application of the NRCS Soil Survey data to the Yakima Valley is available in Attachment 66.

Map 11. Natural Resources Conservation Services – Soil Mapping – Disposal of Waste Water by Irrigation



Economy from WA State Employment Security *Yakima County Profile (2017)*

In Yakima County, total covered employment increased from 93,988 in 2004 to 111,538 in 2016, a 17,550 job and 18.7 percent expansion during this twelve-year period. Of the 22 NAICS sectors mentioned earlier, there were five major sectors/industries that accounted for 65.4 percent of all jobs countywide in 2004. The same "Top Five" accounted for 70.9 percent of all covered employment countywide twelve years later, in 2016. Hence, the Yakima County economy was not a tremendously diverse economy in 2004 and QCEW employment data indicate it has become somewhat less diverse by 2016. In 2016; agriculture provided 28.1 percent, health services 13.7 percent, local government 12.0 percent, retail trade 9.6 percent and manufacturing 7.5 percent of total covered employment countywide. In 2004; agriculture provided 21.3 percent, local government 13.0 percent, health services 11.6 percent, manufacturing 9.8 percent and retail trade 9.7 percent of total covered employment. Hence, there was some repositioning within the "Top Five" rankings of job-providing sectors during this twelve-year period (i.e., from 2004-2016), as follows:

- *Employment in agriculture, forestry and fishing (where the vast majority are in agriculture) jumped 56.4 percent (from 20,057 jobs in 2004 to 31,361 in 2016) as agriculture strengthened its "Number One" position during this twelve-year period (or 13 years, inclusive). The agricultural sector will likely continue to expand in the near future, according to an article entitled "New Industry Coming to Sunnyside Will Bring 200 New Jobs" published in the New Vision website on 19 June 2017 The article states: "Ostrom Mushroom Farms, located in Olympia, WA, and the Port of Sunnyside have announced that the company will be opening a new farm in Sunnyside. . . Ostrom has been growing mushrooms since 1928 and employs 300 growers, pickers, and packers at their Olympia farm. The mushrooms are handpicked daily, refrigerated, and shipped fresh to consumers all over the Pacific Northwest, Alaska, and Hawaii. . . When in full production, Ostrom will create over 200 new jobs and be one of the*

largest employers in the County." Certainly this is good economic news for the local agricultural industry.

- *Local government registered a 9.3 percent employment upturn (from 12,209 jobs in 2004 to 13,350 in 2016) but it moved downwards in the "Top Five" ranking; from the second largest industry employment-wise in 2004 to the "Number Three" position by 2016.*
- *Health services registered a strong 39.7 percent expansion (from 10,914 jobs in 2004 to 15,252 in 2016) improving its ranking from the third largest industry countywide in 2004 to the "Number Two" position by 2016.*
- *Manufacturing employment in Yakima County decreased 8.8 percent (from 9,181 jobs in 2004 to 8,369 in 2016) and this sector/industry slipped from the "Number Four" to the "Number Five" position in the "Top Five" rankings between 2004 and 2016. Why? Durable goods manufacturing took some hits in the decade from 2000-2010. Layoffs were particularly severe in transportation equipment manufacturing (i.e., closures at Chinook Trailwagons and Western RV) and in lumber and wood products (i.e. the Yakima Resources closure). Nondurable goods manufacturing was not immune to layoffs either as food processing/manufacturing shed jobs when Del Monte closed their asparagus cannery in Toppenish. However, annual QCEW employment data show that although Yakima County's manufacturers "troughed" at 7,470 jobs in 2010, this subsector has generally been on an uptrend since then. Specifically, manufacturing employment rose to 7,869 in 2011, ebbed to 7,813 in 2012, expanded to 8,222 in 2014, virtually stalled at 8,216 jobs in 2014 before advancing to 8,279 jobs in 2015 and to 8,369 in 2016. These data indicate a slow, but not steady, resurgence in Yakima County's manufacturing employment since 2010. Following are examples of some manufacturing subsectors that have shown promise, and/or stability, in recent years:*
    - *Food manufacturing (NAICS 311) provides more jobs than any other manufacturing subsector in Yakima County. It provided 2,874 jobs across Yakima County in 2010 (which was the "trough" of the recent recession in terms of its effect on total covered employment). The*

number of food manufacturing jobs accelerated to 3,129 in 2011 before settling in the 3,000-job range from 2012 through 2016.

- *Plastics and rubber product manufacturing (NAICS 326) has escalated slowly and steadily from 1,102 jobs in 2009 to 1,391 in 2016, a 289 job and 26.2 percent upturn. Clearly this is a local subsector that has found a "niche" here in the Yakima Valley. This upturn from calendar year 2019 (674 jobs) to 2016 (905 jobs) equates to 18 more paper manufacturing jobs (up 4.5 percent) in this five-year period.*
- *In 2009 the number of fabricated metal product manufacturing (NAICS 332) jobs bottomed out at 674, but this subsector has generally been in a growth mode ever since. By 2016 it provided 905 positions, equating to 231 additional jobs, a strong 34.3 percent employment rise. Clearly, fabricated metal product manufacturing has been faring well here in Yakima County during this seven-year period (2009 through 2016).*
- *Machinery manufacturing (NAICS 333) progressed from 473 jobs in 2010, to 502, in 2011, to 539 in 2012, to 573 in 2013, stabilized at 602 jobs in 2014 and 2015, and then rose to 617 in 2016. Hence, from 2010 through 2016 this subsector tallied 144 more jobs, a healthy 30.4 percent employment gain during this six-year period. This subsector will likely continue to grow in 2017, according to a 20 June 2017 article entitled "Pro West Mechanical Expands, Plans to Add 40 New Employees" The article states, "The company was diversifying by adding new services while growing their industrial spray painting and finishing business – and this was in addition to expanding their original metal fabrication, manufacturing, and assembly services."*

- *Retail trade increased employment by 17.4 percent (from 9,145 jobs in 2004 to 10,732 in 2016) raising its ranking from the fifth-largest job providing industry/sector countywide in 2004 to the "Number Four" position by 2016.*

Agriculture

Based entirely on statistics from the USDA National Agricultural Statistical Service numbers FOTC observes some trends for Yakima County over the 25 years from 1987 to 2012:

1. The number of farms decreased by 26%

2. The land in farms increased by 10%

3. The average farm size increased by 49%

4. Irrigated cropland decreased by 9% (Decrease from 2007 to 2012 needs explanation)

5. The market value of all farm products increased by 230%

6. Average market value per farm increased by 346%

7. Market value of crops increased by 243%

8. Market value of livestock increased by 209%

9. Total farm expenses increased by 230%

10. Expenses per farm increased by 345%

11. Number of beef cows decreased by 41%

12. Number of milk cows increased by 396%

13. Land in grain corn increased by 166%

14. Land in corn silage increased by 94% from 2002 to 2012

15. Land in vegetables decreased by 67%

16. Number of orchards decreased by 53%

17. Land in orchards decreased by 8%

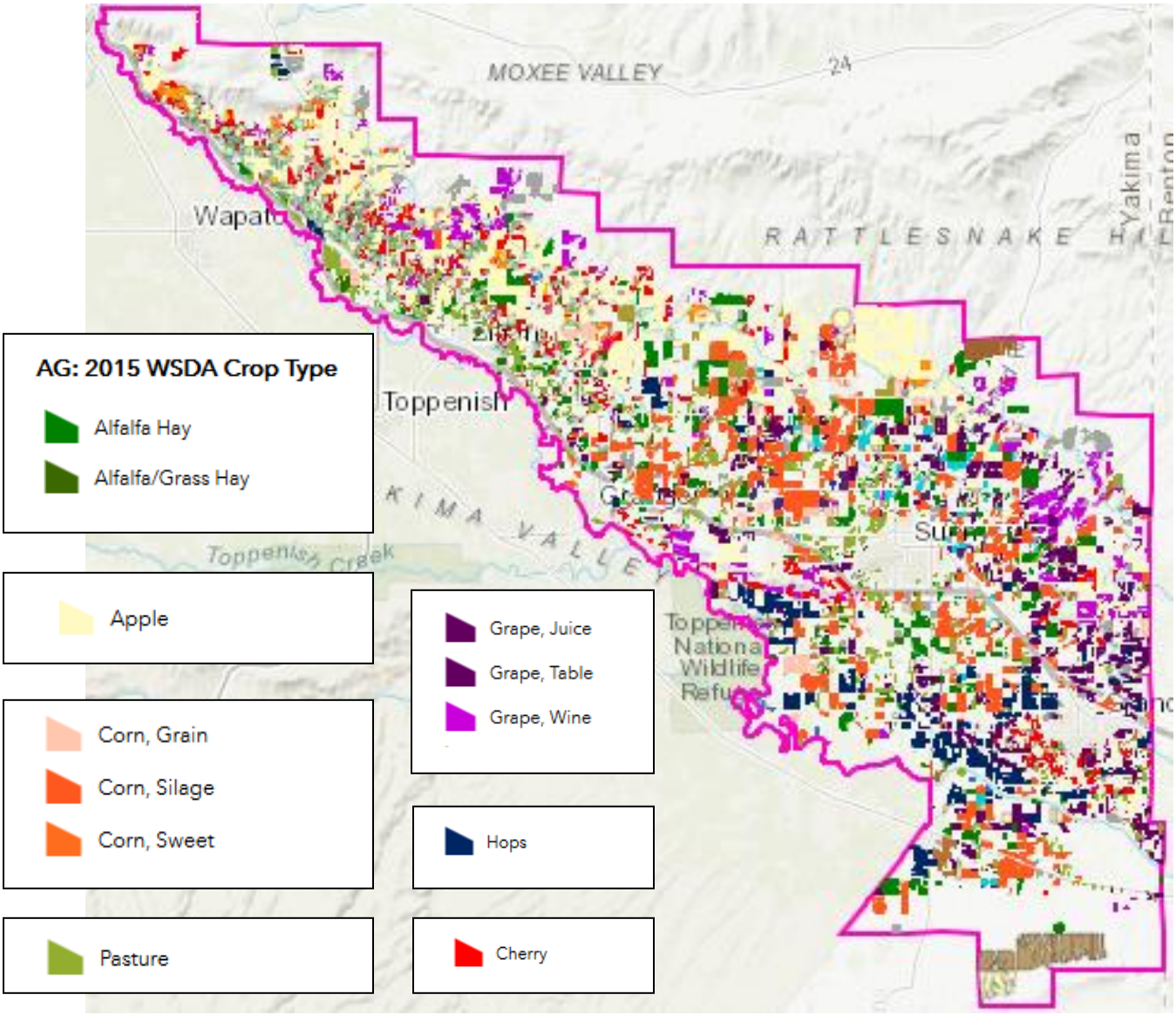
The numbers indicate a shift in cropping patterns away from fruits and vegetables, away from beef cattle, and toward milk production and growing animal feed. Orchards still occupy about half of the irrigated farmland and the number of vineyards is likely increasing. USDA data for grapes and hops is limited.

Yakima County Agricultural Trends from the National Agricultural Statistics Service

Table 10.

Yakima County Statistics	1987	1992	1997	2002	2007	2012
Farms	4,239	3,651	3,365	3,730	3,540	3,143
Land in Farms (acres)	1,612,399	1,639,965	1,682,961	1,678,984	1,649,281	1,780,498
Average Farm Size (acres)	380	449	500	450	466	566
Irrigated Cropland (acres)	247,313	256,508	277,589	269,127	267,566	224,386
Market Value All Farm Products	498,067,000	689,734,000	873,495,000	843,871,000	1,203,806,000	1,645,510,000
Average per Farm ($)	117,496	188,916	259,582	226,239	340,058	523,549
Market Value of Crops ($)	311,621,000	470,771,000	580,897,000	508,254,000	787,459,000	1,069,497,000
Market Value of Livestock ($)	186,445,000	218,963,000	292,598,000	335,617,000	416,347,000	576,013,000
Total Farm Production Expenses	411,259,000	545,701,000	643,211,000	725,281,000	857,111,000	1,358,478,000
Expenses per Farm ($)	97,064	149,466	191,148	193,666	242,122	432,223
Cattle & Calves Inventory	183,908	210,679	191,064	230,275	212,762	258,663
Beef Cows	25,969	29,171	31,755	22,866	28,594	15,414
Milk Cows	25,161	34,703	51,050	67,343	89,575	99,532
Grain Corn (acres)	8,629	10,379	12,680	13,644	16,755	14,303
Corn Silage (acres)				16,440	25,047	31,879
Hay, alfalfa, green chop (acres)	35,971	35,766	43,848	54,413	52,295	36,849
Vegetables (acres)	22,060	19,356	18,479	15,077	10,051	7,305
Number of Orchards	2,366	2,034	1,805	1,809	1,470	1,101
Land in Orchards (acres)	95,690	96,859	109,940	99,834	95,351	87,607
Government Payments ($)				10,501,000	4,705,000	5,804,000
Number of Farms Receiving Payments				735 (20%)	325 (9%)	360 (11%)
From USDA National Agricultural Statistics Service at https://www.agcensus.usda.gov/index.php						

Map 12. WSDA map of crops for ~ 96,000 acres of irrigated land in the LYV in 2015



Commodity	Acreage in the GWMA (2015)
Apple	17,333
Corn Silage	16,778
Triticale	10,780 (Double Cropped with Corn)
Grape (Juice	10,257
Alfalfa	7,989
Pasture	6,731
Cherry	6,336
Hops	5,961
Grape (wine)	5,126

Population

Highlights from the U.S. Census American Fact Finder:

1. The LYV population has grown at a faster rate than Yakima County as a whole

2. Households in the LYV are larger than those for the state or the county

3. There is a wide range of median household incomes for zip codes in the LYV

4. Per capita income in the LYV is significantly lower than Yakima County as a whole

5. Average age in the LYV is lower than that for Yakima County or for Washington State

6. Slightly over 50% of people who live in the LYV have graduated from high school compared to 73% for Yakima County and 91% for Washington State

7. Less than 10% of the people who live in the LYV have college degrees compared to 15% for the county and 34% for the state

8. Poverty levels by zip code in the LYV vary from slightly to 50% higher than those for Yakima County as a whole. They are over 50% higher than those for the state as a whole

9. The percentage of people living below the poverty level in the LYV has decreased between 2000 and 2016, except for the zip code that includes Grandview

10. The percentage of the population that is white, not Latino decreased between 2000 and 2016

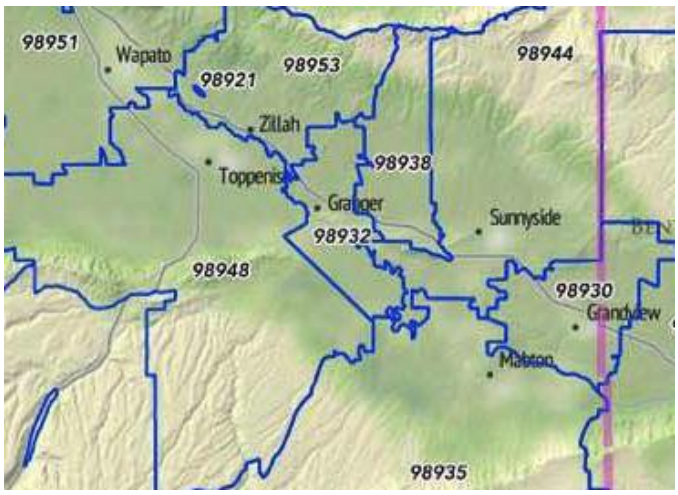
11. The percentage of the population that is Latino has increased by over ten percentage points between 2000 and 2016

12. Over 65% of the population in the LYV speaks a language other than English

13. About a quarter of the people in the LYV do not have health insurance

Map 13.

Lower Yakima Valley Zip Codes



Population Demographics adapted from the U.S. Census *American Fact Finder*

Table 11.

	Zip 98932	Zip 98930	Zip 98935	Zip 98938	Zip 98944	Zip 98953	Yakima Co.	WA State
Population								
2018	5,079	16,599	3,364	3,518	16,407	6,936	250,193	7,405,743
2010	5,032	15,252	4,190	2,177	15,922	6,681	243,237	6,724,545
2000	4,182	12,919	3,885	1,992	13,905	6,079	222,581	5,894,121
2018 minus 2000	897	3,680	-521	1,526	2,502	857	27,612	1,511,622
% Change	21%	28%	-13%	77%	18%	14%	12%	26%
Ave HH Size	3.88	3.45	3.91	5	3.71	3.01	3.04	2.57
Median HH Income	$44,929	$38,936	$45,276	$75,451*	$37,975	$61,267	$45,700	$62,848
Per Capita Income	$13,253	$14,497	$14,011	$18,832	$16,121	$22,276	$20,653	$32,999
Under Age 18	37%	37%	32%	39%	39%	32%	30%	22%
% HS Diploma	58%	57%	52%	38%	52%	79%	73%	91%
% Bachelor's Degree	3%	9%	5%	8%	8%	15%	15%	34%
Individuals < Poverty	31%	22%	20%	19%	24%	8%	21%	13%
% < Poverty 2000	34%	20%	28%	28%	30%	19%	20%	11%
% White Alone	18%	20%	16%	34%	15%	67%	43%	69%
% White 2000	26%	40%	27%	47%	25%	66%	57%	79%
% Latino	78%	80%	81%	65%	84%	41%	49%	13%
% Latino 2000	69%	59%	72%	51%	73%	32%	36%	8%
Language other than English at home	72%	66%	71%	78%	65%	23%	40%	19%
W/O Health Insurance	24%	24%	25%	28%	23%	31%	13%	7%
Data from the U.S. Census - American Fact Finder at https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml								

* Access the web site for the American Fact Finder to better understand this figure

Environmental Justice from *Lower Yakima Valley Groundwater Quality (2010)*

Environmental justice is defined by the EPA as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." This report concludes that a lack of coordination amongst agencies with limited authorities for addressing groundwater conditions in the Lower Yakima Valley has led to confusion amongst members of the public about their options for addressing environmental concerns in the area. This, in itself, represents an environmental justice concern. Additionally, the demographic conditions of the Lower Yakima Valley transposed against the conditions of groundwater pollution create inequities of representation and communication regarding solutions for people to protect themselves from groundwater pollution.

Part of our shared goal is to see that all persons have access to safe drinking water supplies. This includes incorporating environmental justice considerations into the water quality improvement process to ensure that all communities have the same degree of protection from environmental and health hazards.
Attention to environmental justice concerns is necessary because actions to improve water quality that adequately protect the general population, may not always protect discrete segments of the population. Communities face different levels of environmental harms and risks depending on cultural practices, diet, and where they live, work, and play. Further, higher-risk populations, communities with environmental justice concerns, and disadvantaged groups, often face barriers in trying to address concerns within their communities. Such environmental justice concerns are particularly relevant for rural communities, and in this case a predominantly agricultural based community. The following are potential obstacles to public participation and factors that result in differential risks among vulnerable communities:

- *Competing priorities and multiple challenges*

• Lack of personal or community resources (e.g., financial, information, political experience)

• Inadequate access to infrastructure such as housing, utilities, communication, and transportation

• Language barriers (non-English speaking or non-fluency)

• Cultural or other barriers to participation in government processes

• Residents who are not property owners (e.g., tenants and agricultural workers)

• Cumulative risks from exposure to multiple sources of pollution

Climate Change from the *Yakama Nation Climate Change Adaptation Plan (2016)*

The climate is changing in the Pacific Northwest. The average annual temperature increased by 1.3 °F between 1895 and 2011. We have seen changes in the mountains; over the last century, nearly all of the glaciers in Washington State have retreated. Agricultural conditions have changed as well. The number of frost-free days has increased by more than a month, on average, and the growing season has lengthened accordingly. We are seeing changes in our rivers and streams. Peak stream flows are coming earlier in the year than they used to in many locations, and late summer stream flows are declining. These changes are consistent with what we expect to see based on regional projections of climate change, although natural variability also continues to play an important role in what we experience from year to year.

In 2015, the city of Yakima had the warmest June on record, and the Columbia River was the warmest it has been since 1950. Approximately one-quarter of a million salmon died, reportedly because of warm water and resulting diseases. Wildfires brought "unhealthy" and "very unhealthy" air quality conditions to the communities of Toppenish, White Swan, and Yakima. While the high temperatures and drought that we experienced in 2015 cannot be fully attributed to climate change, given the aforementioned role of natural variability and the influence of El Niño, recent

experiences give us a picture of what we are likely to experience more often in the future as the climate continues to change.

There are a number of scenarios that scientists use to project what might happen as a result of climate change. The scenarios make different assumptions about future greenhouse gas emissions. However, all of those scenarios project further warming in this century: between 4.3 to 5.8 degrees F warmer on average in Washington State by the 2050s compared to the 1950-1999 period. In the Yakima Basin, average summer temperatures are expected to be 83 to 90 degrees by mid-century, depending on what choices are made— locally, regionally, and globally—that affect the trend of greenhouse gas emissions. Those would be the averages; our hottest summer days will likely be even hotter than what we are used to.

When it comes to rain and snow, precipitation projections are uncertain. Climate scientists currently anticipate only slight increases in average annual precipitation, with more of that precipitation coming in the winter and in heavier downpours. Meanwhile, the Yakima Basin is a temperature-sensitive system, so warmer temperatures will mean less snow and more rain. We expect to see increasing winter flows and decreasing summer flows in the rivers. We also expect to see peak stream flows occurring four to nine weeks earlier in the 2080s than what we are used to seeing today. Snowmelt runoff already happens two to three weeks earlier than it did historically in many streams in the Pacific Northwest.

State of the Aquifers from *Approaches for Assessing Ground-Water Availability under Competing Demands and Climate Change – 2008, Bachman, Ely & Vaccaro*

Many areas of the American West struggle with the allocation of diminishing water supplies between growing municipal and agricultural demands. In the Pacific Northwest, surface water supplies are additionally stressed by in-stream flow requirements mandated for the protection of endangered salmonid species. In the Yakima River Basin in Washington State, where river and stream flows primarily are

derived from winter snowpack in the mountains, surface-water supplies are fully allocated in wet years and over-allocated in dry years.

Tribal water rights from the 1800s supersede irrigation or municipal rights in the basin, and ongoing litigation to discern the influence of ground-water pumping on surface-water flows led to U.S. Geological Survey involvement in a comprehensive assessment of ground water.

In the Yakima River Basin:

- *In areas of heavy pumping, head declines of greater than 150 feet have been measured*
- *Groundwater users must pay for additional power to pump from greater depths*
- *Lowered water tables likely increase capture of water from streams*
- *Climate Models indicate warming temperatures, which will reduce recharge over the next 20, 50, and 80 years*
- *More precipitation will be in the form of rain rather that snow resulting in increased winter runoff and reduced late-spring and summer runoff*
- *Endangered Species Act mandates protection of three listed salmonid species*
- *2 species already extirpated from the basin*
- *Minimum flow requirements during spawning season conflict with irrigation season*

Clarification: In general there are two types of aquifers in the LYV: shallow unconfined aquifers in the alluvium and deeper, confined basalt aquifers. At some point in time a bureaucratic decisions was made and the GWMA began to focus only on the shallow aquifer. This decision was not made by the GWAC.

Due to recharge from irrigation the shallow aquifers are mostly stable. The deeper aquifers are receding at a rate of approximately 2.9 ft per year. (WA State Dept. of Ecology, 2018d)

Characterization Summary

The Lower Yakima Valley is one of the most productive agricultural areas in the United States. This distinction is due to deep fertile soils, long sunny days and a large system of irrigation canals that tap the Yakima River.

The population of the GWMA target area is about 50,000 and approximately 80% Latino. The median household income is comparable to that for Yakima County as a whole but the per capita income is lower. The percentage of people who live below poverty has decreased over recent years to approximately 20%. Education levels lag and much of the population speaks English less than well. Environmental Justice is a concern when pollution and limited opportunities for community engagement are on the table.

There are about 96,000 acres of irrigated cropland in the GWMA target area. Leading crops are apples, corn, triticale, grapes, alfalfa, cherries and hops. Over the past three decades the dairy industry has quadrupled in size in the area. There are about 100,000 milk cows in the LYV with about the same number of supporting livestock – dry cows, heifers and calves. Currently about a third of crops are grown to provide feed for animal agriculture.

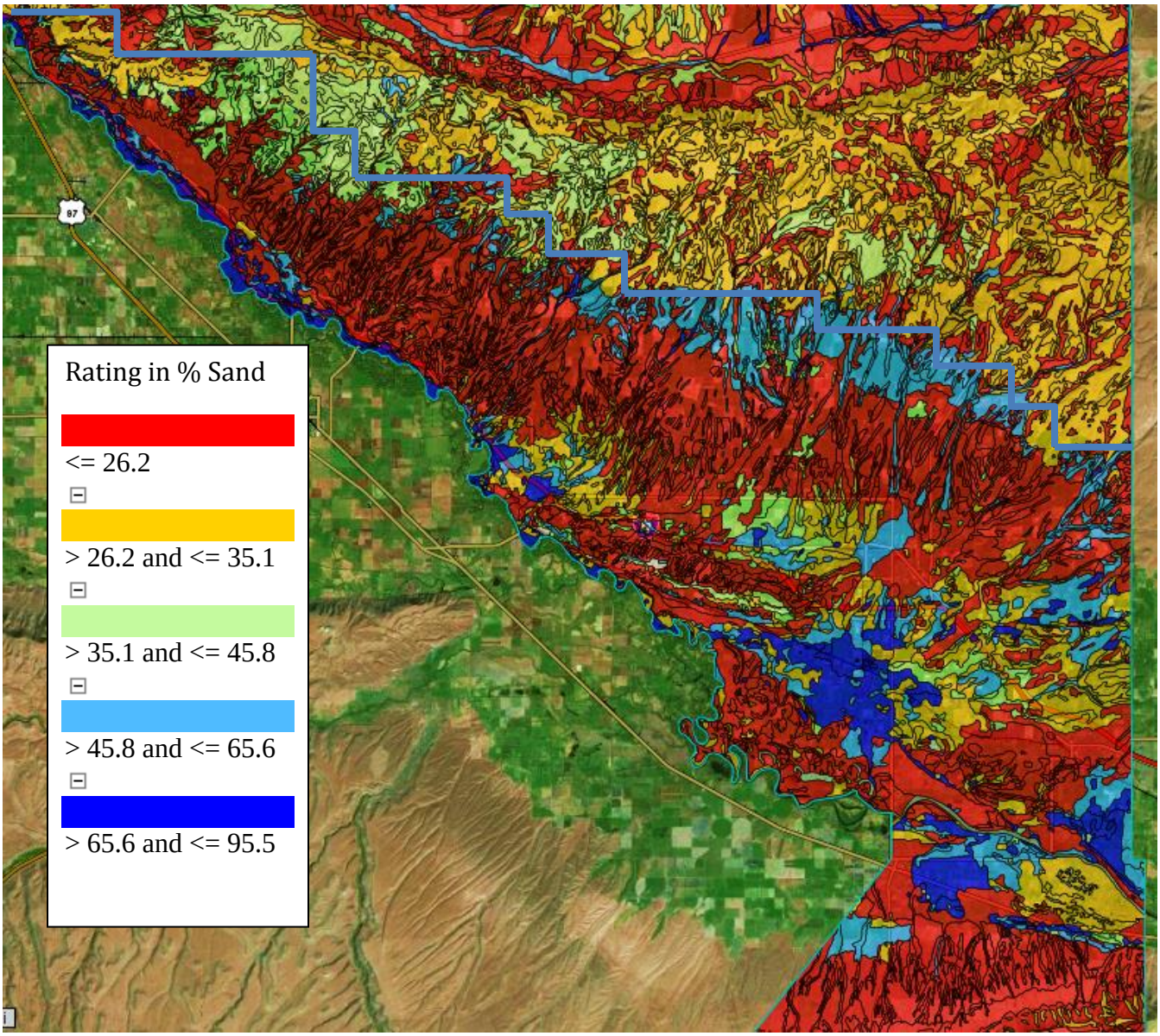
Global warming has begun to change agriculture in the LYV as well as the way we live and work. The growing season begins earlier, there are more frost free days, snow pack is decreasing, and drought years are more frequent. We experience more forest and range fires. This creates opportunities for invasive species that threaten native plants. Any plan for addressing groundwater must consider global warming as well as the consequences of declining aquifers.

Differences in Sub Areas of the GWMA

Comparing areas with very low nitrate levels in groundwater

The LYV GWMA target area is not homogeneous. Nitrate levels in groundwater range from 0 to 240 mg/L. Depth to groundwater ranges from a few feet to several hundred feet. Soils range from poorly drained to excessively drained. Crops range from apples to zucchini squash. These factors all impact nitrate flows. Here is an illustration from Attachment 66.

Map 14 - NRCS Mapping of Sand Percentages in LYV Soils



The GWMA should have performed a more in depth comparison and analysis of the major factors that impact nitrate in groundwater. We did not.

To illustrate what needs to be done FOTC has performed a summary comparison of four areas in the GWMA where nitrate levels were < 1 mg/L in the 2017 USGS well survey. Data sources are the Yakima County GIS mapping at http://arcg.is/1ie9mP, the NRCS Soil Survey at https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx and USGS well water data at maps.waterdata.usgs.gov.

Map 15 – Low Nitrate Areas

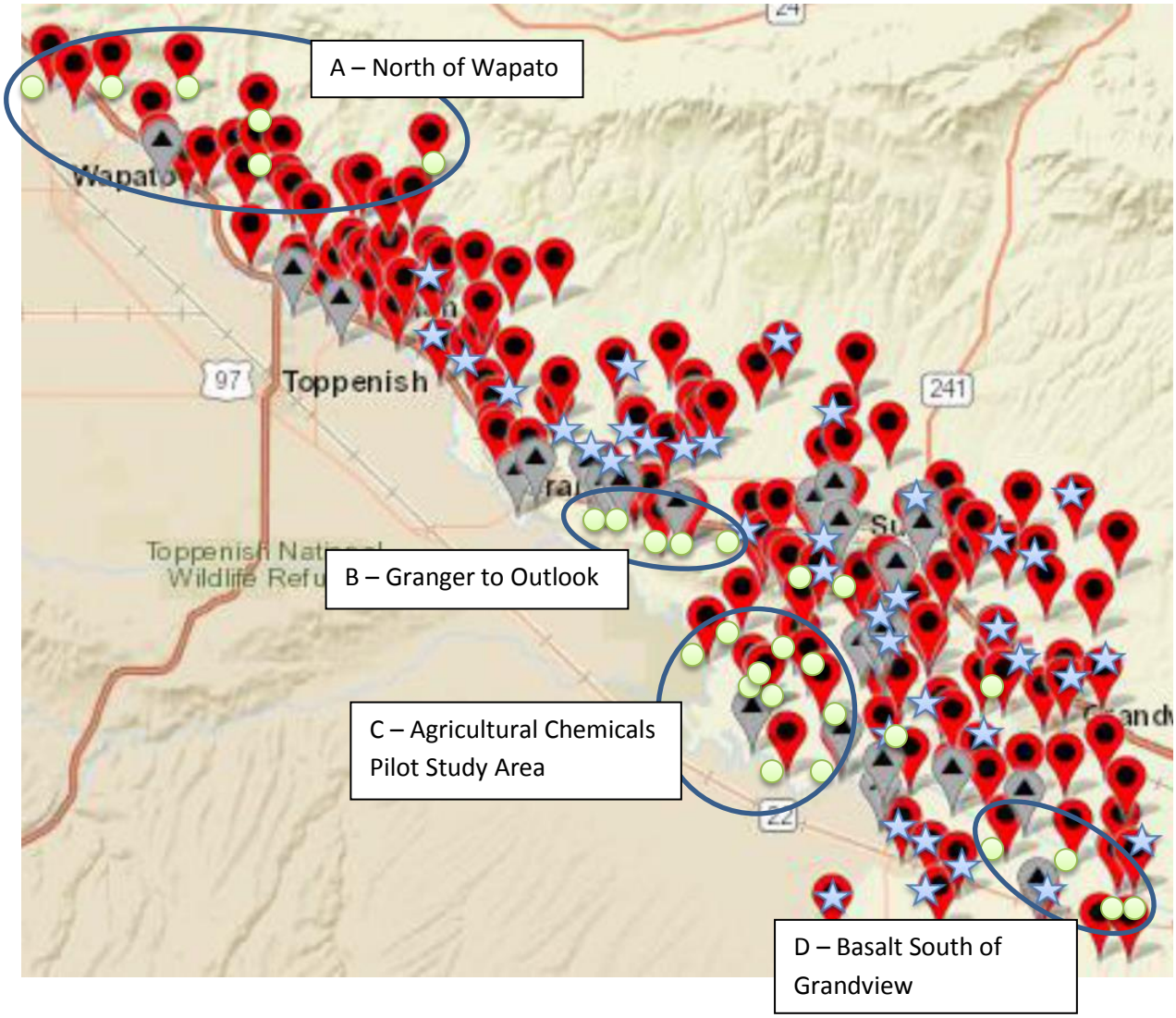


Table 12 – Characteristics of Low Nitrate Areas

Sub-Area		Soils	Crops	CAFO's	Well Depth	Water Table
A		Silt Loams	Fruit	No	Deep 200 - 600 ft	25 - 100 ft, Some > 100
B		Sandy Loam	Corn	Yes	Around 200 ft	Mostly 15 - 25 ft
		Silt Loam	Alfalfa			
		Fine Sandy Loam	Grapes			
			Pasture			
C		Loamy Fine Sand in NE	Corn	Yes	< 100 ft	15- 25 ft, and
		Silt Loam in SW	Hops			25 – 100 ft
			Alfalfa			
D		Starbuck Silt Loam	None	No	Around 150 ft	25 – 100 ft
		Starbuck Rock Outcrop				

Summary of possible reasons for low nitrate levels in these samplings:

A: Deep Wells. More recent agriculture.

B: Wells are drilled into a deeper aquifer? Snipes Mountain lies directly to the south. Groundwater flow makes a 90 degree turn to the east when it reaches Snipes Mountain.

C. The water table is very shallow and the wells are < 100 ft deep. Impact of sandy soils and proximity to the Yakima River.

D. Basalt formation and no cropland.

More study is required to describe the contributors to nitrate in LYV groundwater and the pathways in diverse sections of the target area.

Projection of Water Use Needs in the LYV

Groundwater in the LYV supplies the needs of municipalities, private homeowners, industry, crops, animal agriculture, instream flows and recreation. Demand currently exceeds supply. According to USGS (Bachman, 2008) groundwater pumpage in the entire Yakima Basin increased from 40,000 acre feet in 1960 to 190,000 acre feet in 2000.

- *In areas of heavy pumping, head declines of greater than 150 feet have been measured*
- *Ground-water users must pay for additional power to pump from greater depths*
- *Lowered water tables likely increase capture of water from streams*

Here are predicted changes in LYV groundwater demand for the next 25 years.

Needs of people: Human demands will increase by ~ 28% over 25 years

We assume that the population of the GWMA target area is 50,000. This is based on the sum of populations for zip codes 98930, 98932, 98935, 98938, 98944 and 98953 for 2018 in the *U.S. Census American Fact Finder.* This is a crude estimate. Parts of zip codes 98930, 98932, 98935 and 98944 lie outside Yakima County and parts of zip code 98951plus two smaller zip codes lie within the GWMA target area.

We used growth rates for Yakima County from the WA State Office of Finance & Management (2018). We calculate that the average person uses 100 gallons of water per day (USGS, 2018). This results in demand for about 1,386,200 more gallons per day for domestic use by the year 2045.

Table 13. Projected Population and Water Needs

Year	Population	Growth Rate Over Five Years	Gallons per Day
2015	50,000	5%	5,000,000
2020	52,500	5%	5,250,000
2025	55,125	5%	5,512,500
2030	57,881	4%	5,788,100
2035	60,196	3%	6,019,600
2040	62,002	3%	6,200,200
2045	63,862		6,386,200

Industry: Change in Demands Uncertain

According to the most recent *WA State Employment Security Yakima County Profile,* the Lower Yakima Valley is expected to experience growth in food processing and related industries. We are unable to provide reasonable estimates of the impact this growth will have on groundwater usage.

Instream flows: Challenges

The relationship between groundwater and instream flows is well established. (Vaccaro et al, 2009; USGS 2018) Depletion of the aquifers results in reduced return flow to surface waters. In the Lower Yakima Valley improved irrigation methods such as drip irrigation and lining canals result in decreased groundwater re-charge and decreased groundwater return flow to the rivers and streams.

According to Ecology (2016) during the 2015 drought:

> *The drought was directly responsible for widespread fish die-offs and impacts to wildlife. Hundreds of thousands of Columbia/Snake River Basin sockeye salmon perished in July. There was confirmed mortality of 182 sturgeon, most were large, breeding sized fish, in the Columbia River. Widespread reports of fish strandings occurred throughout the state, including federally-listed species such as bull trout. Also, more than 1.5 million juvenile salmon, steelhead, and rainbow trout died at 11 Washington hatcheries due to drought conditions.*

There is a legal mandate to maintain instream flows in Washington State. (Hirst, 2016)

The Yakima River Basin Integrated Water Resource Management Plan (YRBWEP) is looking at new and innovative ways to store water for irrigation. Periods of time with extra surface water do not always coincides with the periods of highest crop needs. The YRBWEP is studying storage in LYV groundwater. (USBR, 2017) This would impact water levels in the aquifer and return flow to the river.

Crops:

Based on analysis of statistics for Yakima County from the USDA National Agricultural Statistical Service (NASS) for the period between 1987 and 2012 here are some trends:

1. The land in farms increased by 10%
2. Irrigated cropland decreased by 9%
3. Land in grain corn increased by 166%
4. Land in corn silage increased by 94% from 2002 to 2012
5. Land in vegetables decreased by 67%
6. Land in orchards decreased by 8%

There is increasing acreage in corn and decreasing acreage in vegetables and tree fruits. Changes in apple production to smaller trees and drip irrigation provide for increased production with less water and less acreage. (DeVaney, 2018) Most hop and grape fields have changed to drip irrigation.

Nitrogen Available for Transport Lower Yakima GWMA 2018, page 91, provided data for *Water Duty* or the amount of water required on average for the major crops in the LYV. Here is a summary of that data in gallons per day by crop:

Table 14. Water Duty for Major LYV Crops

Crop	Average Water Duty (in/acre)	Gal/Acre/Day	Acres	Gallons/Day
Nectarine/Peach	40.42	2959.8	843	2,495,121
Pear	39.85	2917.8	3,331	9,719,299
Pasture	37.89	2774.1	6,731	18,672,307
Alfalfa Hay	35.87	2626.7	7,989	20,984,380
Mint	34.87	2553	1,418	3,620,084
Cherry (see notes)	30	2196.6	6,336	13,917,730
Apple (see notes)	30	2196.6	17,333	38,073,867
Hops	29.89	2188.6	5,961	13,045,990
Silage Corn	28.55	2090.2	16,778	35,069,340
Field Corn (Grain)	28.55	2090.2	1,166	2,437,171
Triticale (double crop)	28.55	2090.4	10,780	22,534,964

Grape (juice)	26.51		1940.4	10,257	19,902,273
Grape (Wine)	26.51		1941.1	5,126	9,949,937
Wheat	23.29		1705.3	1,283	2,187,903
Totals				95,332	212,610,366

Most of the demand is met with surface water. During periods of drought farmers are permitted to use emergency wells and withdraw from the groundwater.

According to the Roza Irrigation District (nd):

> *1992 through 1994: The longest sustained drought period in the history of the district occurred. Water supplies were critically curtailed, with supplies of only 58%, 67%, and 37% respectively. The 37% supply in 1994 was the worst water shortage ever experienced by the district. The accumulative effect of short water supplies damaged permanent crops causing financial hardship on growers and the district.*

During the most recent 2015 drought, 45 emergency drought wells were used in the Roza Irrigation district. (McClain et al, 2016). Statewide Ecology issued 76 emergency drought permits in that year and 60 were in the Central WA Region. (Anderson et al, 2016). Climatologists predict more frequent drought years and this will no doubt impact groundwater storage and emergency pumping.

Animal Agriculture: At current growth rates groundwater demand will double in 25 years

Data from the National Agricultural Statistics Service that describes changes in LYV animal agriculture since 1987 shows a steady growth in the number of milk cows and a decline in the number of beef cattle. The number of milk cows has increased by almost 3,000 cows per year and the number of beef cows has decreased by about 420 head per year.

Table 14. Numbers of Cattle & Calves in Yakima County 1987 - 2012

	1987	1992	1997	2002	2007	2012
Cattle Population						
Cattle & Calves	183,908	210,679	191,064	230,275	212,762	258,663
Beef Cows	25,969	29,171	31,755	22,866	28,594	15,414
Milk Cows	25,161	34,703	51,050	67,343	89,575	99,532
Change over five years						
Cattle & Calves		26,771	-19,615	39,211	-17,513	45,901
Beef Cows		3,202	3,584	-8,889	5,728	-13,180
Milk Cows		9,542	16,347	16,293	22,232	9,957
Average change every five years				**Average change per year**		
Cattle & Calves		14,951		2,990		
Beef Cows		-2,111		-422		
Milk Cows		14,874		2,974		

With these numbers in mind we can predict an increase of about 2,900 head of cattle per year and associated increase in water consumption. Here we estimate 50 gallons per day per milk cow on average and 10 gallons per animal per day on average for other bovines. (Institute of Agriculture and Natural Resources, 2016; Dairy Herd Management, 2011)

Table 15. Predicted Cattle Populations in Yakima County and Water Needs

	# Milk Cows	Gal per day		# Other Cattle	Gal per day		Total Gallons/day
		50 gal/cow			10 gal/head		
2012	99,532	4,976,600		159,131	1,591,310		6,567,910
2017	114,406	5,720,300		174,082	1,740,820		7,461,120
2022	129,280	6,464,000		189,033	1,890,330		8,354,330
2027	144,154	7,207,700		203,984	2,039,840		9,247,540
2032	159,028	7,951,400		218,935	2,189,350		10,140,750
2037	173,902	8,695,100		233,886	2,338,860		11,033,960
2042	188,776	9,438,800		248,837	2,488,370		11,927,170
2047	203,650	10,182,500		263,788	2,637,880		12,820,380

The amount of groundwater required for animal agriculture will likely increase over the coming years. Wells for animal agriculture are commonly drilled into the deeper basalt aquifers. At the current rate of increase in cattle numbers water needs could double in 25 years. There is no legal limit on the amount of water that producers can withdraw to water livestock based on a recent interpretation of RCW 90.44 by the WA State Supreme Court in Five Corners Family Farms versus the State of Washington. (Find Law, 2011)

Gaps in Knowledge & the GWMA Work

1. Public Health: At the beginning of the GWMA discussions, Friends of Toppenish Creek asked the group to consider a community health assessment for the LYV. This would have provided a baseline understanding of population health and a foundation for measuring the impact of nitrate reduction on health.

The GWAC was not receptive and preferred to focus simply on reducing nitrates in groundwater. Chairman Rand Elliott observed that reducing nitrates in the drinking water would automatically improve public health and measuring the impact was unnecessary. (LYV GWMA, Dec. 12, 2012 meeting of the GWAC)

Since 2012, we have moved from a goal of reducing nitrates within five years to stating that it will take decades to see improvements. Detrimental health effects will be ongoing for a generation. Research demonstrates increased nitrate related risks for certain cancers, reproductive problems, chronic health effects and increased morbidity/mortality among infants who drink formula made from well water. (See Attachment 29)

Rates for congenital anomalies and developmental delay are higher for Yakima County than Washington State (YVMH, 2013, Virginia Mason Memorial, 2016). Rates for pre-term births are consistently higher than the state average (WA DOH, 2018). Hospitalizations for cardiac events, COPD and asthma are higher than the state average (WA DOH, 2018). The contribution of nitrates in drinking water to these conditions in the LYV is unknown.

In terms of standard of living and access to health care, Yakima County is a poor county. Services that are taken for granted in more affluent parts of the state are simply not available to us. (Attachment 67) The tables below compare public health services in Yakima County to those in other large Washington Counties:

Chart 5 – Public Health Expenditures

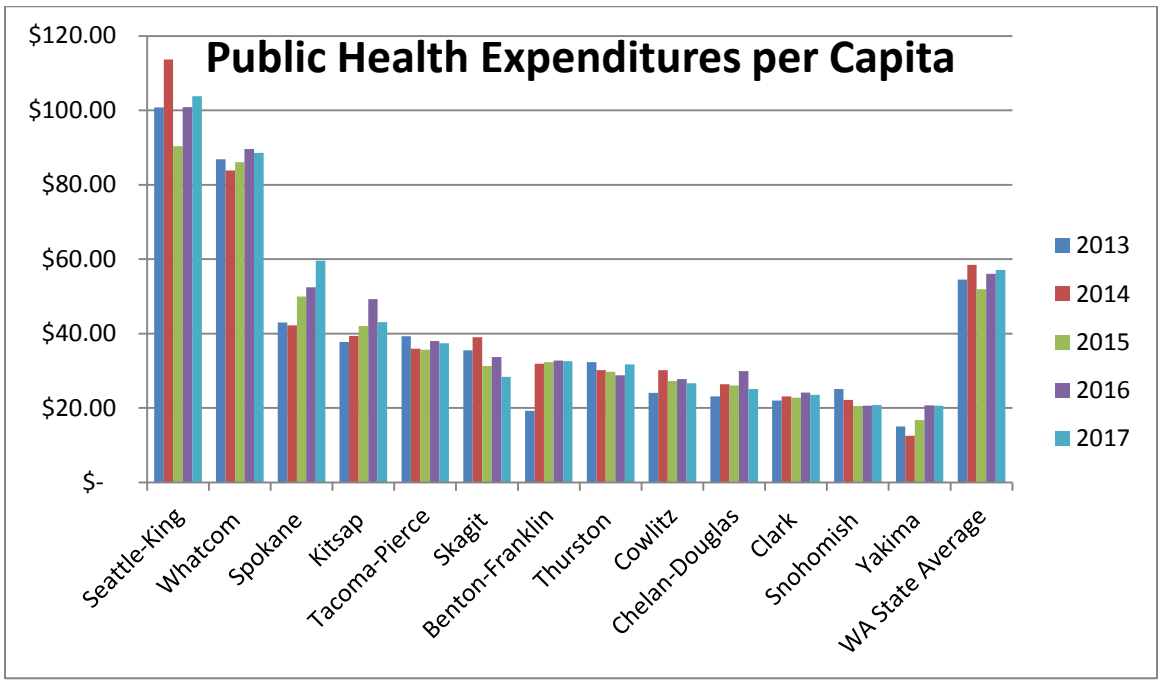
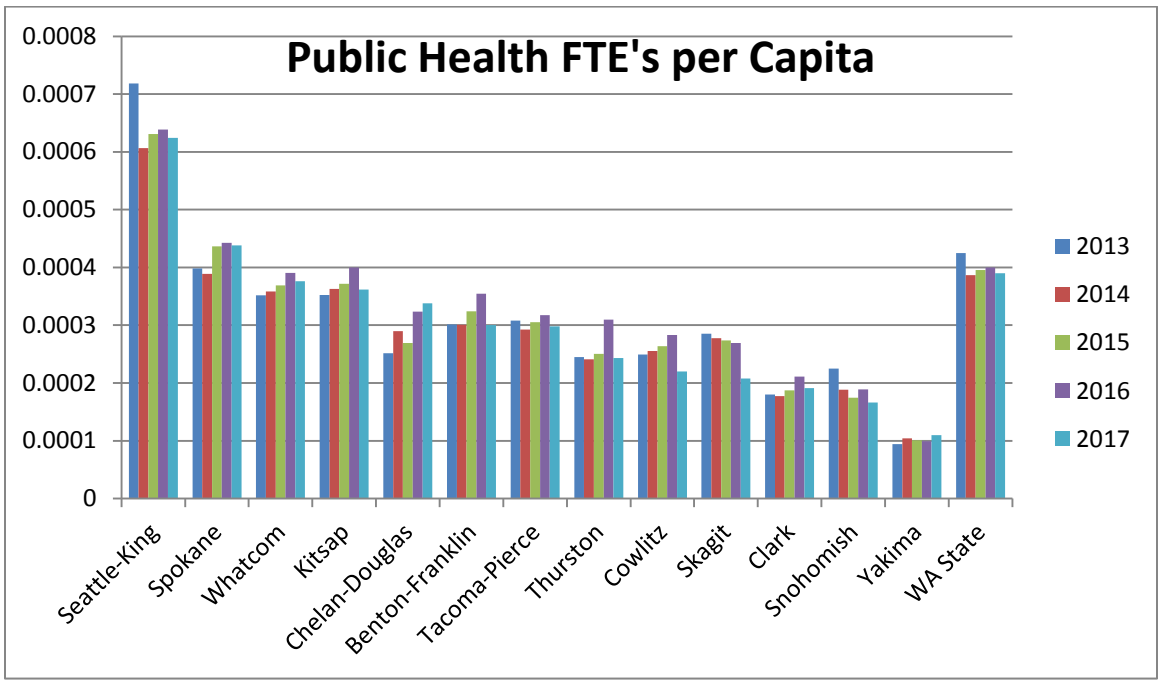


Chart 6 - Public Health FTE's per Capita



Currently methemoglobinemia or blue baby syndrome is a reportable condition in Yakima County. To our knowledge there is no requirement to test methemoglobin levels

when babies present with signs and symptoms which can mimic other conditions. We do not know the level of physician awareness.

A 2009 study of methemoglobinemia and nitrates in drinking water by the WA State Dept. of Health (VanderSlice, 2009) found:

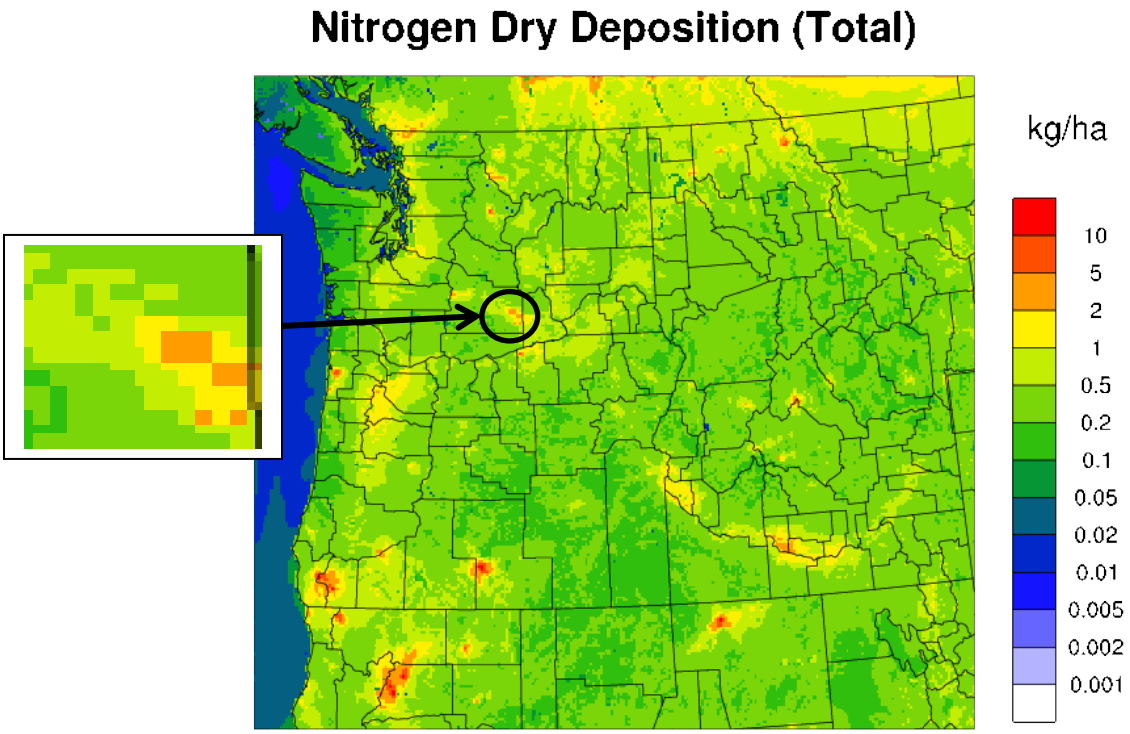
> *The results of this study provide evidence that exposure to nitrate from drinking water significantly and substantially increases the risk of an infant having physiologically elevated levels of methemoglobin. Furthermore, this risk is associated with intake levels above 0.5 mg NO3-N/kg day, approximately one-third of the RfD value. Overall, about 4 percent of the infants had this level of exposure, and it occurred uniformly from 1 to 5 months of age. In this sample, virtually all infants (94.1%) who were given water containing nitrate above 5 mg/L NO3-N had exposures above 0.5 mg/kg day.*

2. Atmospheric Deposition: Atmospheric deposition of nitrogen occurs when nitrogenous compounds that are emitted from traffic, forest fires, combustion, cropland and animal feeding operations falls back to earth and deposits on the land surface. These nitrogenous compounds are called reactive nitrogen. Reactive nitrogen includes nitrite (-NO_2), nitrate (NO_3), nitrous oxide (N_2O), ammonia (NH_3) and ammonium (-NH_4) that are part of the nitrogen cycle. Ammonia and ammonium are re-deposited on the land surface through wet and dry deposition. (Sutton et al, 2011) Approximately 13% of emitted nitrogen redeposits on the land where it originated. (Personal conversation, Dr. Ranil Dhammapala, November 2018)

Washington State University administers a program entitled AIRPACT V that models atmospheric deposition for Washington, Oregon and Idaho on a monthly basis. The results of that modeling predict atmospheric deposition of around 8 lbs nitrogen per acre in the Lower Yakima Valley which is significantly higher than the 2.05 lbs per acre in the WSDA Nitrogen Availability Assessment. (See Attachments 70 and 71)

Below is a map from the WSU AIRPACT V program for the month of August, 2018, available at http://lar.wsu.edu/airpact/monthly_depo_ap5.php (One kg/ha equals 0.89 lbs per acre)

Map 16 – Atmospheric Deposition August 2018



3. Economic Impact: Throughout the GWMA discussions various participants have informed the GWAC that economic factors are a major driving force for decision making. Suggestions to fund an economic analysis have been rejected. The Friends of Toppenish Creek performed a simple study that shows significant costs for the people who live in the Yakima Valley plus significant costs for growers and producers who must address groundwater pollution. (See Attachment 26) This document could be a starting point for further research.

Experts say it is easier and less costly to prevent pollution than to clean up a polluted aquifer. We know that California is currently spending millions upon millions to address severe groundwater pollution in the Central Valley. (Harter et al, 2012; King et al, 2012; Canada et al, 2012) This is a serious warning for Washington State.

We suggest there is a knowledge gap regarding the total costs of groundwater pollution in the LYV and that an economic impact analysis is appropriate in order to minimize cost of prevention and mitigation. It is impossible to analyze and address a problem without accurate measurements.

Our best estimates indicate that the impacted people of the LYV spend over $1 million per year in order to obtain safe drinking water. (Attachment 26)

4. Manure Export: Agricultural experts on the GWAC have repeatedly stated that 50% to 70% of manures produced in LYV dairies are exported as compost. (Attachment 54) Friends of Toppenish Creek have no reason to doubt these statements. However, scientific rigor requires documentation. There is a gap in proving this assumption and a need to quantify the amount of manure and compost that is exported from the target area in order to refine estimates of nitrogen balance. This information could be gathered by survey work or by a reporting mandate for composters under RCW 70.95.

***5*. Commercial Fertilizer:** The study, *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area,* (WSDA, 2018) describes the difficulties involved in obtaining estimates regarding purchase and application of commercial fertilizer in the GWMA target area. Sales are reported on a statewide basis but not at county wide or zip code specific levels. More precise data would allow more accurate calculations of nitrogen balance. This information could be gathered by survey work or by a reporting mandate for wholesalers under RCW 15.54.325.

6. NRCS Monitoring: The Natural Resource Conservation Service funds conservation projects and practices across Washington State. According to Bonda Habets (2015) from the Spokane office the NRCS does not monitor the impact of these grants beyond the funding period. Thus it is difficult to evaluate the long term benefits of NRCS programs.

7. Release of nitrate from organic nitrogen: The GWMA Nitrogen Availability Assessment states on page 31:

> *This organic nitrogen will mineralize over time, making more nitrogen available for plant growth for several years after the initial application. The actual nitrogen available in the first and subsequent years depends on the nitrogen source, weather and temperature conditions, and the breakdown rate of the organic matter containing*

the nitrogen. WSDA did not attempt to account for these nuances of nitrogen availability from different sources

And on page 36:

Previously, practice has been to allow for a minimum of 20 lbs N/ac per % organic matter; however, based on recent soil testing data in the Yakima Valley it appears that the contribution from organic matter should be increased from 20 lbs N/ac to 35-50 lbs N/ac per 1% organic matter when the fields have a history of manure applications.

WSDA does not reference the specific research to support this latter assertion. It would be prudent to locate definitive research or to conduct and publish LYV studies that quantify the amount of nitrogen available from breakdown of organic matter.

8. Nitrogen Balance for Alfalfa Fields: The nitrogen budget proposed in the GWMA Plan severely underestimates the contribution of alfalfa to nitrogen availability.

Below is a table from page 44 of the *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*, the GWMA's NAA. This table states that alfalfa removes large amounts of nitrogen from the soil. This may be true when alfalfa is used to lower nitrogen levels in fields where fertilizer and manures have been over applied. It is certainly not universally true.

Table 15. One year's worth of inputs and outputs for the top 15 crops in the GWMA

Commodity	Acreage	Sum of inputs and outputs for one year (lb N/ac-yr)		
		Low	Medium	High
Apple	17,333	-5	64	165
Corn (silage)	16,778	-156	47	242
Triticale	10,780	-92	13	250
Grapes (juice)	10,257	15	105	142
Alfalfa	7,989	-322	-214	-46
Pasture	6,731	-143	-47	62
Cherry	6,336	27	78	156
Hops	5,961	-41	99	113
Grapes (wine)	5,126	40	67	102
Pear	3,331	-1	65	119
Mint	1,418	-166	46	102
Wheat	1,283	-36	44	113
Corn (grain)	1,166	-4	148	284
Asparagus	854	58	130	156
Peach/Nectarine	843	12	54	104

There is no evidence of over application across the entire GWMA target area. In fact growers point out that fertilizer is expensive and is applied only as needed. In the majority of cases growers are aware of nitrogen fixation and manage their land accordingly.

The source for the GWMA Plan estimate is *Nutrient Management Guide for Dryland and Irrigated Alfalfa in the Inland Northwest* by Koenig et al (2009) who state:

> *Fortunately, alfalfa obtains most of the nitrogen it needs from the atmosphere through a symbiotic association with rhizobia (Sinorhizobium meliloti) bacteria that inhabit nodules in the alfalfa root system. Successful conversion of atmospheric nitrogen to a form usable by alfalfa ("fixation") depends on the presence of rhizobia in soil or inoculated seed, suitable soil pH (discussed above), and nutrient availability—particularly molybdenum, copper, and cobalt (discussed later).*
>
> *Rhizobia require a source of energy (carbohydrate) from alfalfa. This comes at some cost to the plant, so alfalfa preferentially uses ammonium- and nitrate-nitrogen in the soil, if available, rather than fixing its own nitrogen. Nitrogen fixation is, however, a very cost-effective way to obtain nitrogen. Given the high nitrogen content of alfalfa (Table 1), fertilizing stands with nitrogen is seldom economical. For long-term production, correcting the underlying problem that is limiting fixation or shifting to non-legume (grass) production is normally more economical than fertilizing alfalfa with nitrogen.*
>
> *Alfalfa is deep-rooted and drought-tolerant, making it well-suited for nitrogen uptake. The crop is commonly used to dispose of waste nitrogen from a variety of industries. At 50–70 lb per ton of hay, alfalfa removes more nitrogen than almost any other crop. When nitrogen is supplied via wastewater or manure, alfalfa preferentially absorbs nitrogen from the soil rather than fixing it from the atmosphere. A reasonable nitrogen application rate for disposal situations is 80% of the nitrogen removed by the hay crop. Fertilizing alfalfa with nitrogen may increase nitrate in the hay, so monitoring is helpful to curtail this problem if necessary.*

Other nitrogen balance studies state that alfalfa adds to nitrogen loading:

1. The Lower Umatilla Basin Groundwater Management Area estimated 45 lb/acre nitrogen remained in the soil profile on alfalfa fields at the end of the season. (Grondin et al, 1995, page I-40)
2. The comprehensive study of groundwater in the Tulare Lake Basin and the Salinas Valley by the University of California at Davis estimated that 2.4% of leaching to groundwater in that area was from alfalfa cropland. (Viers et al, 2012, page 11)
3. In the Sumas Blaine aquifer, about 2% of on-ground nitrogen loading comes from legumes. (Almasri, 2007, pager 277)
4. In the Mississippi Basin, legumes (alfalfa and soybeans) contribute over a million metric tons of nitrogen input every year. (Goolsby and Battaglin, 1997)

Closer to home, the GWMA Deep Soil Sampling found extreme variability in nitrate levels on LYV fields. This sampling clearly shows nitrate leaching from some alfalfa fields in the area.

The table below describes 7 fields where only alfalfa was grown for at least four years. (There were 27 fields in the DSS where alfalfa was grown for some of the preceding four years but other crops were grown on that land as well.) (Please note the higher levels of organic matter in these fields compared to the GWMA average of 2.17 %.)

Table 18 – Nitrate Levels in DSS Alfalfa Fields

Field ID	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total	Ammonia	Organic
2044	29	152	457	623	706	409	2376	31	3.4
2045	29	4	20	22	13	31	119	25	2.37
2047	113	466	913	951	626	242	3321	21	3.11
2073	36	35	31	38			140	27	2.42
2074	75	55	68	97	94	26	415	26	2.51
4152	25	106	319	279	256	219	1204	26	2.63
4153	17	9	21	21	5	10	83	17	2.62
Averages	46.29	118.14	261.29	290.14	283.33	156.17	1094	24.7	2.72

It is incorrect to state that alfalfa cropland in the LYV does not contribute to the problem of nitrates in groundwater. It is inappropriate to look at agriculture as a whole using only the dairy perspective.

9. Vegetative Buffers: According to the EPA (Helmers et al, 2008)

> *Buffers and filter strips are areas of permanent vegetation located within and between agricultural fields and the water courses to which they drain. These buffers are intended to intercept and slow runoff thereby providing water quality benefits. In addition, in many settings they are intended to intercept shallow groundwater moving through the root zone below the buffer.*

Vegetative buffers reduce runoff of nitrate, phosphate and other pollutants into surface waters. The size of buffers is an ongoing source of disagreement between environmentalists and growers who see buffers as land lost to production. (Wasserman, 2016)

Current extent, cost and benefits of vegetative buffers in the GWMA target area have not been accurately measured. Buffers have not been included in recommended ways to reduce nitrate pollution to the ground and surface waters. Sequestration of nitrate in buffers hs not been measured or estimated.

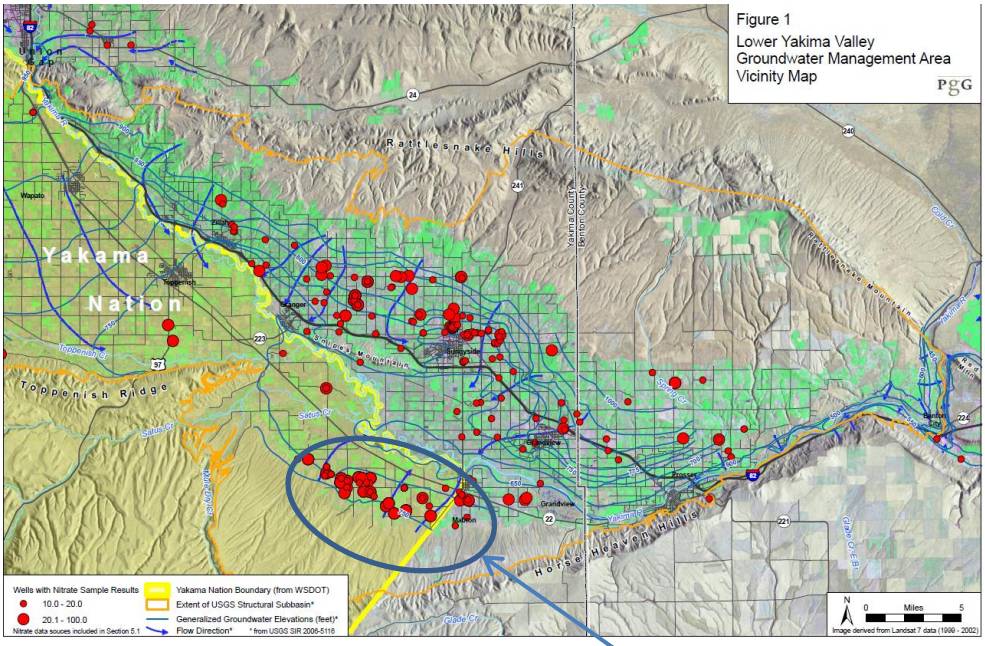
According to the Roza-Sunnyside Joint Board of Control (2010) current recommendations for buffers surrounding irrigation waterways in the LYV are 20 feet. This is almost half the size of the buffer widths recommended by advocates for salmon. Those who worry about fish habitat recommend buffers that are 35 to 50 feet wide. (Wasserman, 2016; EPA 2018)

10. Data sharing between the Yakama Nation and the LYV GWMA: The Yakama Nation is a sovereign government while the LYV GWMA is a temporary project designed to address a specific problem. The Yakama Nation has sent a representative to almost every meeting of the GWAC. He has actively participated in several work groups. The Yakama Nation has chosen to address nitrate problems on the reservation using a separate process, one that does not require public information sharing.

Early investigations demonstrated extensive nitrate contamination of the groundwater in parts of the Yakama Reservation surrounding Satus Creek. Ground water in this area flows in a north and north-easterly direction and eventually reaches the Yakima River. The aquifer here is shallow and water from the reservation travels to non-reservation land.

We suggest a need for sharing of data gathered on the Yakama Reservation with the LYV GWMA. This would require nation to nation agreements.

Map 4. Nitrates in Wells Lower Yakima Valley - 2010



11. Leaching from pens, corrals and compost yards: Multiple small data sets clearly demonstrate leakage of nitrate and ammonia to the vadose zone beneath pens, corrals and compost areas. Some stakeholders from the agricultural community question the reliability of this data. The WSDA chose not to estimate leakage from compost areas in their Nitrogen Availability Assessment (Attachment 32, page 13), in spite of the fact that 2015 WSDA research showed elevated nitrate levels below compost areas (Attachments 13, Attachment 14 & Attachment 15).

Table 8. Nitrate Levels beneath LYV Compost Yards - 2015

Compost Yards		**Nitrate - mg/kg**						
Site	Surface	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft
1C1	364.0	116.3	95.6	82.6	31.1	15.4	15.6	8.3
1C2	292.7	49.8	24.5	28.6	27.1	21.0	19.8	
5C1	159.0	118.8	133.8	225.0	153.9	116.7	28.0	8.5
2Cl	139.0	1.3	6.3	1.0	3.2	1.9	8.5	
2Cu	649.4	30.0	2.2	36.9	150.0	175.1	151.5	
4C1	48.3	164.5	226.1	216.9	222.5	132.1	59.1	
6C	123.2	73.5	34.7	24.7	17.7	9.1		
Average	253.7	79.2	74.7	88.0	86.5	67.3	47.1	8.4
Range	48.3-649.4	1.3-164.5	2.2-226.1	1-216.9	3.2-222.5	1.9-175.1	8.5-151.5	8.3-8.5

With these concerns in mind, it is important to conduct high quality studies that assess movement of nitrogen beneath production areas with different soil types, hydrogeology and histories.

12. Environmental Justice (EJ): The majority of the people who live in the LYV are people of color. Due to language barriers, Yakima County has been under a court order to publish voting materials in both English and Spanish since 2004. (U.S. Dept. of Justice, 2004) The best available information says that a quarter of the LYV population speaks English less than well. (U.S. Census, 2018)

FOTC believes that the GWMA leadership and many members of the GWAC do not understand the foundation for Environmental Justice, the risks of not implementing EJ, or the benefits of implementing EJ. This is evidenced by the fact that Environmental Justice was never referenced in the GWAC meetings and never discussed by the GWAC. Translation from English to Spanish does not equate to communicating in "culturally appropriate" ways. (See Attachment 67 for Economic Impact on Poor Families)

13. Movement of Water and Nitrates in the Vadose Zone: Since the beginning of the GWMA work some stakeholders have made "legacy nitrates" part of the conversation. This

term describes nitrates that have remained in the vadose zone as the result of fertilization that dates back to the 1950's. The amount or distribution of "legacy nitrates" in the GWMA target area has not been quantified. (Vadose zone = area between land surface & aquifers)

International experts on changing nitrogen cycles have attempted to quantify the amount of nitrogen sequestered in typical vadose zones. (Ascott et al, 2017) They argue that conventional nitrogen budgets are incomplete. There are inputs and outputs, but nitrogen also accumulates in "sinks" such as the vadose zone. The amount of nitrogen storage varies depending on travel time, depth to groundwater, soil porosity, years of farming and recharge. In areas that have been cultivated for centuries there are steady states in which inputs may equal outputs. Patterns of nitrogen movement are different in more recently farmed locations compared to regions that have been farmed for centuries.

Ascott et al (2017) state:

> *Storage of nitrate in the vadose zone is one of a number of temporary catchment retention processes such as storage in soil organic matter, subsoils, land not in agricultural production, the riparian zone and in rivers. These possible nitrogen stores and how they change through time (eg, N release through mineralisation of soil organic matter) should also be compared with storage in the vadose zone to determine whether they are significant enough to be incorporated into future nutrient budgets. In combination, these processes will result in substantial delays in the impacts of changes in agricultural management practices on groundwater and surface water quality.*

Some GWMA stakeholders maintain that not all nitrates that leach below the root zone ultimately reach the aquifer. (Attachment 42) They propose that nitrification and denitrification take place and this decreases the impact on the groundwater. Others (Shaw, 2015) state that denitrification is minimal in the well drained soils of the LYV

It is instructive to look at deep soil sampling from LYV operations. Here are the results of DSS with a Geoprobe in the soils beneath a LYV dairy compost yard. Observe that nitrate concentrations in the pore water are very high.

Table 19. Soil and Pore Water Testing Beneath a LYV Compost Yard

Boring ID		Soil							Pore water
		Moisture content		Concentration (C_t)					Concentration (C_w)
	Interval (ft)	Weight (%)	θ_w (-)	Chloride (mg/kg)	Phos (mg/kg)	Ammonia (mg/kg)	Nitrate (mg/kg)	TKN (mg/kg)	Nitrate (mg/L)
DA-SB-02	0-1	20.4	0.388	404	95	12	158	896	775
	1-2	17.3	0.329	243	58	21	72	560	416
	2-3	12.4	0.236	407	14	13	76	448	613
	3-4	11.4	0.217	303	4	8	43	280	377
	4-5	13.8	0.262	374	4	11	160	224	1,159
	5-6	12.7	0.241	320	2	9	252	56	1,984
	6-7	14.6	0.277	282	3	104	403	112	2,760
	7-8	15.1	0.287	257	4	6	466	112	3,086
	8-9	15.2	0.289	220	3	5	464	112	3,053
	9-10	13.8	0.262	150	3	5	322	112	2,333
	10-11	16.9	0.321	324	47	8	226	672	1,337
	13-14	17	0.323	236	3	5	88	224	518
	14-15	20.4	0.388	299	4	4	36	168	176
	15-16	19.8	0.376	247	4	5	29	168	146
	16-17	14.6	0.277	150	8	5	19	336	130
	17-18	13.6	0.258	236	14	5	30	336	221
	18-19	5.9	0.112	87	3	4	11	112	186
	19-20	7.8	0.148	66	2	4	11	168	141
DA-SB-03	0-1	14.4	0.274	135	97	8	43	168	299
	1-2	15.5	0.295	135	31	4	19	560	123
	2-3	14.9	0.283	191	21	4	82	336	550
	3-4	12.5	0.238	303	34	3	117	504	936
	4-5	12.8	0.243	285	2	3	113	224	883
	5-6	13.9	0.264	326	8	3	175	224	1,259
	6-7	17.1	0.325	341	7	4	216	224	1,263
	7-8	17.8	0.338	294	15	4	217	280	1,219
	8-9	13.9	0.264	130	5	4	93	224	669
	9-10	17.6	0.334	119	3	5	117	672	665
	10-11	21.9	0.416	148	4	5	214	168	977
	11-12	20.2	0.384	143	4	2	221	168	1,094
	12-13	19.6	0.372	152	3	4	256	168	1,306
	13-14	17.1	0.325	142	3	7	237	168	1,386
	14-15	19.8	0.376	158	3	5	242	168	1,222
	15-16	17.8	0.338	109	4	4	162	112	910
	16-17	13.5	0.257	89	4	4	101	112	748
	17-18	12	0.228	68	11	5	80	224	667
	18-19	9.1	0.173	86	7	5	98	224	1,077
	19-20	5.5	0.105	0	2	5	46	112	836

From Second Supplemental Report *Community Association for Restoration of the Environment, Inc. and Center for Food Safety, Inc. v. George & Margaret, LLC, George DeRuyter & Son Dairy, LLC, D & A Dairy, and D & A Dairy, LLC.* (Attachment 65)

Farming is relatively recent in the LYV going back about 150 years. The soils are mostly well drained to very well drained. Depth to groundwater is not great due in part to recharge from irrigation.

There are well accepted models that could be applied (UC Davis, 2018; Nolan 2010; Ascott et al, 2017). The USGS has begun work to model the flow of groundwater in the Lower Yakima Valley (Bachman, 2015) and finds that 86% of groundwater reaches the water table within 42 years of application to the land surface, and "Well to water-table travel times for 75.4 percent of the particles were less than the average travel time of 3,749 days."

There are serious conversations within the Yakima Basin Integrated Plan about storing water in the LYV groundwater during periods of high surface water flow, for use later in the year when flows are low and irrigation needs are high. (Personal conversations YRBWEP LYV Groundwater Work Group, Sept. 11, 2018). Sites for groundwater storage must be evaluated for capacity, expected losses, cost to store and cost to retrieve the water. Is there nitrogen in the vadose zone that would leach to the aquifers as a side effect from such a project? That is a worthy question.

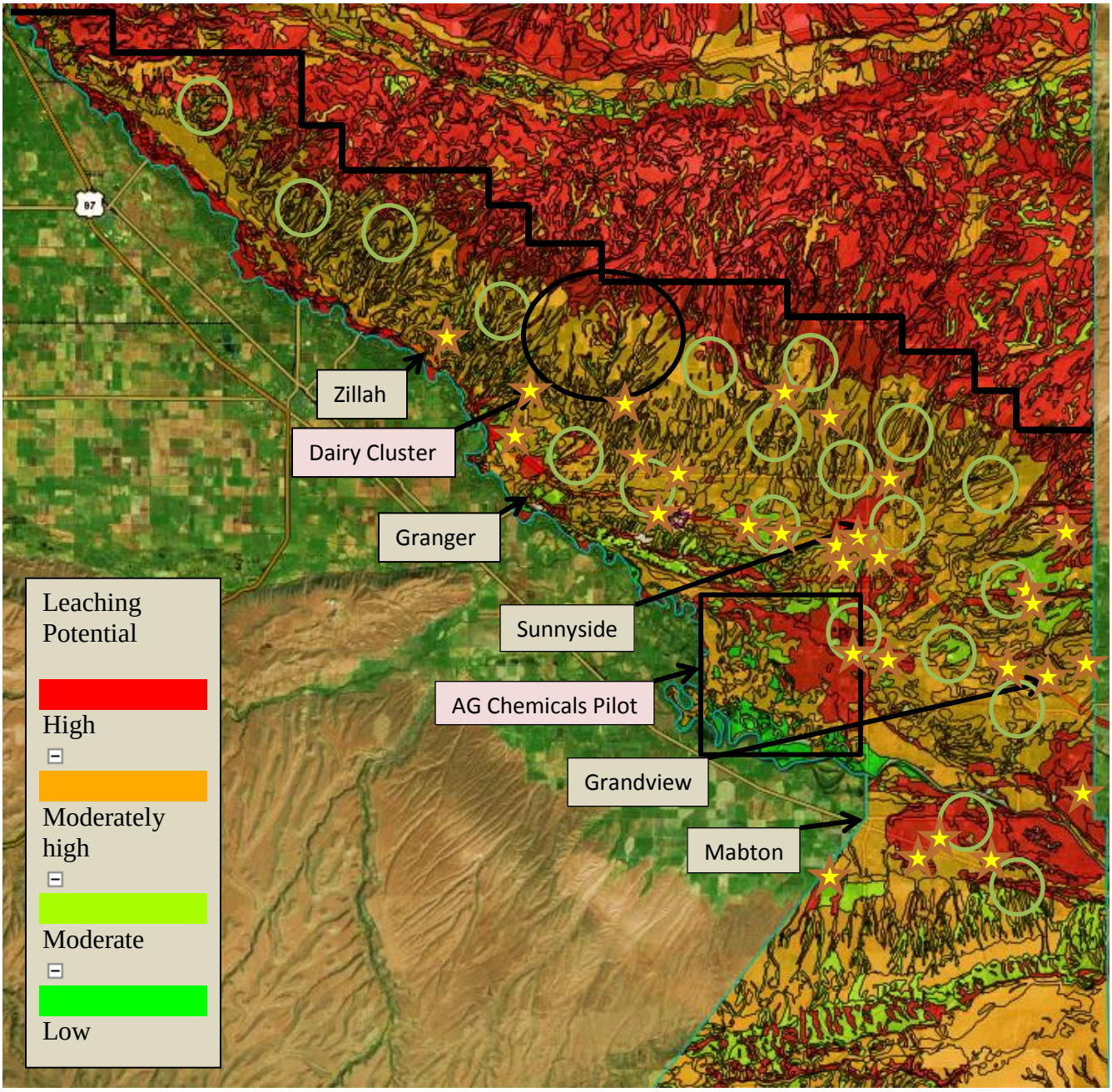
In summary, irrigation has modified groundwater storage in the LYV. Changes in irrigation practices and water storage will impact groundwater flows in the near future. Some nitrogen is sequestered in LYV vadose zones and it would be helpful to model and quantify this process. Due to soil properties and a shallow water table the amount of nitrogen in the vadose zones is not as large as the amounts from regions with deep water tables or poor drainage.

14. Nitrate Leaching for Various Soils in the GWMA:

Soil and groundwater nitrate levels vary across the GWMA. Contributing factors are hydraulic conductivity, soil properties, depth to groundwater, groundwater flow patterns, cropping patterns, and irrigation practices. (See Attachment 66) Nitrate leaching potential is calculated by interpreting the impact from: mean annual precipitation; water travel time through the profile; available water capacity; depth to the water table; slope gradient adjusted for the hydrological soil group; and potential evapotranspiration. (NRCS 2018)

Most of the GWMA target area has leaching potentials in the moderately high and high categories. This information must be part of the long term GWMA program. The map below shows leaching potentials, wells with high nitrates in 2017 and proposed monitoring wells.

Map 17. NRCS Leaching Potentials in the GWMA Target Area

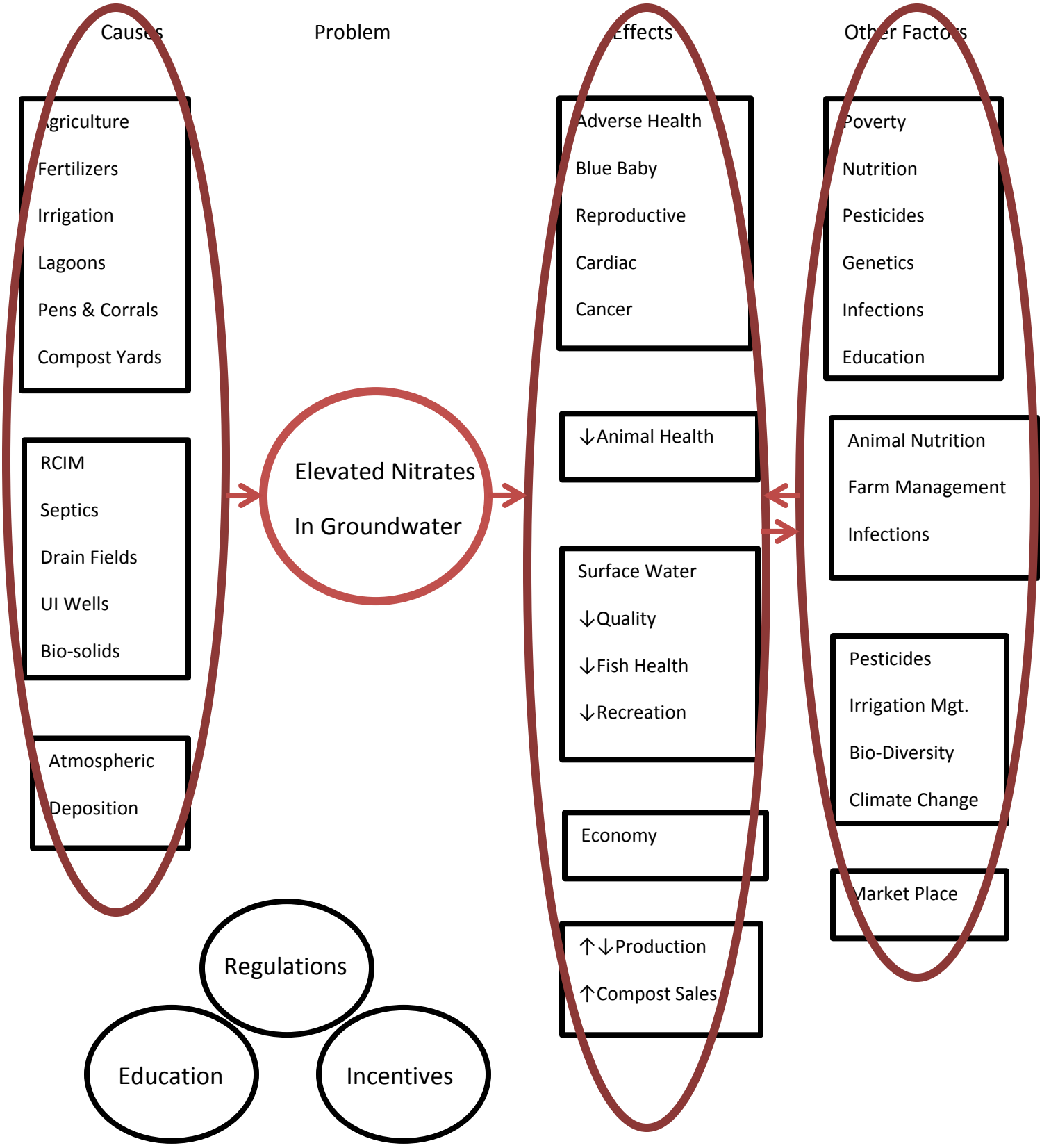


High Nitrate USGS Test Well = ★ Proposed Monitoring Wells = ○

16. Comprehensive Data Base - Central Repository for Analysis of Relevant Data:
FOTC believes that many environmental, economic and public health issues in the LYV are interconnected. We favor robust data gathering and expert analysis of the many causes and effects. In order to do this we need a central repository of relevant data. The GWMA made a timid start, in our opinion. Much more work is needed. (See GWMA Evaluation Plan on page 146 of this Minority Report)

The proposed model below shows potential causes, effects and unanticipated consequences related to elevated groundwater nitrate. This model can be used to identify sources and contributing factors and choose the most effective targets for interventions.

Diagram 3. **Conceptual Model for a Data Base**



Gaps in Regulations

1. Chapter 90.44.050 RCW allows animal agriculture to withdraw unlimited amounts of groundwater for livestock. This law was enacted long before concentrated animal feeding operations came into existence. As a result factory farms can withdraw millions of gallons of water per day while neighbors must ration water and drill deeper and deeper wells.

2. The Dairy Nutrient Management Act (DNMA) does not authorize penalties when dairies do not follow their Nutrient Management Plans (NMPs). Dairies in Washington State must have NMP's in place but there is no requirement for them to follow these plans. Large dairies in Yakima County have ignored their NMP commitments and have polluted the groundwater, often at very high rates. (Tebbutt Law, 2016) And non-enforcement sits at the very center of these dairy related pollution problems in the LYV

In the fall of 2017 David Bowen from Ecology advised the GWAC that the appropriate way to achieve a modification of WA State laws is to write a white paper on a topic and submit it to the appropriate state agency. FOTC followed his advice and wrote a draft letter recommending enforcement of NMP commitments. (See Attachment 33) The draft letter was never brought to the table for GWAC discussion.

3. Non-point source pollution: In order to qualify for section 319 grant funding under the Clean Water Act, Washington must have a plan for controlling non-point source pollution. Work on a plan has stagnated for some time and Washington's plan for control of non-point source pollution has not yet been approved by the EPA. Ecology is currently working on a plan to address non-point sources that will prove acceptable. This draft plan includes the LYV GWMA project as one tool for monitoring and controlling non-point sources. (Rau, 2015)

In *Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution* Ecology (Rau, 2015) says on page 101:

> *WSDA has been heavily involved with the nitrate groundwater contamination issues in the lower Yakima valley for over a decade. Recent work on the groundwater*

management area (GWMA) included staffing the technical committees and committing resources through an interagency agreement to conduct a comprehensive nitrogen loading assessment. Completion of this assessment will allow members of the GWMA to focus nitrogen management actions on land uses that contribute excess nitrogen most significantly to degradation of groundwater quality in the area.

And on page 112:

In 2011, the Lower Yakima Valley GWMA was formed to address nitrate contamination in groundwater. The GWMA is a response to the elevated nitrate levels found in the Lower Yakima Valley which often exceed the state groundwater standard of 10.0 mg/L. The goal of the Lower Yakima Valley GWMA is to reduce nitrate contamination concentrations in groundwater below state drinking water standards.

Yakima County requested that Ecology recognize the GWMA and provide assistance for helping reduce the nitrate level in the groundwater. Tasks include:

- *Data collection, monitoring and analysis.*
- *Public education and outreach.*
- *Problem identification.*
- *Potential measures or practices for reducing groundwater contamination.*

There is no GWMA Nitrogen Loading Assessment and the most recent Nitrogen Availability Assessment has not been approved. This promised step toward meeting EPA approval of a Non-Point Source Pollution Prevention Plan is in jeopardy.

4. The Yakima County Voluntary Stewardship Work Plan (2017) relies on the LYV GWMA plan to fulfill VSP obligations in the area. The VSP agricultural viability aim on page 89 is to:

Support actions that benefit groundwater quality and agricultural viability

And the associated activity on pages 89 & 98 is to:

Support Lower Yakima Valley Groundwater Management Area (LYGWMA) group outcomes

Under Section 8.1 – Monitoring Tools, the VSP states:

> *In addition to parameters with specific thresholds identified in Appendix G, the Work Group will also consider available monitoring information and trends (e.g., groundwater data collected through the LYGWMA process) to ensure that the Work Plan's goals and benchmarks continue to be consistent with the latest understanding of ecological functions, potential impairments, agricultural practices, and opportunities for critical area protection or enhancement or enhancement of agricultural viability.*

If, as seems likely, the GWMA plan fails to provide monitoring of LYV groundwater quality with a method for evaluating the effectiveness of prevention strategies, then the VSP will lose this tool for evaluation of their program.

5. WAC 173-201A-020 requires Ecology to approve Best Management Practices (BMPs) for protection of Washington waters. To date there is no listing of Ecology approved BMPs.

The history of Ecology's efforts to comply with the law goes back, at least, to 2009 when the department tried to provide clarity for livestock producers on what they were expected to do to protect waters of the state. Ecology developed a guide entitled, *Clean Water Practices for Livestock Grazing,* designed to "satisfy both the legal definition of BMPs and the compliance requirements for nonpoint sources of pollution, as defined by water quality regulations." (Western Environmental Law Center, 2016, page 24).

Some conservations districts and the WA Association of Conservation Districts saw this as an Ecology intrusion into their domain, in spite of the fact that it is a requirement in the law. Since that time the conservation districts have argued that NRCS standards should be used as official BMPs and Ecology has argued that the NRCS standards are guidelines that do not meet the criteria needed for enforcement. ." (Western Environmental Law Center, 2016, page 24). There are currently no Ecology approved BMPs in Washington State.

6. Total Maximum Daily Loads (TMDLs) have not been fully developed for the Lower Yakima River. Specifically there are no TMDLs for nutrients.

Testing of drains in the GWMA target area clearly show significant discharge of nitrogen and phosphate to the river from cropland. (Attachment 28) The Roza Sunnyside Joint Board of Control has conducted research that shows declining concentrations of most major pollutants in the drains and wasteways except for nitrogen. (Zuroske, 2009) Ecology has calculated annual land surface nitrate loading that exceeds 200 kg/km^2/yr for Spring Canyon, Deep Canyon and Sunnyside that lead to high discharge of nutrients to the Yakima River (Whiley, 2015).

If we had TMDLs for nitrogen and phosphorous in place there are regulatory mechanisms that could be used to monitor and address discharge by irrigated parcel. The irrigation districts currently do this for turbidity and total suspended solids. (Roza-Sunnyside Joint Board of Control, 2010)

7. The Memorandum of Understanding between Ecology and the WSDA (Ecology, 2011) is cumbersome and unwieldy with many opportunities for mis-interpretation and mis-application. An outsider needs a road map to navigate the > 70 points of decision-making that specify whether Ecology or WSDA is in charge of a given situation. This MOU is Washington's attempt to comply with the Clean Water Act as it applies to animal agriculture. To our knowledge it has never been approved by the EPA.

In addition it is functionally impossible for the WSDA to adequately perform the inspections allocated to them by the MOU, at least for the lands east of the Cascades where 60% of Washington dairy cows are housed. There is one dairy inspector for Eastern Washington, in spite of the fact that the legislator provided funding for an additional inspector in 2015. (WA State Dairy Nutrient Management Program 2016 & 2017)

LYV residents have filed complaints with WSDA DNMP and those complaints have not been investigated for days, until after the evidence had been flushed away. (Attachment 75)

8. NPDES Permit for CAFOs: State law requires Ecology to issue a new National Pollutant Discharge Elimination System (NPDES) permit for CAFOs every five years. The 2006 permit expired in 2011 and Ecology did not begin constructing a new one until 2015.

The NPDES permit for CAFOs that was issued in early 2017 was challenged before the WA State Pollution Control Hearing Board (PCHB) by the WA State Dairy Federation, the Washington Farm Bureau and a coalition of seven environmental groups. Concerns are detailed at http://www.eluho.wa.gov/Decision/Search_Cases Closing arguments can be seen by video at the City of Yakima website: http://205.172.45.10/CablecastPublicSite/show/8763?channel=1

The WA Dairy Federation (WDF) and the WA Farm Bureau (WFB) argued:

1. Ecology has changed depth to groundwater requirements by measuring from the bottom of lagoon liners instead of the top.
2. The Economic Impact Analysis did not adequately account for all costs of compliance with the NPDES permit for CAFOs
3. The plan underestimates the costs of soil sampling
4. The permits do not provide for a stable and predictable business climate

Ecology disagrees.

Environmental Groups argued:

1. Without groundwater monitoring it is impossible to determine effluent limitations for groundwater
2. The NPDES permits for CAFOs violate Washington's anti-degradation requirements
3. The permits violate Washington's AKART (all available known and reasonable technology) requirements for lagoon construction.
4. The permits violate the anti-backsliding provision of the Clean Water Act

Ecology disagrees.

The PCHB found in favor of Ecology on all counts except #1 for the WDF and WFB above. Both industry and the environmental groups are appealing this decision.

In the meantime only 23 of the 450 plus dairies in Washington State are covered by NPDES permits, the approved way to manage pollution from concentrated animal feeding operations. In Yakima County only 5 out of approximately 60 dairies are covered by an NPDES permit. These five have chosen the State Only General Permit that does not fall

under the Clean Water Act, does not address discharge to surface waters and has no provisions for citizen enforcement. (WA State Dept. of Ecology, 2018) Since regulators must prove discharge to waters of the state in order to require an NPDES permit (Ecology 2017a) and there is no groundwater monitoring it is difficult to bring dairies into the program.

9. WAC 173-350-220 provides guidance for management of composting facilities, including composting of manures. Section (1) (b) provides exemptions for certain operations that process agricultural wastes, manure and bedding from zoos and bulking agents. These operations must secure exemptions from Ecology and must report monitoring and record keeping to local health districts. Based on the results of public records requests FOTC believes that manure composting operations in the Yakima Valley are not complying with the law. In PRR responses Ecology stated that only one dairy in the LYV has applied for an exemption and the Yakima Health District had annual reports from only one LYV dairy. (Documents available on request)

In addition, the South Yakima Conservation District has stated in a meeting of the GWMA Regulatory Work Group that it is acceptable to compost on bare ground. Dan DeGroot, a member of the GWAC and a dairyman, stated that Ecology told him compaction from movement of vehicles was sufficient to prevent discharge to the aquifer. (LYV GWMA Regulatory WG Meeting, November, 2016)

No agency appears to take responsibility for groundwater pollution related to composting, in spite of the fact that leaching from compost yards is well-documented. (Attachments 13, Attachment 14 & Attachment 15)

10. Tax on Water: Since 2017 Washington residents have been required to pay a tax on bottled water. (WA Dept. of Revenue, 2017). There are very cumbersome exemptions for people areas such as the LYV where there is no readily available source of potable water. These exemptions are not well publicized and it would be cost prohibitive to publicize them.

Being forced to purchase water when groundwater is unsafe and the responsible agencies do nothing is already an unacknowledged tax. Addition of an official tax is a cruel abuse of low income people who have no way to complain.

A reasonable change to the law is an exemption for entire communities when nitrates in groundwater exceed 10 mg/L for > 10% of domestic wells. This would require changes to RCW 82.12, RCW 82.32, RCW 82.04, and RCW 82.14

11. WAC 16-06-210 (29) states:

> *Under RCW 42.56.610 and 90.64.190, information identifying the number of animals; volume of livestock nutrients generated; number of acres covered by the plan or used for land application of livestock nutrients; livestock nutrients transferred to other persons; and crop yields in plans, records, and reports obtained by state and local agencies from dairies, animal feeding operations, and concentrated animal feeding operations not required to apply for a National Pollutant Discharge Elimination System permit is disclosable in the following ranges:*

For simplicity only the ranges for dairy heifers are provided here:

> *(c) Number of animals: Dairy heifers*
> *1 to 49*
> *50 to 149*
> *150 to 299*
> *300 to 999*
> *1,000 to 1,999*
> *2,000 to 2,999*
> *3,000 to 3,999*
> *4,000 and above*

These ranges are so large that a citizen who wishes to investigate potential for pollution cannot make reasonable calculations about manure production and availability of cropland for manure disposal. Citizens have the right to protect ourselves from pollution and WAC

16-06, as currently written makes it very difficult to exercise that right by accessing accurate data. (Barton, 2017; Wishart, 2017)

12. WAC 173-224-040 Permit fee schedule provides the following fees for NPDES permits for concentrated animal feeding operations (CAFOs):

Concentrated Animal Feeding Operation – Fee per Year	2018	2019
a. < 200 Animal Units	264.00	279.00
b. 200 - < 400 Animal Units	663.00	700.00
c. 400 - < 600 Animal Units	1,327.00	1,401.00
d. 600 - < 800 Animal Units	1,990.00	2,101.00
e. 800 Animal Units and greater	2,657.00	2,805.00
Dairies $.50 per Animal Unit not to exceed $1,776.00 for FY 2018 and $1,875.00 for FY 2018 & beyond		

Thus a dairy with 400 animal units would pay $200 per year instead of the $663 per year that a beef operation pays. A dairy with 800 animal units would pay $1,600 per year instead of the $2,657 per year that a beef operation would pay. A 1,000 head dairy would pay the same permit fees as a 10,000 head dairy. This does not seem fair to us and validates our fears that policy makers favor larger businesses and certain forms of agriculture, especially dairy, over others.

13. Reporting of emissions from CAFOs. Based on simple estimates of average emissions from cows it is easy to show that the amounts of ammonia and other hazardous compounds emitted by CAFOs would trigger reporting requirements if they came from warehouses or factories. (See WAC 173-460). However, recent federal legislation rejects reporting requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Emergency Planning & Community Right-to-Know Act (EPCRA). (EPA, 2018) Thus people in Yakima County have great difficulty calculating an accurate Nitrogen Balance.

14. Reporting of manure applications to non-dairy fields. Under RCW 90.64, the Dairy Nutrient Management Act (DNMA), dairymen must report the amount of manure applied to fields under their control, along with the nutrient content of the manures. If manure is sold

to a neighboring farmer and applied to land not controlled by the dairy there is no requirement or mechanism for monitoring the amount of application, timing of application or nutrient content. There is no requirement for soil testing on non-dairy cropland.

15. Yakima County Code: With 35% of all dairy animals housed in Yakima County, there is a great need for a clear definition of confined animal feeding operations and appropriate regulations to address public health issues associated with this form of animal agriculture. (See further discussion under Viable Alternative Solutions, page 128)

The Yakima County Code requires permits for new construction. Concentrated animal feeding operations (CAFOs) are allowed in agriculture zoned areas under a Type II administrative review. (See 19.14.010 Allowable Land Use Table. (Yakima County, n.d.))

There is a LYV dairy with a NMP that was approved in 1995 and updated in 2013. The dairy currently has about 3,000 milk cows. In 2017, in order to make certain capital improvements, construction permits from Yakima County were needed. The permit application revealed that the CAFO had never obtained the appropriate land use permits. The dairy simply started as a small operation and gradually added cows.
Here is an excerpt from the permit application:

> *The castle grove dairy is a concentrated animal feeding operation (CAFO) in the AG land use zone. Chapter 15 of YCC requires a Type II review and a conditional use permit. Prior to this set of capital improvements, castle grove has not needed to obtain these land use permits.*
>
> *It is not uncommon for dairies in Yakima Valley to be operating without the proper land uses permits. Many dairies began as small operations and grew to CAFO status without triggering a review by the Yakima County Planning Department. But when capital improvement require building permits, the building permits force the land use permits.* (See Attachment 56)

To be clear, in 2017 there was at least one large dairy in Yakima County that had never applied for or received the proper land use permits to operate as a CAFO.

Ecological Perspective/Sustainability - Everything is Connected

It is important to listen to the people on the ground. Farmers, and others, are dependent on weather, people, insects, microbes, research and politics. Sooner or later one more gallon of water will overtop a dike, leading to a flood of family homes, leading to an illness that causes a mother to lose her job, and so on ad infinitum. It is in everyone's best interests to watch out for each other. There is a lot to contemplate. Actions have consequences.

There is a member of the gWAC who tells a great story about seeing the whole picture.

> *There was an intelligent and affluent man who had the opportunity to buy a very large acreage in an area that was well suited for growing wine grapes. The man chose the perfect variety; planned to cover his land with this type of grapes and make a huge profit.*
>
> *The story teller gently pointed out that there was one major flaw in the plan. All the grapes would ripen at the same time and it is impossible to bring in a thousand pickers for just a few days of work.*

Jon DeVaney from the WA State Tree Fruit Association tells audiences that one of the strengths of agriculture in the Yakima Valley is a diversity of crops. Because of the variety of apples planted here harvest lasts from late July to after Thanksgiving. (DeVaney, 2018)

Change in one part of the valley has a ripple effect in other areas. If we take actions to reduce nitrate in groundwater we need to look at the side effects from our actions. For example:

1. Is it cost effective; is it reasonable to make all farmers test their soils?
2. Do certain subsidies help one set of farmers and make competing harder for others?
3. How does runoff impact the fish population?
4. If we spend public monies on nitrates does that mean less funding for our schools?
5. Should we improve water quality at the expense of air quality?
6. Does poor air quality affect the crops? The forests? Our lives?
7. Who bears the burden when cities and towns must drill new and deeper wells

Special Issues

Some issues are hard to classify but nevertheless important. These discussions are introduced here.

Discrimination/Marginalization: Prior to the first GWMA meeting the Friends of Toppenish Creek set up a meeting between Commissioner Rand Elliott and three women of color from Radio KDNA. The hope was that one of the three would be invited to sit on the GWMA advisory committee. The Commissioner never arrived. He forgot to put the meeting on his calendar. There was no invitation.

At the March, 2013 meeting of the GWAC, a citizen, a man of color, asked for help because manure from a neighboring dairy was flowing onto his property and contaminating his septic field. He was referred to the Yakima Health District and that agency subsequently condemned his home.

In the fall of 2014 FOTC and two Latina leaders from El Proyecto Bienestar introduced a professor from the University Of Washington School Of Public Health to the GWMA Education and Public Outreach Work Group. The group worked with her to develop a project in which graduate students from the university would assist the GWMA EPO to investigate abandoned wells. Two dairy members from the EPO argued against the project and convinced the GWAC to reject it.

On April 23, 2015 the GWMA Regulatory Work Group met at the Conference Room for District Court Probation Offices in Yakima. Friends of Toppenish brought a videographer to tape the meeting. The videographer happened to be a young Yakama woman. When she went to use the rest room the Yakima County staff told her she could not use the facilities. She then walked down the street to use the restroom at McDonalds. Although the GWAC and Yakima County were informed about the incident there was no effort to make contact and no apology.

On October 20, 2016 Ecology and the Dept of Health provided a one hour “Groundwater Primer” and demonstration of groundwater flow using a sand tank. FOTC asked to have this

demonstration provided in Spanish. The answer was “yes” but that demonstration never took place.

In the fall of 2017 and the spring of 2016 FOTC and a representative from the Latino Community Fund met with the Yakima County Director of Public Services twice to explain why the GWMA should pursue a project to educate the Spanish speaking community about basic groundwater concepts such as “agronomic rates”, “groundwater flow”, “vadose zone”, etc. FOTC put together some proposed informational leaflets in Spanish. The suggestion was never even put on the EPO agenda for discussion.

The GWMA Livestock/CAFO BMPs are not really BMPs:

WAC 173-200-020(5) defines

> *"Best management practices" or "BMPs" mean schedules of activities, prohibitions of practices, maintenance of procedures, and other management practices, to prevent or reduce the pollution of groundwaters of the state. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or water disposal, or drainage from raw material storage.*

This is a legal definition that is used to enforce the chapter 90.48 RCW, the Water Pollution Control Act and chapter 90.54 RCW, the Water Resources Act of 1971.

NRCS Conservation Practices are voluntary guidelines designed to advise growers and producers how to best promote conservation. NRCS Conservation Practices are not BMP’s and are not designed for regulation. (NRCS, nd)

The GWMA CAFO/Livestock Work Group chose to recommend the NRCS standards in place of BMP’s. It is incorrect to label them as BMP’s.

Tale of Two Lagoons

In Snohomish County the Tulalip Indian Tribe has partnered with dairymen and power plants to develop a manure digester that transforms effluent from thousands of cows into

electricity and keeps the nutrients out of the Skykomish/Snohomish River. The digester breaks even financially but the water is protected. (Northwest Indian Fisheries Commission, 2009; personal communication Darryl Williams, 2017)

In the Yakima Valley there is a private manure digester, financed in large part by public monies, that is being re-fitted to produce bio-gas, again using public monies. The rationale for abandoning the original plan is that producing electricity was not sufficiently profitable for the dairy. (Fletcher, 2014)

Our point is that goals are important. The goal of making money requires a different mindset than the goal of protecting the waters.

Bureaucratic Inefficiency. Several years ago, some of the local people on the GWAC observed that the process was moving very slowly. One of the bureaucrats from Olympia joked that "At least it means job security". (Some people are paid for their work on the GWMA, others are not.). At the rate we are going the aquifers of the LYV will not recover.

Here is a timeline for major events regarding regulation of discharges to water of the state by dairies in Washington:

1992: Stakeholders develop "Protecting Groundwater: A Strategy for Managing Agricultural Pesticides and Nutrients"

1998: Passage of RCW 90.64 the Dairy Nutrient Management Act. Inspections are done by Ecology

2002: Close to 100 dairies are under NPDES permits. There are 7 inspectors

2003: Inspections turned over to WSDA. Number of inspectors reduced to 2 ½

2004: WSDA notes that only 15% of producers are keeping records

2005: Water quality issues in the Yakima Valley brought up through complaints

2006: Ecology issues a new NPDES permit for CAFO's

2008: "Hidden Wells, Dirty Water" published in the Yakima Herald Republic

2009: Legislation makes it a violation of the statute not to keep records

2010: Legislation establishes a penalty for not keeping records

2011: CAFO NPDES permit expires

2012: The LYV GWMA begins. The goal is to reduce nitrates in the groundwater within five years.

2015: Ecology begins work on a new CAFO NPDES permit. There has been no permit in place for four years.

2015: WSDA informs the legislature of the need to enforce dairy nutrient management plans. No action is taken.

2017: A new CAFO NPDES permit is issued. Less than 25 dairies statewide are under permit.

2018: The LYV GWMA has not yet approved a plan. Reducing nitrates in groundwater "will take decades".

(See Attachment 74 & Attachment 76 for more details)

What Will Happen if We Do Nothing?

Based on the above Characterization of the LYV GWMA target area, along with trends from the U.S. Census and the National Agricultural Statistics Service there are potential outcomes and/or scenarios of what the LYV will look like in 25 years if we do nothing different.

Water Quantity

Assumptions/predictions/estimates for the next 22 - 24 years are:

1. At current rates the population will increase at about 1% per year from a current estimate of 50,000 to 62,002 in the year 2040.
2. Demand for water for humans will increase from 5 million gallons per day in 2015 to 6.20 million gallons per day in 2040.
3. Most of the people will live in the smaller cities. About a third will be < 18 years of age. The poverty level will be higher than the state or the county level as a whole and the educational level will be lower than the state or the county level as a whole.
4. There will be a need for about 8,000 more jobs, assuming a 60% rate of participation in the labor force (U.S. Census, 2018)
5. Land in farming will stay about the same and land under irrigation will stay about the same at 96,000 to 99,000 acres. (McClain, 2015)
6. The number of farms will decrease by 1% per year – for Yakima County as a whole from 3,143 in 2012 to 2,200 in 2042
7. Farms will continue to enlarge. (Already two very large dairies in the LYV are owned by out of state investors.)
8. Land in grapes and hops may increase. (Attachment 42, page 3) (We do not have hard data from USDA.}
9. If the amount of land in orchards continues to decrease at a rate of .32% per year the land in apples will decrease from the current level of 17,333 acres to 15,990 in 2042
10. If the amount of land in orchards continues to decrease at a rate of .32% per year the land in cherries will decrease from the current level of 6,336 acres to 5,845 acres in 2042

11. The GWMA target area cannot sustain the present rate of increase of 6.6% per year for land planted in grain corn or 9.4% per year for land planted in corn silage. At this rate, in 25 years, the amount of land planted in corn would exceed the total irrigated acreage for the GWMA target area.
12. At current rates of change, by the year 2042 there will be 248,837 cows and calves, plus 188,776 milk cows in Yakima County, mostly in the LYV. The demand for water for cows will increase from 11,544,510 gallons per day in 2012 to 23,003,330 gallons per day in 2042.
13. In the next 25 years demand for groundwater will change:
    a. Increased demand for people – about 1.38 million more gallons per day (LYV)
    b. Increased demand for animals – about 11.5 million more gallons per day (All of Yakima County)
    c. Improved efficiency due to methods such as drip irrigation and canal lining will reduce demand and reduce recharge
    d. Increased demand for irrigation water due to double cropping
    e. Increased demand for emergency groundwater withdrawals due to increased frequency of drought years
    f. In many parts of the GWMA target area water tables will decline

Although the shallow, unconfined aquifers in the LYV remain stable at this time, the deeper basalt aquifers are declining at an average rate of 2.19 ft per year, according to Ecology (2018d)

Water Quality:

When the GWMA first met in 2012 the best estimates said that about 12% of domestic wells in the LYV had nitrate levels > 10 mg/L. (Attachment 2) The GWMA asked the Pacific Groundwater Group (PgG) to explore these numbers in more depth. Their study *Potential Groundwater Monitoring Stations Yakima Groundwater Management Area* (See First

Quarterly GWMA Report, 2014, page 100/162) found steadily increasing levels of nitrates in the area, based on analysis of all well water testing grouped by years.

Table 3. Nitrate Levels and Trends in the GWMA Target Area: 1975 - 2014

Date Range	Number of Wells	Mean Nitrate	Median Nitrate	Standard Deviation
1975 -1979	4	1.45	1.1	1.66
1980 - 1984	51	3.48	1.7	4.1
1985 - 1989	40	3.33	1.8	3.63
1990 - 1994	76	3.52	2.6	3.89
1995 - 1999	69	4.06	3.9	3.29
2000 - 2004	295	6.36	4	8.56
2005 - 2009	90	4.74	4.44	3.6
2010 - 2014	323	13.51	11.5	11.17

For readers who are unfamiliar with statistical analysis half of the numbers in a data set are above the median and half are below. This means that for the studies done between 2010 and 2014 half of the samples had nitrates > 11.5 mg/L.

This observation is not definitive. In 2017 the GWMA contracted with the USGS to sample 156 voluntarily submitted domestic wells in the target area. That study found 19.7% of wells had nitrate levels > 10 mg/L. (Huffman, 2018) In the GWMA High Risk Well Assessment 15% of wells had nitrate levels > 10 mg/L. In any case, water quality appears to be worsening in the LYV.

The GWAC has intuitively assumed that the most impacted aquifers are the shallower aquifers. This is not totally true. (See Attachment 28) The study, *Potential Groundwater Monitoring Stations Yakima Groundwater Management Area,* found data from 22 GWMA area wells that are deeper than 1,000 feet. Four of these wells or 18% had maximum nitrate levels > 10 mg/L.

One way to understand the rise in nitrate levels is to analyze “hot spots” or areas with very high nitrate levels. At this point in time the most visible and best studied “hot spot” in the

area is a “dairy cluster” that is under consent decree with the Environmental Protection Agency for remediation. This is an approximately 12 square mile area north of the unincorporated community of Outlook. There are five dairies in the cluster and they house about 24,000 animals. Initial well water testing down gradient from the cluster found that 61% of domestic wells had nitrate levels > 10 mg/L. (EPA Region X, 2014 & 2016)

Since 2013 the EPA has been working with the dairies on implementing best management practices designed to improve water quality. Part of this work involves quarterly testing of water from a system of 23 monitoring wells. This ongoing study will assess the impact of BMP’s for animal agriculture and cropland. (EPA Region X, 2014 & 2016)

The 2016 EPA Progress Update stated:

> *In the third quarter of 2013, the first quarter that the dairies conducted groundwater sampling, nitrate concentrations in seven of the downgradient wells were less than the MCL of 10 ppm; nitrate concentrations in 15 of the wells exceeded the MCL. The nitrate concentrations in the wells that exceeded the MCL ranged from 12 ppm to 166 ppm.*
>
> *Two years later, in the third quarter of 2015, nitrate concentrations in seven of the downgradient monitoring wells were less than the MCL; nitrate concentrations in 14 of the wells exceeded the MCL; no sample could be taken from one groundwater monitoring well. The nitrate concentrations in the downgradient wells that exceeded the MCL ranged from 14 ppm to 180 ppm.*

Remediation of aquifers near “hot spots” does not happen quickly. There are at least six other areas in the LYV GWMA target area with high concentrations of dairies and milk cows. The WSDA Dairy Nutrient Management Program has been in place since the late 1990’s and appears unable to prevent the related groundwater pollution.

<u>Groundwater quality in the LYV GWMA is worsening. Current efforts to address the problem are not working. If we do nothing different the future will bring falling aquifers with increasingly polluted water.</u>

Worst Case Scenario – Concentrated Animal Feeding Operations take over the Lower Yakima Valley

Data from the National Agricultural Statistics Service indicates a 25 year trend toward more dairy cows (see above) and more land planted in forage crops.

Table 20. Percentage of Land by Crop Type in Yakima County

Crop Type		1987	1992	1997	2002	2007	2012
Grain Corn		3%	4%	5%	5%	6%	6%
Total Forage – Corn Silage, Alfalfa, Hay		15%	14%	16%	26%	29%	30%
Vegetables		9%	8%	7%	6%	4%	3%
Orchards		39%	38%	40%	37%	36%	39%
Other		34%	36%	32%	26%	25%	22%

If these trends continue we could see a community defined by concentrated animal feeding operations (CAFOs). The adverse consequences to communities from CAFOs have been clearly documented in other parts of the country. (PEW Commission, 2008; American Public Health Association, 2003; National Association of Local Boards of Health, 2010)

Number and Size of Dairies: In the 2016 *WSDA Dairy Nutrient Management Program Implementation of Nutrient Management Training Program for Farmers Report to the Legislature,* the agency stated that Yakima County had 69 dairies in 2014 and 62 dairies in 2016. (WSDA, 2016) This is a decrease of about 3.5 dairies per year. WSDA (2017) also states that, during the 43 years from 1969 to 2012, the number of dairies in Yakima County decreased from 301 to 97, a loss of 4.7 dairies per year.

If the LYV loses 4 dairies per year we would predict no dairies at all in the LYV in 25 years. At a decrease of 2 dairies per year there would be 12 dairies remaining in 25 years. These are no longer family farms where the children help with the work after school and show calves at the county fair. These are factory farms where each cow has a number and lives or dies based on how much milk she produces.

Number of Milk Cows: If trends continue (and this is a big if) there will be ~189,000 milk cows in the GWMA target area in 25 years. This equates to 12 mega dairies with ~15,000 cows per dairy.

Change in Land Usage: This approximate doubling of dairy cow numbers would increase the acreage in pens and compost to 5,200 acres and lagoon acreage to well over 420 acres. (WSDA, 2018) In order to feed this number of animals the land in corn silage and forage must approximately double.

There are well documented benefits from agricultural diversity including the ability to better manage soils, enhanced disease/pest resistance, agility in a fluid market place, protection of the environment, and protecting bio-diversity in general. Historically, the Yakima Valley has been well-known for and benefited from a diversity of crops. (DeVaney, 2018) Planting more land in corn reduces these benefits.

Adverse Side Effects: Some of the adverse side effects from an increase in CAFOs are:

1. Increased withdrawal of groundwater
2. Increased groundwater pollution assuming that the regulatory climate is unchanged
3. Increased nitrogenous and other emissions to the ambient air (Rotz, 2004)
4. Decreased employment opportunities (Community Attributes Inc, 2015, pp 7 & 8)
5. Depressed local economy (PEW Commission, 2009)
6. Increased adverse health impacts (American Public Health Association 2003; National Association of Local Boards of Health, 2010)
7. Decreased quality of life (PEW Commission, 2009)

Future Costs of Drinking Water Treatment for Rural Areas & Municipalities

Known methods of addressing nitrate pollution of drinking water include:

- Connecting smaller water systems with nearby larger water systems
- Consolidating smaller waters systems into larger regional water systems
- Installing groundwater community treatment

- Drilling new wells
- Blending sources
- Providing and maintaining point of use treatment for households

(Harter et al, 2012)

Drinking water costs for rural populations that are impacted by nitrate pollution are high and are increasing across the nation. For example:

Harter et al (2017) devoted Technical Report 7 to analysis of drinking water supply options in central California. This comprehensive study concluded that

> *The overall cost of providing nitrate-compliant drinking water to the currently affected population in the Tulare Lake Basin and Salinas Valley is estimated to be about $20 million per year for the short-term and about $36 million per year for the long-term. Roughly $17 to $34 million per year of this estimate is for community public water system users for the short- to long-term, respectively, and about $2.5 million is for providing and maintaining point-of-use treatment for household self-supplied or local small water system users. To put this funding need in perspective, the overall costs correspond to $80 to $142 per year per susceptible person, $5 to $9 per study area irrigated acre per year, or $100 to $180 per ton of fertilizer nitrogen applied, for the short- to long-term, respectively.*

Vedachalam, Mandelia and Heath (2018) studied three municipal water treatment sites in Iowa and Illinois in order to estimate treatment costs for bringing nitrate levels down to drinking water standards. At these sites, less costly options such as blending high nitrate water with low nitrate water were no longer viable. This study emphasized that lowering nitrate levels in the groundwater is more cost effective than removing nitrate through water treatment. The study found

> *Capital expense is a significant component of the overall cost of nitrate treatment at the three utilities. Amortized capital cost of the treatment unit outweighed annual operations and maintenance (O&M) costs, except in Des Moines, which experienced*

heavy use of its treatment unit, especially in the latter half of the study period. A review of capital cost data from 10 other locations, in addition to the three study utilities, showed a scale effect: the cost per unit volume at the largest utility was orders of magnitude lower than that at much smaller ones. This suggests that smaller utilities face an undue burden of nitrate pollution in drinking water sources. A lack of robust data precluded any conclusions on O&M costs, but limited data from Des Moines and Decatur showed that in years when influent nitrate levels were the highest, the utilities spent 9 percent and 4 percent, respectively, of their overall operating budget on nitrate treatment.

Consider the small town of Pretty Prairie, Kansas, population 650. That town has embarked on a $2.4 million project to remove nitrates that are double the safe standard. The town's annual budget is $1.2 million. (Walton, 2017)

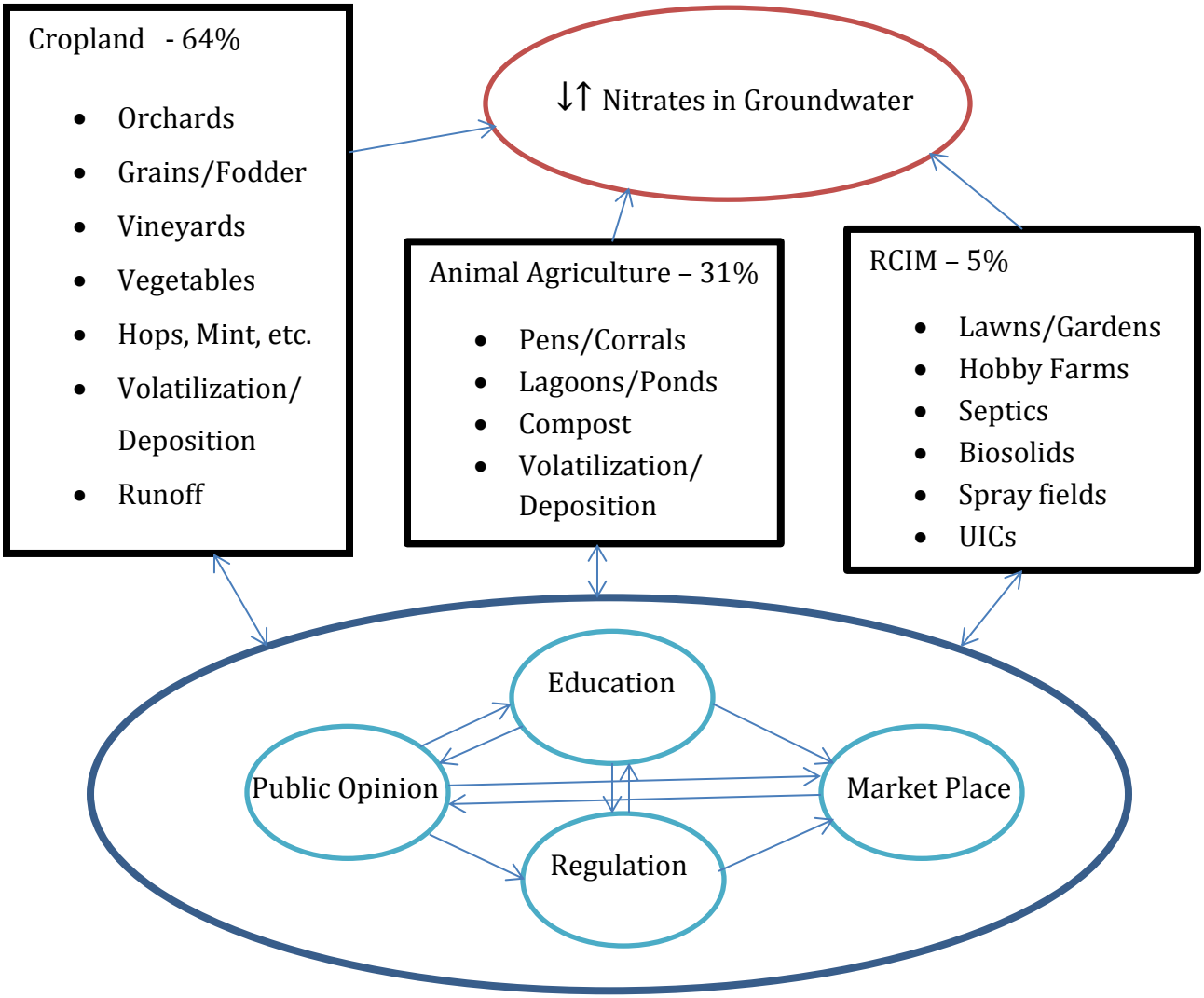
In the LYV Grandview is already blending water in order to deliver drinking water with safe nitrate levels. The City of Mabton and the Outlook Elementary School have been forced to drill new wells. (Attachment 36 & Attachment 57) FOTC estimates that vulnerable people in the LYV spend over $1 million per year on bottled water (Attachment 26).

Costs to the tax paying public will increase significantly if LYV municipalities are required to install reverse osmosis treatments. "Building a treatment facility can cost a mid-sized city $10 million to $15 million." (Walton, 2018)

Water Quantity and Quality Goals

To review, here is the conceptual framework from page 66 - *Relationships between sources, nitrate pollution of groundwater and solutions*

Diagram 2.



It is odd for a single stakeholder to propose goals and objectives. But FOTC will make some suggestions for Water Quality Goals based on the above understanding of relationships.

Overarching Goal: Reduce Nitrates in Lower Yakima Valley Groundwater to Safe Levels of < 10 mg/L

Pollution prevention will be a guiding principle

1. Everyone who lives in the LYV will have access to safe and affordable drinking water. No one will pay more than 2% of their income for bottled water.

2. People who live in the Lower Yakima Valley will be engaged and involved in programs to reduce nitrates in groundwater

3. There will be no more "bureaucratic runaround". When people call authorities they will receive accurate and helpful information.

4. The LYV aquifers will show decreasing nitrate levels beginning in 2020. The aquifers will reach safe levels by 2030

5. Soil nitrate levels below the root zone on LYV cropland will be < 15 ppm

6. There will be no leaching of nitrate below animal pens & corrals, lagoons & ponds, or compost yards

7. Volatilization of nitrogen from production areas and cropland will be quantified and controlled

8. Costs for cleanup of the LYV aquifers will be borne by those who pollute

Currently Available Management Strategies

Best Management Practices: In 2013 the GWMA contracted with HDR Engineering to compile a summary of recommended best management practices (BMPs) for irrigated cropland; livestock operations; turf grass and urban landscaping; industrial and municipal land application of wastewater, sewer leakage and septic systems. Those BMPs are available in Attachment 37. Many have been promoted for years and many have delivered impressive results. For example BMPs for irrigation management have been implemented in the LYV and the result is reduced runoff, reduced turbidity in runoff and reduced total suspended solids in runoff. (Roza-Sunnyside Joint Board of Control, 2010) NRCS promotes these practices and others through cost sharing and incentives.

Recommended conservation practices for dairies have been shared and encouraged by the WSDA Dairy Nutrient Management Program with an annual budget over $600,000 (WSDA, 2018) and the South Conservation District with an annual budget of $247,000. (WA CC, 2018)

Public Health: The Yakima Health District with an annual budget of $6 million has a mandate to address, among other things:

1. Water and Vector-borne Disease Services
2. Solid and Hazardous Waste Services
3. Waste Water Treatment Services

The WA Dept of Health inspects and regulates public water systems and waste water management systems. The WA State Dept of Ecology is responsible for water quality, waste and toxics in the state. Ecology has authority over NPDES permits, abandoned wells, underground injection control wells, implementation of the CWA (with delegation of dairy policy to WSDA), composting operations, regulation of bio-solids, and industrial waste water treatment.

Zoning: Yakima County has authority under the State Environmental Policy Act, the Subdivisions Act, the Growth Management Act and Local Project Review to control zoning in the county for the benefit of present and future generations.

Promising Alternative Strategies

The above strategies have been ongoing for decades. While important, these strategies were not sufficient to prevent contamination of the LYV aquifers with nitrates.

FOTC will use this section of our Minority Report to re-introduce some potential Alternative Strategies that are likely to deliver positive results.

1. High Tech Modeling of Nitrate Flows in the LYV

In 2013 the United States Geological Survey presented a plan to the GWAC that would have created a model of nitrogen flow in the LYV. This model would help growers, producers, policy makers and advocates better understand the impact of various practices and take measures to prevent further pollution and mitigate ongoing pollution.

The GWAC turned to other options and never returned to the discussion of technological solutions. FOTC strongly recommends a revisit to this modeling. See Attachment 72 for a more in-depth description of the USGS proposal.

2. Soil Moisture Testing

Growers who attended various work group meetings have been unanimous in their praise of the benefits gained by using soil moisture sensors. These same people have asked for assistance incorporating various software packages into a useable on-farm program. FOTC strongly recommends allocation of public funds to increase the use of soil moisture sensors and to facilitate on-farm use of computerized programs that improve farming efficiency.

3. Ecology's Nitrate Prioritization Project

In 2016 Ecology published a document entitled *Washington Nitrate Prioritization Project.* The paper concluded with clear and valuable recommendations for developing a statewide program to address the problem of groundwater contamination. Other western states including Idaho, California and Oregon have groundwater quality programs in place, while Washington struggles with naive GWMA advisory groups that necessarily start from scratch and try to re-invent the wheel with each new endeavor.

FOTC believes that a well-funded and well-staffed state directed program could provide each GWMA with the tools needed for success. There would be a central data base, information sharing in real time, and a framework for cooperation between agencies and the public. (Morgan, 2016)

4. Revision of the Dairy Nutrient Management Act RCW 90.64

Proposed Addition:

RCW 90.64.027 Dairy nutrient management plan non-compliance

(1) A dairy shall be out of compliance with a nutrient management plan if:

(a) Elements to fully implement the plan are not in place eighteen months after plan submission

(b) At any time actions described in the nutrient management plan are not being implemented as described

(2) The WSDA Dairy Nutrient Management Program and Dairy Inspectors shall report instances when dairies are out of compliance to the Department

(a) The Department shall consult with the non-compliant dairy and determine whether the non-compliance endangers waters of the state. If the non-compliance potentially causes pollution of the waters of the state the dairy shall take immediate actions to implement the nutrient management plan and shall immediately apply for a National Pollutant Discharge General Permit for Concentrated Animal Feeding Operations

(b) If the non-compliance does not potentially cause pollution of the waters of the state the dairy shall have thirty days to work with the conservation district and return to compliance. If compliance is not achieved in thirty days the dairy shall immediately apply for a National Pollutant Discharge General Permit for Concentrated Animal Feeding Operations

(3) A dairy farm that is determined to be out of compliance is subject to the provisions of this chapter and to the enforcement provisions of chapters 43.05 and 90.48 RCW, including civil penalties levied under RCW 90.48.144. (See Attachment 33)

5. CAFO Regulation at the Local Level: Here is a proposed Yakima County Ordinance that will address issues related to CAFO water pollution.

Proposed Ordinance – Chapter 19.37 Regulation of Concentrated Animal Feeding Operations

Whereas RCW 36.32.120 provides that Yakima County Commissioners may (7) make and enforce, by appropriate resolutions or ordinances, all such police and sanitary regulations as are not in conflict with state law; and

Whereas RCW 36.32.120 provides that the Yakima County Commissioners (10) have power to declare by ordinance what shall be deemed a nuisance within the county; and

Whereas RCW 70.05.060 provides a local board of health with the power to (2) supervise the maintenance of all health and sanitary measures for the protection of the public health within its jurisdiction; and

Whereas RCW 70.05.060 provides a local board of health with the power to (3) enact such local rules and regulations as are necessary in order to preserve, promote and improve the public health and provide for the enforcement thereof; and

Whereas RCW 70.05.060 provides a local board of health with power to (4) provide for the control and prevention of any dangerous, contagious or infectious disease within the jurisdiction of the local health department; and

Whereas RCW 70.05.060 provides a local board of health with power to (5) provide for the prevention, control and abatement of nuisances detrimental to the public health; and

Whereas RCW 70.05.060 provides a local board of health with power to (7) establish fee schedules for issuing or renewing licenses or permits or for such other services as are authorized by the law and the rules of the state board of health: PROVIDED, That such fees for services shall not exceed the actual cost of providing any such services; and

Whereas concentrated animal feeding operations in Yakima County have been found to contaminate the groundwater downgradient from pens, corrals, lagoons, ponds and cropland where manures are applied in excessive amounts; and

Whereas manure lagoons without synthetic liners are known to leak, and

Whereas some concentrated animal feeding operations in Yakima County have been found to ignore the standards of practice agreed to in their nutrient management plans; and

Whereas elevated levels of bacteria and nitrates in groundwater are known to endanger the public health

Now, therefore, be it ordained by the Board of County Commissioners of Yakima County, Washington, as follows:

Definitions (To be added to Chapter 19.01.070):

Agricultural Composting: means composting of agricultural waste as an integral component of a system designed to improve soil health and recycle agricultural wastes. Agricultural composting is conducted on lands used for farming.

Agricultural Wastes: means wastes on farms resulting from the raising or growing of plants and animals including, but not limited to, crop residue, manure from herbivores and nonherbivores, animal bedding, and carcasses of dead animals.

Agronomic Rate: means the application rate (dry weight basis) that will provide the amount of nitrogen or other critical nutrient required for optimum growth of vegetation, and that will not result in the violation of applicable standards or requirements for the protection of ground or surface water as established under chapter 90.48 RCW, Water pollution control and related rules including chapter 173-200 WAC, Water quality standards for groundwaters of the state of Washington, and chapter 173-201A WAC, Water quality standards for surface waters of the state of Washington.

Animal Units (AU): A unit of measurement for calculating the number of animals on a concentrated animal feeding operation. One AU approximately equals 1,000 lbs of live animal weight. One AU equals:

a) 1.0 beef feeder or slaughter animal
b) 0.5 horse
c) 0.7 dairy cow
d) 1.1 jersey cow
e) 2.5 swine weighing over 55 lbs
f) 15 swine under 55 lbs
g) 10 sheep

h) 10 goats
i) 50 ducks
j) 50 turkeys
k) 100 chickens
l) an equivalent animal type and weight that has a similar amount of manure produced as one of the animal unit categories set forth in the definition of animal unit above

Animal Waste: Any animal excrement, animal carcass, feed waste, animal water waste, or any other waste associated with animals.

Animal Waste Water: Any animal excreta, any liquid which comes into contact with any manure, litter, bedding or other raw material or intermediate or final material or product used in or resulting from the production of animals or products directly or indirectly used in the operation of a CAFO, or any spillings or overflow from animal watering systems, or any liquid used in washing, cleaning or flushing pens, barns, or manure pits, or any liquid used in washing or spraying to clean animals, or any liquid used for dust control on the premises of a CAFO.

Compost Categories are:

a) Compost IA - Agricultural wastes, manure and bedding from zoos, bulking agents. Greater than 25 cubic yards with no upper limits when only agricultural wastes, manure and bedding from zoos, and bulking agents are processed on-farm, or on-site for zoos.
b) Compost IB - Agricultural wastes, yard debris, bulking agents. Greater than 25 but no more than 1,000 cubic yards of agricultural wastes and bulking agents on-farm at any one time, and up to 50% of organic materials on-farm can be yard debris.
c) Compost IC - Yard debris, crop residues, manure and bedding, bulking agents. Greater than 25 but no more than 500 cubic yards of material on-site at any one time, not to exceed 2,500 cubic yards processed in a calendar year.

d) Compost ID – All organics feedstocks. Greater than 25 but no more than 250 cubic yards of material on-site at any one time, not to exceed 1,000 cubic yards in a calendar year.
e) Compost II – All organic feedstocks. No more than 5,000 gallons or 25 cubic yards of material on-site at any one time.

Composted material: means organic solid waste that has undergone biological degradation and transformation under controlled conditions designed to promote aerobic decomposition at a solid waste facility in compliance with the requirements of this chapter. Composting is a form of organic material recycling. Natural decay of organic solid waste under uncontrolled conditions does not result in composted material.

Composting: means the biological degradation and transformation of organic solid waste under controlled conditions designed to promote aerobic decomposition. Natural decay of organic solid waste under uncontrolled conditions is not composting.

Composting Yard: Any area where manure is composted

Confinement Building: Any structure that:

a) Has a full or partial roof supported by columns or walls and that is used for the housing or enclosure of animals, or
b) Anything that is constructed or erected, the use of which requires location on the ground or attachment to something having location on the ground or attachment to something having location on the ground and that is used or designed for housing or enclosure of animals

Confinement Lot: Any area of land that is fenced or enclosed, and that is used to confine animals.

Dry Handling Waste: Manure (urine or feces), litter, bedding, or feed waste from animal feeding operations.

Land Apply/Application: The process of putting manure, litter, process wastewater, or other organic by-products on to a field to provide nutrients for crop growth.

Livestock: Cattle, sheep, swine, poultry, and other animals or fowl, which are being produced primarily for use as food or food products for human consumption.

Manure Compost: Composting is the controlled aerobic biological decomposition of organic matter into a stable, humus-like product called compost. It is essentially the same process as natural decomposition except that it is enhanced and accelerated by mixing organic waste with other ingredients to optimize microbial growth. Classifications are:

a) Class IA - Agricultural wastes, manure and bedding from zoos, bulking agents. Greater than 25 cubic yards with no upper limits when only agricultural wastes, manure and bedding from zoos, and bulking agents are processed on-farm, or on-site for zoos.
b) Class IB - Agricultural wastes, yard debris, bulking agents. Greater than 25 but no more than 1,000 cubic yards of agricultural wastes and bulking agents on-farm at any one time, and up to 50% of organic materials on-farm can be yard debris.
c) Class IC - Yard debris, crop residues, manure and bedding, bulking agents. Greater than 25 but no more than 500 cubic yards of material on-site at any one time, not to exceed 2,500 cubic yards processed in a calendar year.
d) Class ID – All organics feedstocks. Greater than 25 but no more than 250 cubic yards of material on-site at any one time, not to exceed 1,000 cubic yards in a calendar year.
e) Class II – All organic feedstocks. No more than 5,000 gallons or 25 cubic yards of material on-site at any one time.

Manure Storage Area: Any area where manures are stockpiled and stored for more than 30 days.

Populated Area: Any circular area inscribed by a radius of 1,442 feet and a circumference of 9,059 feet (such area including not more than approximately one hundred fifty (150) acres and having at least ten (10) occupied dwellings/establishments, which area is not on CAFO property, as measured in a straight line from the nearest occupied dwelling/establishment to the nearest CAFO confinement building, confinement lot, or other confinement area, or waste handling facility.

Waste Treatment Lagoon (Also known as Livestock Lagoon): A waste treatment impoundment made by constructing an embankment and/or excavating a pit or dugout.

19.37.010 Classification of Concentrated Animal Feeding Operations:

a) A Class IA CAFO is one that has a capacity of at least seven thousand 7,000 AU.
b) A Class IB CAFO is one that has a capacity between three thousand (3,000) AU and six thousand nine hundred ninety-nine AU (6,999) inclusive.
c) A Class IC CAFO is one that has a capacity between one thousand (1,000) AU and two thousand nine hundred and ninety-nine (2,999) AU inclusive.
d) A Class II CAFO is one that has a capacity of at least six hundred (600) AU, but less than one thousand (1,000) AU.
e) A Class III CAFO is one that has a capacity of at least three hundred (300) AU, but less than six hundred (600) AU.

19.37.020 Permit Requirements for CAFOs:

19.37.021. No CAFO shall be constructed, operated, used, or established within Yakima County unless a CAFO permit has been issued by the Yakima County Code Enforcement. To apply for a Yakima County Permit the CAFO shall submit to the County Code Enforcement a plan showing the location of the proposed facility, the number of proposed animal units, the proposed method and locations of animal waste disposal and the name and address of the owner of the proposed CAFO as well as the name and address of the owner of the land

on which the CAFO will be located, if different from the owner of the CAFO. In such case, if the County Code Enforcements determines that the proposed CAFO complies in every respect with the terms of this Chapter, then the Code Enforcement shall issue a CAFO permit.

19.37.022. Prior to filing an application to acquire a CAFO permit, the owner or operator of any concentrated animal feeding operation shall provide the flowing information to County Code Enforcement and to all adjoining property within two miles of the CAFO boundaries

a) The number of animals anticipated at such facility by type of animal;
b) The waste handling plan and general layout of the facility
c) The location and number of acres of such facility;
d) Name, address, telephone number and registered agent for further information as it relates to the permit
e) The location of all leased properties and acreage where the CAFO proposes to land apply manures (see section 19.37.0311)

19.37.023. At least one public hearing shall be held by the county before approving any CAFO permit. Such public hearing may be continued from time to time and additional hearings may be held.

19.37.024. It shall be a violation of this chapter and unlawful for any person to operate a CAFO without first obtaining a CAFO permit from Yakima County

19.37.025. It shall be a violation of this chapter and unlawful for any person to operate a CAFO with a number of Animal Units in excess of the number specified in the permit issued by Yakima County.

19.37.026. It shall be a violation of this chapter and unlawful for any person to apply animal waste or animal waste water in a manner inconsistent with the requirements of this chapter.

19.37.030 Rules Applicable to All CAFOs;

19.37.031. The proposed CAFO shall be in compliance with all provisions of this chapter

19.37.032. No lagoon shall be constructed, operated or established unless it is designed, inspected, and approved by a Civil Engineer licensed in the State of Washington

19.37.033. All Livestock Feedlots, Compost yards and Livestock Lagoons shall be designed in such a manner as to avoid degrading the quality of surface or groundwaters.

19.37.034. All Livestock Feedlots, Composting yards and Livestock Lagoons shall be designed in such a manner as to avoid degrading air quality. In no event shall the concentration of gases at the boundary of the land resulting from the operation of a Livestock Lagoon or Livestock Feedlot exceed the following levels:

Gas	Maximum Allowable Concentration	Exposure Period
Carbon Dioxide (CO_2)	5,000 parts per million (ppm)	Not applicable
Ammonia (NH_3)	5 ppm	Not applicable
Hydrogen Sulfide (H_2S)	10 ppm	2 hours
Methane (CH_4)	1,000 ppm	Not applicable
Carbon Monoxide (CO)	35 ppm	1 hour

19.37.035. The applicant shall demonstrate that the soils on the premises, including a soil-plant filter area, are suitable for and compatible with the proposed CAFO with respect to Livestock Lagoons, Compost Yards and the application of liquid, slurry or solid animal waste onto or into the soil on the premises. Further, no animal waste from a Livestock Lagoon shall be applied when soils are water saturated, frozen, or covered with snow, or when other soil conditions would result in waste runoff.

19.37.036. The Livestock Feedlot, Compost Yard or Livestock Lagoon shall at all times be operated in compliance with any required local, state or federal permits, licenses or other approvals and in compliance with all applicable state and local laws and regulations.

19.37.037. The CAFO shall own or lease one acre of land for each 4 AU of capacity. This requirement may be modified so that a CAFO can house more animals if the manures and/or compost from the extra animals are exported from the facilities and documentation of the export is provided. The applicant shall provide a nutrient management plan that addresses environmental monitoring and reporting, including nitrogen, phosphorous and potassium levels in the soil. In the case of dairy operations a WSDA or Conservation District approved nutrient management plan will suffice.

19.37.038. Animal waste and animal waste water shall not be applied to land with a slope greater than 10%.

19.37.039. Animal waste shall be injected, knifed or incorporated into the soil within 36 hours of application. There shall be no application of animal waste or animal waste waters within five hundred (500) feet of an occupied dwelling/establishment which existed prior to the date the CAFO was constructed. This rule shall not apply to occupied dwellings/establishments owned by the CAFO.

19.37.0340. Animal waste and animal waste water shall not be applied within five hundred (500) feet of any sink hole, or well or spring or other water supply or one hundred (100) feet from any stream (including intermittent streams). This rule shall not apply to waste lagoons on the CAFO property, but shall apply to all other wells, water supplies, streams, ponds, lakes, springs, and sink holes on the CAFO property. No Feedlot or Livestock Lagoon shall be located within a Floodplain.

19.37.0341. If the applicant or the operator of a CAFO does not own all of the land which will be used for the spreading of animal waste and waste water, the applicant shall provide an enforceable lease, easement, or other written agreement as part of the application for a CAFO permit. The length of the agreement shall be such that the CAFO has adequate time to make other alternative arrangements in the event that the existing lease, easement or other written agreement cannot be renewed. Such proof must annually be provided to the commission on the anniversary of the issuance of the permit.

19.37.0342. Any person selling, giving, purchasing, receiving or dispensing animal waste within Yakima County will be held responsible for full compliance with the Yakima CAFO ordinance.

19.37.040. Setback Requirements:

19.37.041. Setbacks from other CAFOs

a) No Class IA CAFO shall be located within one and one-half mile of any Class IA or Class IB CAFO
b) No Class IA CAFO shall be located within one mile of any other Class IC, Class II CAFO or Class III CAFO.
c) No Class IB, Class IC, Class II CAFO or Class III CAFO shall be located within one mile of any Class IB CAFO.
d) No Class IC, Class II CAFO or Class III CAFO shall be located within three quarters (3/4) mile of any Class IC CAFO.
e) No Class II CAFO or Class III shall be located within one-half (1/2) mile of any Class II CAFO or Class III CAFO
f) These distances shall be measured from the nearest point of one CAFO's confinement or waste containment system to the nearest point of another CAFO's confinement or waste containment system.

Setback Distances	Class IA	Class IB	Class IC	Class II
Class IA	1.5 miles	1.5 mile	1 mile	1 mile
Class IB	1.5 mile	1 mile	1 mile	1 mile
Class IC	1 mile	1 mile	¾ mile	¾ mile
Class II	1 mile	1 mile	¾ mile	½ mile
Class III	1 mile	1 mile	¾ mile	½ mile

19.37.042. The following minimum buffers are required between Feedlots, Compost yards or Livestock lagoons and any public building or occupied dwelling/establishment:

a) For a Class II, Class III and Class IC CAFO, two thousand (2,000) feet;
b) For a Class IB CAFO, three thousand (3,000) feet; and
c) For a Class IA CAFO four thousand (4,000) feet.

Size of CAFO	Minimum Distances from Occupied Dwelling/Establishment
Class IA	4,000 ft
Class IB	3,000 ft
Class IC	2,000 ft
Class II	2,000 ft
Class III	2,000 ft

19.37.043 Setbacks shall not apply to occupied dwellings/establishments owned by the CAFO or to dwellings not in existence at the time of issuance of the Yakima County CAFO permit.

19.37.044. No CAFO shall be located within two miles of an incorporated area. The two mile distance shall be measured from the outermost boundary of the production area – pens, barns, corrals, lagoons and manure storage areas – to the nearest border of the incorporated area.

19.37.045. No CAFO shall be located within one-thousand (1,000) feet of the property line or within one-thousand (1,000) feet of any public use area or conservation area. The distance shall be measured from the outermost boundary of the production area – pens, barns, corrals, lagoons and manure storage areas – to the nearest border of the public use or conservation area.

19.37.046. No Class IA, IB, IC, II or Class III CAFO shall be located within one (1) mile of a populated area. The distance shall be measured from the outermost boundary of the production area – pens, barns, corrals, lagoons and manure storage areas – to the nearest border of the populated area.

19.37.050. Groundwater Testing & Monitoring

19.37.051. Every concentrated animal feeding operation in Yakima County with more than 600 animal units shall install monitoring wells to measure changes to water quality in the underlying aquifers. One well shall be upgradient and the remainder shall be downgradient. Sample shall be collected semi-annually and tested for bacteria, chloride, total dissolved solids, ammonia, nitrate plus nitrite, total phosphorous, chemical oxygen demand, and total organic carbon. Groups of CAFOs in close proximity to one another can create a ground water monitoring network. The numbers of monitoring wells shall be:

a) Class IA – six (6) wells plus one more well for each 2,000 additional cows above 9,000
b) Class IB – five (5) wells
c) Class IC – four (4) wells
d) Class II – three (3) wells

19.37.052. Selection of well sites shall be done by the CAFO operator in consultation with experts from the WA State Dept. of Ecology

19.37.060. Financial Guarantees

19.37.061. No permit for a Class IA, IB, IC, or II CAFO shall be issued unless adequate security has been furnished to ensure proper cleanup and disposal as required below:

19.37.062. A cash, surety bond or irrevocable letter of credit shall be furnished to the Yakima County Treasurer for any manure storage system. A manure storage system may include one or more lagoons at any single CAFO. If the bond is a surety bond, the surety shall be approved by the County Commission and found to be of reputable character and financially sound with respect to the obligation incurred. The bond shall be furnished before construction and during the operating period. The bond shall remain with the County treasurer until the operator has complied with all Federal, State and Local laws in operation of the facility and until the prompt clean up and proper disposal of any waste

improperly handled or disposed of at the facility and restoration of the premises upon which the facility operated. If a cash bond is posted, all interest earned thereon shall become part of the bond subject to terms and conditions, including the condition of release. The County Commission shall give approval before release of the bond.

19.37.070. Variance: Where, due to an extraordinary or exceptional situation or condition of a specific piece of property, the strict application of the Ordinance would result in peculiar and exceptional difficulties to, or an exceptional and demonstrable undue hardship upon, the owner of the property as an unreasonable deprivation of use as distinguished from the mere grant of a privilege, the County Commission may authorize, as part of the application for a CAFO permit, a variance from the strict application so as to relieve said demonstrable difficulties or hardships, provided the relief can be granted without substantial detriment to the public good and without substantially impairing the intent, purpose, and integrity of the regularities, standards and criteria established in this Ordinance.

19.37.080. Application of Ordinance: A CAFO in existence at the time of the enactment of this Ordinance is exempt from its terms and conditions, so long as the operating conditions do not change. A CAFO already in existence that increases AUs, increases waste production, or changes waste management practices must obtain a new CAFO permit before making changes and must comply with the Ordinance within three (3) months of permit approval.

19.37.090. Administrative Fees:

19.37.091. No application for approval of a Yakima County CAFO permit shall be accepted until the applicant has paid all processing fees as set forth below. Fees paid shall be non-refundable except as provided in section 19.37.094 below.

19.37.092. The fee amount shall not exceed the amount needed to recover the cost of inspection, investigation and review of the proposed application. The fee amounts are based upon the anticipated costs of review, inspection and investigation. The fee amounts have taken into consideration the need for special investigative services including geological inspections, hydrologic inspections, groundwater monitoring, soils evaluation, and other unique costs of a scientific or technical nature associated with the processing of the application. For purposes of this Ordinance the initial administrative fee amounts shall be as follows:

Classification of CAFO	Initial Fee
Class IA	$10,000
Class IB	$5,000
Class IC	$2,500
Class II	$2,000
Class III	$1,500

In the event the cost to the county exceeds the above amounts, the additional cost will be assessed to the applicant with a maximum fee of twice the administrative fee listed above.

19.37.093. There shall be established with the County Treasurer an escrow fund, for each application for a Yakima County CAFO permit, for the purposes of reimbursing the county for services rendered in connection with administration of this Ordinance. Said escrow account shall include the proceeds of project review fees established pursuant to this section. The funds contained in said escrow account shall be used solely to reimburse the county for actual costs associated with administration of this Ordinance, for actual services rendered for investigation, administration and processing of a county CAFO permit including costs associated with the retaining and compensation of experts on scientific and technical issues associated with the application, and costs associated with public hearings. The County Treasurer shall disburse payments based upon billings supplied by Code Enforcement and approved by the County Commissioners.

19.37.094. The applicant for a county CAFO permit may apply to the county for a credit against the fee previously paid in the event that a portion of the costs of review and processing is duplicative, pursuant to the standards of applicable case law or statutes then in effect. After the approval, conditional approval or denial of a CAFO permit the County Treasurer shall refund to the applicant any unexpended or unencumbered balance of the escrow account established pursuant to this section for said application.

19.37. 100 Violation of Ordinance. Any person violating this Ordinance shall be subject to punishment by imprisonment or fine as provided by law. Each day a person operates a CAFO in violation of this Ordinance, and each time a person applies animal waste or animal waste water in a manner inconsistent with the requirements of this Ordinance, shall be considered a separate offense.

19.37.110. Severability. The chapters, sections, paragraphs, sentences, clauses, and phrases of Ordinance 97.37 are severable, and if any phrase, clause, sentence, paragraph, or section of this ordinance shall be declared unconstitutional or otherwise invalid by the valid judgement or decree of any Court of competent jurisdictions, such unconstitutionality or invalidity shall not affect any of the remaining phrases, clauses, sentences, paragraphs, or sections of this Ordinance since the same would have been enacted by the Board of County Commissioners without the incorporation in the Ordinance of any such unconstitutional or invalid phrase, clause, sentence, paragraph or section.

6. An ACT relating to creating a task force on hazardous air emissions from confined animal feeding operations

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WSHINGTON:

NEW SECTION. Sec.1. (1) A task force on hazardous air emissions from confined animal feeding operations and manure composting operations is established, with members as provided in this subsection.

(a) The governor shall appoint seven members, who must include a representative from the following:

(i) The department of ecology;

(ii) The department of health

(iii) The department of agriculture;

(iv) A state association of counties;

(v) An academic research institution

(vi) A state agricultural association

(vii) A state environmental organization

(b) The task force shall choose its chair from among its membership. The department of ecology shall convene the initial meeting of the task force.

(2) The task force shall review the following issues:

(a) The most expedient and accurate way to estimate emissions of hazardous air pollutants – ammonia, hydrogen sulfide, particulate matter, fine particulate matter, oxides of nitrogen, nitrous oxide, methane, volatile organic compounds (n-Propanol, Ethyl Acetate, iso-propanol, Acetaldehyde, Methanol, n-Propyl acetate, 2-butanone, Toluene, phenol, 2-butanol, Benzene, Hexanal, Dimethyl sulfide, acetic acid, Pentanol, 1-Butanol, Heptanal, 4-Methyl-phenol, 2-pentanone, Benzaldehyde) – from confined feeding operations and manure composting operations

(b) The pathways that hazardous air pollutants follow when they leave confined animal feeding operations or manure composting operations

(c) A dose response impact on human health due emissions of hazardous air pollutants from confined animal feeding operations and manure compost operations

(d) The impact on global warming from emissions of hazardous air pollutants from confined animal feeding operations and manure compost operations

(e) The relationship between air pollution and water pollution in terms of the nitrogen balance in communities where the department of ecology regulates nutrients under the Clean Water Act

(3) Staff support for the task force must be provided by the department of ecology.

(4) The task force must report its findings and recommendations to the governor and the majority and minority leaders of the two largest caucuses of the house of representatives and the senate by December 31, 2019.

(5) This section expires June 30, 2020.

7. Request for Ecology to Review WAC 173-100 - Groundwater Management Areas

In Washington State protection of groundwater quality is achieved through implementation of WAC 173 – 100: Groundwater Management Areas and Programs. There is room for improvement.

> *The purpose of this chapter is to establish guidelines, criteria, and procedures for the designation of groundwater management areas, subareas or zones and to set forth a process for the development of groundwater management programs for such areas, subareas, or zones, in order to protect groundwater quality, to assure groundwater quantity, and to provide for efficient management of water resources for meeting future needs while recognizing existing water rights. The intent of this chapter is to forge a partnership between a diversity of local, state, tribal and federal interests in cooperatively protecting the state's groundwater resources.*

The guidelines for formation and developing a groundwater management area or GWMA are spelled out clearly in the law. There is no accountability built in to the code. There are no consequences when a groundwater management area committee does not complete the

mandated work which is what happened in the Lower Yakima Valley over the past six years.

WAC 173 – 100 – 160 states:

> *The department of ecology shall initiate a review of the rules established in this chapter whenever new information, changing conditions, or statutory modifications make it necessary to consider revisions.*

FOTC strongly suggests that the conditions are ripe for a revision of WAC 173 – 100 because the LYV GWMA:

1. Did not create an advisory committee with a broad spectrum of stakeholders
2. Failed to gather input from minority populations in the LYV
3. Failed to analyze the relevant data in order to determine the etiology of groundwater contamination in the LYV
4. Failed to compel compliance with contracts
5. Ignored the impact of contaminated drinking water on public health
6. Failed to estimate historical and current rates of groundwater use and purposes
7. Failed to define the extent of the problem caused by each source of pollution
8. Allowed publication of an inaccurate, incomplete and misleading estimate of nitrogen availability in the area
9. Failed to develop a monitoring system for evaluating the effectiveness of the program as required by WAC 173-100
10. Failed to develop a process for the periodic review and revision of the groundwater management program as required by WAC 173-100
11. Wasted $2.3 million in tax payer monies designated to address and reverse groundwater pollution in the LYV.

FOTC believes that a lack of consequences encouraged the GWMA leadership and advisory committee to ignore the codes designed to protect groundwater in Washington State. FOTC believes that revision of WAC 173 – 100 that adds consequences for non-compliance to the code is in order.

Here are suggested measures that will potentially improve the implementation of WAC 173 – 100.

1. Each GWMA shall employ a science officer with expertise in water science to oversee the plan development. He/she shall be responsible for maintaining scientific standards and accepted principles of scientific research during the program development.
2. The first three meetings of each GWMA shall be dedicated to education of the advisory committee on:
    a. WAC 173-100
    b. Applicable federal, state, Indian and local water laws
    c. Principles of project development and committee work
    d. Principles of groundwater flow
    e. Ecological connections between ground and surface water; groundwater and the ambient air
    f. Basic tenets of public health
    g. Principles of Environmental Justice
3. Ecology shall develop a curriculum that facilitates this preliminary education of the committee
4. Every meeting of each GWMA advisory group and work group shall be recorded and the recordings shall be stored and maintained for a period of five years after completion of each GWMA program.
5. In areas where over 10% of the community speaks a language other than English at home or speaks English less than well, the meeting summaries shall be translated into the commonly used language and made available to that population.
6. Every six months each active GWMA shall publish a report to the public that is written in commonly used language and clearly describes the GWMA activities.
7. There shall be a well-defined plan for periodic, formative annual evaluation throughout the program development. Ecology shall approve or disapprove each evaluation.

a. Each evaluation and report shall include a statement of the GWMA goals and objectives with a description of GWMA advisory committee actions that address and achieve those goals and objectives
b. Every year each member of the GWMA advisory committee shall submit a report of the actions taken by that individual stakeholder to promote the GWMA goals and objectives
c. There shall be a publicly disseminated attendance record for GWMA meetings and work group meetings for each member of the advisory committee

8. Every action by any GWMA advisory committee shall be approved or disapproved by a vote of the members in attendance and that vote shall be recorded.
9. The Washington State Department of Health and local health jurisdictions shall ensure that their representative understands the principles of public health and the physiological effects of contaminated water on the human body.
10. The Washington State Department of Health and local health jurisdictions shall ensure that their representatives educate each GWMA advisory committee regarding the impact of contaminated drinking water on the affected population.
11. Each GWMA shall complete an analysis of the economic impacts of groundwater pollution on the targeted communities
12. There shall be an annual audit of expenditures for each GWMA. Failure to spend funds appropriately using accepted accounting practices shall cause classification of a GWMA as non-compliant. Non-compliance requires:
    a. Hiring a finance officer to oversee all expenditures
    b. Prompt notification of the public regarding causes for non-compliance
    c. Department of Ecology review of the work done by GWMA leadership and replacement of responsible program leaders as appropriate
13. There shall be a process by which citizens can request a review of GWMA activities by Ecology at any time during a GWMA program

A Monitoring System for Evaluating the Effectiveness of the Program

In order to effectively monitor progress it is necessary to have clear and measureable goals and objectives. The potential objectives and proposed actions below are based on the vision of a small group and do not carry the weight of consensus. However, they are worthy of consideration.

Overarching Goal: Reduce Nitrates in Lower Yakima Valley Groundwater to Safe Levels of < 10 mg/L

Pollution prevention will be a guiding principle

1. Everyone who lives in the LYV will have access to safe and affordable drinking water. No one will pay more than 2% of their income for bottled water.

Objective 11: Reduce the number of domestic wells with nitrate levels > 10 mg/L by 5% per year until all domestic wells provide safe drinking water

Action 111: Implementation of GWMA Plan

Action 112: Implement a system for annual monitoring of domestic well water. Ongoing free well water testing will increase community engagement and facilitate data collection.

Objective 12: People with contaminated domestic wells will receive free drinking water until their well water is safe to drink

Action 121: Drill deep public wells at 2 – 3 locations in the LYV, (Cost $50,000 - $75,000) or

Action 122: Provide public faucets connected to municipal water systems (Cost $20,000)

Evaluation:

- Analysis of data from domestic well monitoring system
- Number of times people draw water from the public system

2. People who live in the Lower Yakima Valley will be engaged and involved in programs to reduce nitrates in groundwater

Objective 21: Over 90% of the people who live in the Lower Yakima Valley will understand the pathways and process that contaminate groundwater in the area

Action 211: Ongoing outreach and education with periodic updates on groundwater in the LYV

Action 212: Annual community surveys that include understanding of groundwater ($25,000 per year)

Objective 22: Over 20% of adults in the LYV will participate in surveys and focus groups that address ways to protect the groundwater

Action 221: Hire dedicated staff to create study materials, meet with small groups, inform and educate (Cost $100,000 per year)

Action 222: Annual community surveys that include understanding of groundwater

Evaluation:

- Annual public survey
- Number of focus groups
- Number of focus group participants
- Pre and post surveys

3. There will be no more "bureaucratic runaround". When people call authorities they will receive accurate and helpful information.

Objective 31: The Yakima Health District, Yakima Public Works and Ecology will create a small task force to develop a flow chart and information sheet that informs the public where to call for assistance with water pollution issues and related health concerns. (Cost $10,000)

Objective 32: The document produced will be shared with groups that meet the public regarding health, environment, agriculture, commerce and real estate.

Evaluation:

- Include access/satisfaction question in annual public surveys

4. The LYV aquifers will show decreasing nitrate levels beginning in 2020. The aquifers will reach safe levels by 2030

Objective 41: Growers will observe the 4 R's – Right product, Right source, Right timing and Right location.

Action 411: Hire dedicated staff to create study materials, meet with small groups, inform, educate and gather feedback (Cost $100,000 annually)

Action 412: Annual surveys that include understanding of 4 R's

Objective 42: Growers will optimize efficiency of irrigation systems and practices

Action 421: Hire dedicated staff (WSU?) to create study materials, meet with small groups, inform, educate and gather feedback

Action 422: Annual surveys that include irrigation practices and results

Objective 43: Producers will either line pens, corrals, lagoons, ponds and compost areas or they will monitor groundwater downgradient from these production areas

Action 431: Hire dedicated staff (SYCD?) to create study materials, meet with small groups, inform, educate and gather feedback ($100,000 annually)

Action 432: Annual surveys that include producers' feedback and groundwater testing

Evaluation (Cost $70,000 annually)

- Analysis of results from domestic well testing
- Analysis of water testing from municipal wells
- Results from monitoring wells on the "Dairy Cluster"
- Analysis of samples from promised system of purpose built wells
- Annual grower surveys
- Annual producer surveys
- Number of lagoons, ponds, pens, corrals, compost areas that are lined
- Analysis of samples from monitoring wells down gradient from lagoons, ponds, pens, corrals, compost areas

5. Soil nitrate levels below the root zone on LYV cropland will be < 15 ppm

Objective 51: Soil testing will become routine practice in the LYV

Action 511: Hire dedicated staff (WSU?) to create study materials, meet with small groups, inform, educate and gather feedback

Action 512: Annual surveys that include grower feedback and soil testing results

Action 513: Discounts on soil testing for participation in studies

Objective 52: Growers will value their role in protecting the groundwater

Action 521: Awards for protecting the environment

Action 522: Annual surveys that include grower feedback

Evaluation:

- Analysis of soil test data base
- Analysis of grower feedback

6. There will be no leaching of nitrate below animal pens & corrals, lagoons & ponds, or compost yards

Objective 61: Producers will understand the risks of nitrate leaching from pens, corrals, lagoons, ponds and compost areas

Action 611: Hire dedicated staff (SYCD?) to create study materials, meet with small groups, inform, educate and gather feedback

Objective 62: Producers will either line pens, corrals, lagoons, ponds and compost areas or they will monitor groundwater downgradient from these production areas

Action 621: Change RCW 90.64 to require implementation of nutrient management plans. Require implementation of NMPs or application for an NPDES CAFO General Permit

Evaluation:

- Number of lagoons, ponds, pens, corrals, compost areas that are lined
- Analysis of samples from monitoring wells down gradient from lagoons, ponds, pens, corrals, compost areas

7. Volatilization of nitrogen from production areas and cropland will be quantified and controlled

Objective 71: Create a state level task force to address this problem (Cost $10,000)

Action 711: Agree on a system for estimating and/or measuring nitrogen emissions from CAFO's and cropland in the LYV (Cost $50,000)

Action 712: Estimate the impact on public health and the environment from agricultural emissions (Cost $50,000)

Action 713: Create a task force to find ways to minimize these emissions (Cost $10,000)

Action 714: Create a task force to find ways to protect public health (Cost $10,000)

Action 715: Incorporate agricultural emissions into WA State Climate Change policy. This will shine a light on our role in global warming.

Evaluation

- Success in creating a plan for modeling or measuring
- Analysis of the data from the model or testing
- Analysis of health impacts
- Analysis of impacts on global warming

8. Costs for cleanup of the LYV aquifers will be borne by those who pollute

Objective 81: Craft a local ordinance that places a limit on cows per acre, identifies polluting CAFOs and requires a CAFO bond to cover any cleanup costs.

Action 811: Add staff at the county level to monitor nitrate levels in groundwater near CAFOs and to enforce the Yakima County Code (Cost $100,000 covered by fees)

Objective 82: Levy fines for dairies that do not comply with nutrient management plans.

Action 821: WSDA and Ecology to coordinate

Evaluation:

- Passage of regulations
- Analysis of data gathered from implementation of the permitting programs

When evaluation of these goals and objectives is combined with readily available studies that evaluate the effects of nitrate water pollution along with studies of contributing factors, we have a robust data base for discussion of LYV environmental, community and economic well-being. Note that only the leading causes of nitrate pollution were addressed.

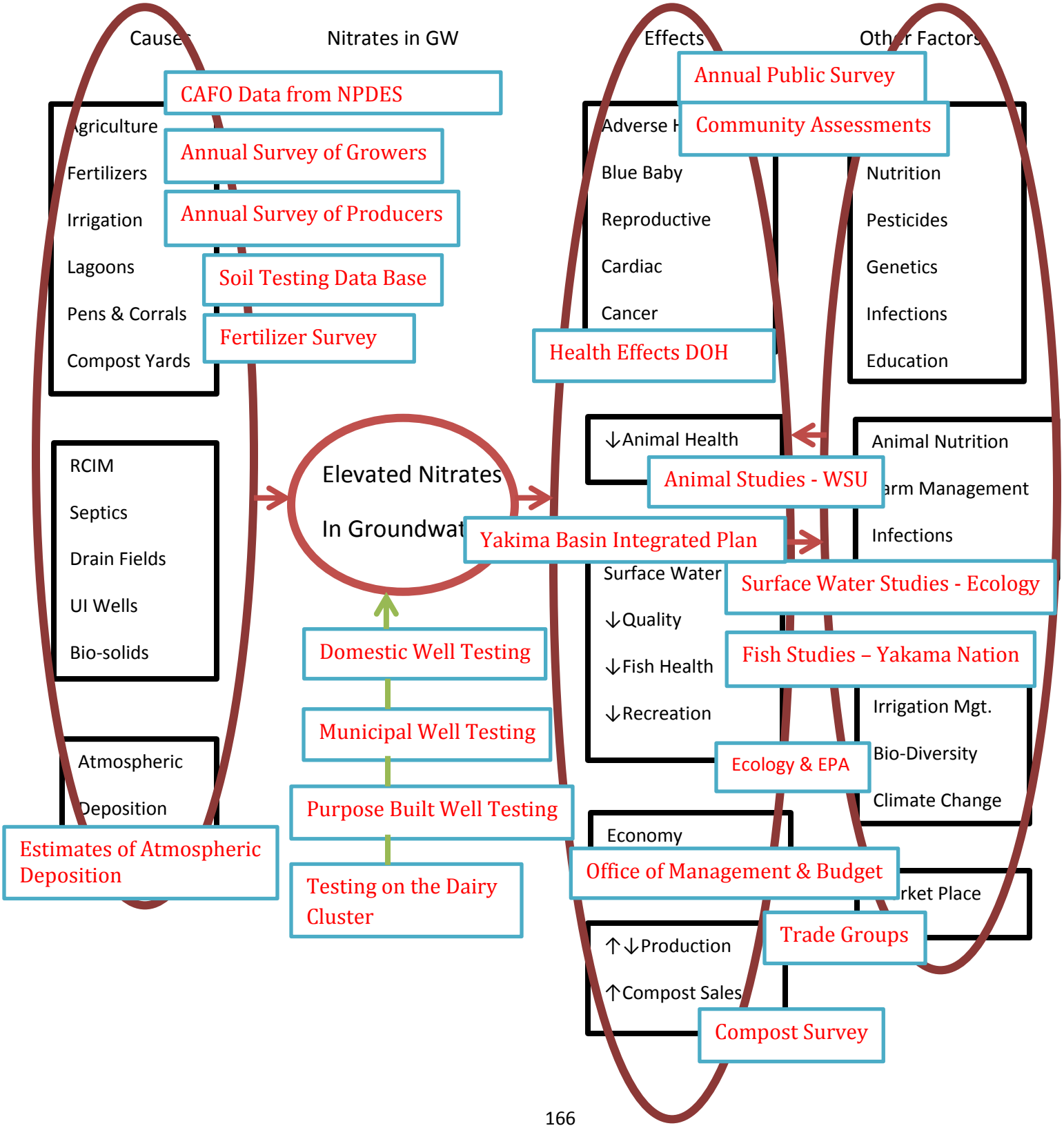
Please look at the list of evaluation tools below and the conceptual model that follows. (See Attachment 73 for a description of recommended programs and tools)

Table 21. Potential Evaluation Tools LYV GWMA

Evaluation of GWMA Data	**Evaluation of Other Factors**
Annual Public Survey • Knowledge of groundwater • Environmental Concerns • Satisfaction with access to agencies and level of response • Water related health • Understand strategies to improve the aquifers Annual Survey of Growers • Understanding of groundwater N • Implementation of BMPs • Irrigation Management • Soil Test Results • NASS Annual Survey of Producers • Implementation of BMPs • Soil Testing • Groundwater Testing • Understanding of groundwater N • NASS Analysis of soil testing data base Results from domestic well testing Results of water testing from municipal wells Results from monitoring wells on the "Dairy Cluster" Analysis of samples from purpose built wells CAFO data from regulatory agencies Estimates of nitrogen emissions and atmospheric deposition	Health Effects – DOH • Rates for Infectious Disease • Cancer Statistics • Washington Tracking Network • Maternal Child Statistics • Farmworker Health • CHARS (Hospital Data) • BRFSS (Behavior Survey) Animal Health – WSU, UW One Health Surface Water • Monitoring of drains • TMDL monitoring by Ecology • Fish Studies by the Yakama Nation • Studies from the Yakima Basin Integrated Plan (YRBWP) Watershed – Studies by the Yakima County Voluntary Stewardship Program Economy – Employment Security, WA State Office of Management and Budget Production – Trade Groups Crop Values – WSDA, Trade Groups Compost Sales – Survey Community Assessments • Virginia Mason Memorial • Astria Health • Opportunities Industrialization Center Tools • SPARROW (Surface Water) • USGS GW MODFLOW (GW Flow) • HYDRUS (Vadose Zone) • SSURGO (NRCS Soils)

Conceptual Model for Evaluation

Diagram 4.



A Process for the Periodic Review and Revision of the Groundwater Management Program

There is a grave need for someone to take responsibility to ensure follow through on recommended solutions to the problem of elevated nitrates in LYV groundwater, whether those recommendations come from the GWAC as a whole, from FOTC, or from other stakeholders.

Here is an example of the tragedy that occurs when no one pays attention:

Beginning in 1989 Ecology convened a group of stakeholders who worked on *Protecting Groundwater: A Strategy for Managing Agricultural Pesticides and Nutrients.* In 1992 that group published a summary of their findings.

The Overview of the Strategy developed by that group says:

> *While there is evidence of contamination of ground water by pesticides and nutrients, the focus of this Strategy is on protection of ground water, rather than remediation. The Strategy identifies and supports activities and programs to prevent contamination, and will allow both the agricultural community and involved agencies to make best uses of resources. We have an opportunity to implement a strong program of protection that will meet the needs of the state both to safeguard the quality of its waters and to enhance the long-term viability of agriculture. In many cases, what the Strategy is advocating is not new. The state is already undertaking many of the activities recommended by this Strategy. The Strategy provides a common focus for the agencies and organizations involved, and sets up a mechanism to guide the development of programs.*

Twenty five years later, with water quality in the LYV worsening, no one is checking to see which strategies from 1992 were effective, which were implemented and which were not. The LYV GWMA could easily cut and paste this "hope for the future" into our final GWMA plan and no one would notice that it is old work.

Suggestion: FOTC suggests a review of the plan every five years, with a requirement to consider the multiple data sets listed in Table 18. FOTC suggests that the Review Committee should consist of representatives from:

- The U. Environmental Protection Agency
- The U.S. Geological Survey
- The Yakama Nation
- The WA State Dept. of Ecology
- The WA State Dept of Agriculture
- The WA State Dept. of Health
- Yakima County
- The Yakima County Health District
- The Roza Sunnyside Joint Board of Control
- The South Yakima Conservation District
- The Yakima Valley Farmworker Clinics
- The Yakima Valley Farm Bureau
- A Local Environmental Group
- Five citizens with letters of support from the community
- An attorney with expertise in environmental and water law
- A data analyst

This group would evaluate progress based on well-defined criteria that includes well water testing. This group would write a progress report to the Governor and the Legislature. Failure to meet goals and objectives must trigger a strong regulatory response. Regulators must have authority to impose sanctions against those who continue to pollute.

Regulatory Review

Federal:

Clean Water Act: 33 U.S.C. §1251 et seq. (1972)

Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs)

Clean Water Act, Section 402: National Pollutant Discharge Elimination System

Safe Drinking Water Act 42 U.S.C. §300f et seq. (1974)

Emergency Planning & Community Right-to-Know Act (EPCRA) 42 U.S.C. §11001 et seq. (1986

Resource Conservation and Recovery Act (RCRA) 42 U.S.C. §6901 et seq. (1976)

Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) 42 U.S.C. §9601 et seq. (1980)

Important Note: There are recent changes in CERCLA and EPCRA Reporting Requirements for Air Releases of Hazardous Substances from Animal Waste at Farms

Winters Doctrine

Clean Air Act 42 U.S.C. §7401 et seq. (1970)

Title VI of the Civil Rights Act of 1964 42 U.S.C. § 2000d Et Seq.

Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 13132 – Federalism

State of Washington:

RCW 90.03 Water Code

RCW 90.48.010 Water Pollution Control Act

RCW 90.54 Water Resources Act

RCW 90.44 Regulation of Public Groundwaters

Hirst decision

RCW 90.82 Watershed Planning Act

RCW90.64 Dairy Nutrient Management Act

RCW 43.05Technical Assistance Programs

RCW 70.85 Solid Waste Management

Public Trust Doctrine

RCW 7.48.305 Agricultural activities and forest practices—presumed reasonable and not a nuisance (Right to Farm)

RCW 36.70a Growth Management Act

RCW 36.70A.700 Voluntary Stewardship Program

RCW 26.25.010 Tribal Sovereignty

RCW 42.30 Open Public Meetings Act

Local Ordinances:

Yakima County Code

Yakima County Code Title 6.22 Rights of Farmers

Yakima County Code Title 16A Critical Areas

Yakima County Code Title 16C Critical Areas

Yakima County Code Title 19 Unified Land Development Code

Yakima County Code Title 19.25 Sewer and Water

Description of Purpose- Rules & Regulations

Federal:

Clean Water Act: 33 U.S.C. §1251 et seq. (1972)

https://www.epa.gov/laws-regulations/summary-clean-water-act

> *The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1972.*
>
> *Under the CWA, EPA has implemented pollution control programs such as setting wastewater standards for industry. EPA has also developed national water quality criteria recommendations for pollutants in surface waters.*
>
> *The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. EPA's National Pollutant Discharge Elimination System (NPDES) permit program controls discharges. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.*

Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs)

https://www.epa.gov/tmdl

> *EPA's 303(d) Program assists states, territories and authorized tribes in submitting lists of impaired waters and developing TMDLs. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality.*

Clean Water Act, Section 402: National Pollutant Discharge Elimination System

https://www.epa.gov/cwa-404/clean-water-act-section-402-national-pollutant-discharge-elimination-system

> *National Pollutant Discharge Elimination System (NPDES) Program - Establishes an effluent permit system for point source (e.g., pipe, ditch, sewer) discharges of pollutants into waters of the U.S. The NPDES permit system requires those permitted to maintain records and report on the amount and nature of discharged effluent waste components. The stormwater program is a part of the NPDES program and is designed to reduce or eliminate the discharge of contaminated stormwater into waters of the U.S. The program requires the following stormwater discharges to be covered by an NPDES permit:*
>
> - *discharge associated with industrial activity*
> - *discharge from a large or medium municipal separate storm sewer system, or*
> - *discharge which EPA or the state/tribe determines contributes to a violation of a water quality standard or which is a significant contributor of pollutants to waters of the United States*

Safe Drinking Water Act 42 U.S.C. §300f et seq. (1974)

https://www.epa.gov/laws-regulations/summary-safe-drinking-water-act

> *The Safe Drinking Water Act (SDWA) was established to protect the quality of drinking water in the U.S. This law focuses on all waters actually or potentially designed for drinking use, whether from above ground or underground sources.*
>
> *The Act authorizes EPA to establish minimum standards to protect tap water and requires all owners or operators of public water systems to comply with these primary (health-related) standards. The 1996 amendments to SDWA require that EPA consider a detailed risk and cost assessment, and best available peer-reviewed science, when developing these standards. State governments, which can be approved to implement these rules for EPA, also encourage attainment of secondary standards (nuisance-*

related). Under the Act, EPA also establishes minimum standards for state programs to protect underground sources of drinking water from endangerment by underground injection of fluids.

Emergency Planning & Community Right-to-Know Act (EPCRA) 42 U.S.C. §11001 et seq. (1986)

https://www.epa.gov/laws-regulations/summary-emergency-planning-community-right-know-act

Authorized by Title III of the Superfund Amendments and Reauthorization Act (SARA), the Emergency Planning & Community Right-to-Know Act (EPCRA) was enacted by Congress as the national legislation on community safety. This law is designed to help local communities protect public health, safety, and the environment from chemical hazards.

To implement EPCRA, Congress requires each state to appoint a State Emergency Response Commission (SERC). The SERCs are required to divide their states into Emergency Planning Districts and to name a Local Emergency Planning Committee (LEPC) for each district.

Broad representation by fire fighters, health officials, government and media representatives, community groups, industrial facilities, and emergency managers ensures that all necessary elements of the planning process are represented.

Resource Conservation and Recovery Act (RCRA) 42 U.S.C. §6901 et seq. (1976)

https://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act

The Resource Conservation and Recovery Act (RCRA) gives EPA the authority to control hazardous waste from the "cradle-to-grave." This includes the generation,

transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes. The 1986 amendments to RCRA enabled EPA to address environmental problems that could result from underground tanks storing petroleum and other hazardous substances.

HSWA - the Federal Hazardous and Solid Waste Amendments - are the 1984 amendments to RCRA that focused on waste minimization and phasing out land disposal of hazardous waste as well as corrective action for releases. Some of the other mandates of this law include increased enforcement authority for EPA, more stringent hazardous waste management standards, and a comprehensive underground storage tank program.

Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
42 U.S.C. §9601 et seq. (1980)

https://www.epa.gov/laws-regulations/summary-comprehensive-environmental-response-compensation-and-liability-act

The Comprehensive Environmental Response, Compensation, and Liability Act -- otherwise known as CERCLA or Superfund -- provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through CERCLA, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

EPA cleans up orphan sites when potentially responsible parties cannot be identified or located, or when they fail to act. Through various enforcement tools, EPA obtains private party cleanup through orders, consent decrees, and other small party settlements. EPA also recovers costs from financially viable individuals and companies once a response action has been completed.

EPA is authorized to implement the Act in all 50 states and U.S. territories. Superfund site identification, monitoring, and response activities in states are coordinated through the state environmental protection or waste management agencies.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 reauthorized CERCLA to continue cleanup activities around the country. Several site-specific amendments, definitions clarifications, and technical requirements were added to the legislation, including additional enforcement authorities. Also, Title III of SARA authorized the Emergency Planning and Community Right-to-Know Act (EPCRA).

Winters Doctrine

http://nationalaglawcenter.org/wp-content/uploads/assets/crs/RL32198.pdf

Although the federal government has authority to regulate water, it typically defers to the states to allocate water resources within the state. The federal government maintains certain federal water rights, though, which exist separate from state law. In particular, federal reserved water rights often arise in questions of water allocation related to federal lands, including Indian reservations.

Indian reserved water rights were first recognized by the U.S. Supreme Court in Winters v. United States in 1908. Under the Winters doctrine, when Congress reserves land (i.e., for an Indian reservation), Congress also reserves water sufficient to fulfill the purpose of the reservation.

Clean Air Act 42 U.S.C. §7401 et seq. (1970)

https://www.epa.gov/laws-regulations/summary-clean-air-act

The Clean Air Act (CAA) is the comprehensive federal law that regulates air emissions from stationary and mobile sources. Among other things, this law authorizes EPA to

establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants.

One of the goals of the Act was to set and achieve NAAQS in every state by 1975 in order to address the public health and welfare risks posed by certain widespread air pollutants. The setting of these pollutant standards was coupled with directing the states to develop state implementation plans (SIPs), applicable to appropriate industrial sources in the state, in order to achieve these standards. The Act was amended in 1977 and 1990 primarily to set new goals (dates) for achieving attainment of NAAQS since many areas of the country had failed to meet the deadlines.

Section 112 of the Clean Air Act addresses emissions of hazardous air pollutants. Prior to 1990, CAA established a risk-based program under which only a few standards were developed. The 1990 Clean Air Act Amendments revised Section 112 to first require issuance of technology-based standards for major sources and certain area sources. "Major sources" are defined as a stationary source or group of stationary sources that emit or have the potential to emit 10 tons per year or more of a hazardous air pollutant or 25 tons per year or more of a combination of hazardous air pollutants. An "area source" is any stationary source that is not a major source.

For major sources, Section 112 requires that EPA establish emission standards that require the maximum degree of reduction in emissions of hazardous air pollutants. These emission standards are commonly referred to as "maximum achievable control technology" or "MACT" standards. Eight years after the technology-based MACT standards are issued for a source category, EPA is required to review those standards to determine whether any residual risk exists for that source category and, if necessary, revise the standards to address such risk.

Important Note: CERCLA and EPCRA Reporting Requirements for Air Releases of Hazardous Substances from Animal Waste at Farms https://www.epa.gov/epcra/cercla-and-epcra-reporting-requirements-air-releases-hazardous-substances-animal-waste-farms

Due to legislative changes in the Consolidated Appropriations Act, 2018 (Omnibus Bill), "air emissions from animal waste at a farm" are exempt from reporting under CERCLA. On May 2, 2018, the D.C. Circuit Court of Appeals issued its mandate vacating the 2008 final rule. However, farms will remain exempt from the CERCLA reporting requirements as a result of the FARM Act. Additionally, these types of releases do not need to be reported under EPCRA.

Title VI of the Civil Rights Act of 1964 42 U.S.C. § 2000d Et Seq.

https://www.justice.gov/crt/fcs/TitleVI-Overview

Title VI, 42 U.S.C. § 2000d et seq., was enacted as part of the landmark Civil Rights Act of 1964. It prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance. As President John F. Kennedy said in 1963:

Simple justice requires that public funds, to which all taxpayers of all races [colors, and national origins] contribute, not be spent in any fashion which encourages, entrenches, subsidizes or results in racial [color or national origin] discrimination.

If a recipient of federal assistance is found to have discriminated and voluntary compliance cannot be achieved, the federal agency providing the assistance should either initiate fund termination proceedings or refer the matter to the Department of Justice for appropriate legal action. Aggrieved individuals may file administrative complaints with the federal agency that provides funds to a recipient, or the individuals may file suit for appropriate relief in federal court. Title VI itself prohibits intentional discrimination. However, most funding agencies have regulations implementing Title VI that prohibit recipient practices that have the effect of discrimination on the basis of race, color, or national origin.

Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations 59 FR 7629; February 16, 1994

https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice

> *Executive Order (E.O.) 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations - was issued by President William J. Clinton in 1994. Its purpose is to focus federal attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving environmental protection for all communities.*
>
> *The E.O. directs federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law. The order also directs each agency to develop a strategy for implementing environmental justice. The order is also intended to promote nondiscrimination in federal programs that affect human health and the environment, as well as provide minority and low-income communities access to public information and public participation.*
>
> *In addition, the E.O. established an Interagency Working Group (IWG) on environmental justice chaired by the EPA Administrator and comprised of the heads of 11 departments or agencies and several White House offices.*

Executive Order 13132 – Federalism

https://www.epa.gov/laws-regulations/summary-executive-order-13132-federalism

> *Executive Order (E.O.) 13132 - Federalism - was issued by President William J. Clinton in 1999. The E.O.'s objective is to guarantee the Constitution's division of governmental responsibilities between the federal government and the states. It furthers the policies of the Unfunded Mandates Reform Act.*

To the extent practicable and permitted by law, the Agency cannot promulgate two types of rules unless we meet certain conditions as described below. The two types of rules are:

1. *rules with Federalism Implications (FI), substantial direct compliance costs on state and local (S/L) governments, and not required by statute, and*
2. *rules with FI and that preempt S/L law.*

FI is defined as having substantial direct effects on states or local governments (individually or collectively), on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

The Agency cannot promulgate the first type of rule unless we:

- *provide funds necessary to pay direct compliance costs of the S/L governments, or*
- *early in the process before promulgation, consult with elected S/L officials or their representative national organizations.*

We cannot promulgate the second type unless we consult with elected S/L officials or their representative national organizations early in the process before promulgation.

For these two types of rules, we also must:

- *adhere to the fundamental principles in §2 of the E.O. and comply, to the extent permitted by law, with the general policymaking criteria in §3 of the E.O.;*
- *provide in a separate preamble section a federalism summary impact statement;*
- *make available to the Office of Management and Budget any written communications from S/L officials; and*
- *for final rules subject to E.O. 12866 review, include certification from EPA's Designated Federalism Official stating EPA has met E.O. requirements.*

State of Washington:

RCW 90.03 Water Code
http://app.leg.wa.gov/rcw/default.aspx?cite=90.03

> *It is the policy of the state to promote the use of the public waters in a fashion which provides for obtaining maximum net benefits arising from both diversionary uses of the state's public waters and the retention of waters within streams and lakes in sufficient quantity and quality to protect instream and natural values and rights. Consistent with this policy, the state supports economically feasible and environmentally sound development of physical facilities through the concerted efforts of the state with the United States, public corporations, Indian tribes, or other public or private entities. Further, based on the tenet of water law which precludes wasteful practices in the exercise of rights to the use of waters, the department of ecology shall reduce these practices to the maximum extent practicable, taking into account sound principles of water management, the benefits and costs of improved water use efficiency, and the most effective use of public and private funds, and, when appropriate, to work to that end in concert with the agencies of the United States and other public and private entities.*

RCW 90.48.010 Water Pollution Control Act
http://app.leg.wa.gov/RCW/default.aspx?cite=90.48.010

> *It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington. Consistent with this policy, the state of Washington will exercise its powers, as fully and as effectively as possible, to retain and secure high quality for all waters of the state. The state of Washington in recognition of the federal government's interest in the quality of the navigable waters of the United States, of which certain*

portions thereof are within the jurisdictional limits of this state, proclaims a public policy of working cooperatively with the federal government in a joint effort to extinguish the sources of water quality degradation, while at the same time preserving and vigorously exercising state powers to insure that present and future standards of water quality within the state shall be determined by the citizenry, through and by the efforts of state government, of the state of Washington.

RCW 90.54 Water Resources Act

http://app.leg.wa.gov/RCW/default.aspx?cite=90.54

It is the purpose of this chapter to set forth fundamentals of water resource policy for the state to insure that waters of the state are protected and fully utilized for the greatest benefit to the people of the state of Washington and, in relation thereto, to provide direction to the department of ecology, other state agencies and officials, and local government in carrying out water and related resources programs. It is the intent of the legislature to work closely with the executive branch, Indian tribes, local government, and interested parties to ensure that water resources of the state are wisely managed.

RCW 90.44 Regulation of Public Groundwaters

http://app.leg.wa.gov/RCW/default.aspx?cite=90.44&full=true

This chapter regulating and controlling groundwaters of the state of Washington shall be supplemental to chapter 90.03 RCW, which regulates the surface waters of the state, and is enacted for the purpose of extending the application of such surface water statutes to the appropriation and beneficial use of groundwaters within the state.

Hirst decision – Ecology Statement

https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-rights/Case-law/Hirst-decision

A 2016 Washington State Supreme Court decision changed how counties decide to approve or deny building permits that use wells for a water source.

In the Whatcom County vs. Hirst, Futurewise, et al. decision (often referred to as the "Hirst decision"), the court ruled that the county failed to comply with the Growth Management Act requirements to protect water resources. The ruling required the county to make an independent decision about legal water availability.

Streamflow restoration

Washington State has a new streamflow restoration law in response to the "Hirst decision." The law, Engrossed Substitute Senate Bill 6091, was passed on Jan. 18, 2018, and signed by Gov. Inslee the next day.

'Hirst decision' background

We protect rivers and streams across the state by creating instream flow rules, which set the amount of water necessary for protecting fish, wildlife, and recreation. In 1985, we adopted an instream flow rule for the Nooksack River (WAC 173-501) in Whatcom County. This rule closed most streams in the watershed to new water right permits but allowed landowners to use permit-exempt wells in most of the area. Whatcom County's development regulations followed our instream flow rule.

A reliable, year-round supply of water is necessary for new homes or developments. Before the Oct. 6, 2016, court decision, many counties relied on our determination about whether year-round water was available. The court decision changed that. Counties had to make their own decisions about whether there was enough water, both physically and legally, to approve any building permit that would rely on a well.

In response to the decision, several counties severely restricted approvals of subdivisions and building permits for houses relying on permit-exempt wells. Some counties required permit applicants to pursue expensive hydrogeological study before building.

Key points of the decision

- *Science has shown that rivers and streams are generally connected to groundwater. In the decision, the Washington State Supreme Court said that water is not legally available if a new well would impact a protected river or stream, or an existing senior water right.*
- *If a county determined that water was not legally available for a new use, the county would not be able to approve a building permit — even if a well was already drilled.*

RCW 90.82 Watershed Planning Act
http://apps.leg.wa.gov/rcw/default.aspx?cite=90.82&full=true

The purpose of this chapter is to develop a more thorough and cooperative method of determining what the current water resource situation is in each water resource inventory area of the state and to provide local citizens with the maximum possible input concerning their goals and objectives for water resource management and development.

It is necessary for the legislature to establish processes and policies that will result in providing state agencies with more specific guidance to manage the water resources of the state consistent with current law and direction provided by local entities and citizens through the process established in accordance with this chapter.

RCW90.64 Dairy Nutrient Management Act
http://app.leg.wa.gov/rcw/default.aspx?cite=90.64

The legislature finds that there is a need to establish a clear and understandable process that provides for the proper and effective management of dairy nutrients that affect the quality of surface or ground waters in the state of Washington. The legislature finds that there is a need for a program that will provide a stable and predictable business climate upon which dairy farms may base future investment decisions.

The legislature finds that federal regulations require a permit program for dairies with over seven hundred head of mature cows and, other specified dairy farms that directly discharge into waters or are otherwise significant contributors of pollution. The legislature finds that significant work has been ongoing over a period of time and that the

intent of this chapter is to take the consensus that has been developed and place it into statutory form.

*It is also the intent of this chapter to establish an inspection and technical assistance program for dairy farms to address the discharge of pollution to surface and ground waters of the state that will lead to water quality compliance by the industry. A further purpose is to create a balanced program involving technical assistance, regulation, and enforcement with coordination and oversight of the program by a *committee composed of industry, agency, and other representatives. Furthermore, it is the objective of this chapter to maintain the administration of the water quality program as it relates to dairy operations at the state level.*

It is also the intent of this chapter to recognize the existing working relationships between conservation districts, the conservation commission, and the department of ecology in protecting water quality of the state. A further purpose of this chapter is to provide statutory recognition of the coordination of the functions of conservation districts, the conservation commission, and the department of ecology pertaining to development of dairy waste management plans for the protection of water quality.

RCW 43.05 Technical Assistance Programs

http://app.leg.wa.gov/rcw/default.aspx?cite=43.05&full=true

The legislature finds that, due to the volume and complexity of laws and rules it is appropriate for regulatory agencies to adopt programs and policies that encourage voluntary compliance by those affected by specific rules. The legislature recognizes that a cooperative partnership between agencies and regulated parties that emphasizes education and assistance before the imposition of penalties will achieve greater compliance with laws and rules and that most individuals and businesses who are subject to regulation will attempt to comply with the law, particularly if they are given sufficient information. In this context, enforcement should assure that the majority of a regulated community that complies with the law are not placed at a competitive disadvantage and that a continuing failure to comply that is within the

control of a party who has received technical assistance is considered by an agency when it determines the amount of any civil penalty that is issued.

RCW 70.85 Solid Waste Management

http://apps.leg.wa.gov/RCW/default.aspx?cite=70.95

The purpose of this chapter is to establish a comprehensive statewide program for solid waste handling, and solid waste recovery and/or recycling which will prevent land, air, and water pollution and conserve the natural, economic, and energy resources of this state.

Public Trust Doctrine

https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-laws-rules-and-cases/Public-Trust-Doctrine

The Public Trust Doctrine is a legal principle derived from English Common Law. Under this doctrine, the waters of the state are a public resource owned by and available to all citizens equally for:

- *Purposes of navigation*
- *Conducting commerce*
- *Fishing*
- *Recreation and similar uses*

The Public Trust Doctrine trust is not invalidated by private ownership of the underlying land. The doctrine limits public and private use of tidelands and other shoreline areas to protect the public's right to use the waters of the state.
The Public Trust Doctrine does not allow the public to trespass over privately-owned uplands to access the tidelands. It does, however, protect public use of navigable water bodies below the ordinary high water mark.

Protecting the public trust is a duty of Washington. The state Shoreline Management Act is

one of the primary means by which this duty is carried out. The doctrine requires a careful evaluation of the public interest served by any proposed action

RCW 7.48.305 Agricultural activities and forest practices—presumed reasonable and not a nuisance (Right to Farm)
https://app.leg.wa.gov/rcw/default.aspx?cite=7.48.305

(1) Notwithstanding any other provision of this chapter, agricultural activities conducted on farmland and forest practices, if consistent with good agricultural and forest practices and established prior to surrounding nonagricultural and nonforestry activities, are presumed to be reasonable and shall not be found to constitute a nuisance unless the activity or practice has a substantial adverse effect on public health and safety.

(2) Agricultural activities and forest practices undertaken in conformity with all applicable laws and rules are presumed to be good agricultural and forest practices not adversely affecting the public health and safety for purposes of this section and RCW 7.48.300. An agricultural activity that is in conformity with such laws and rules shall not be restricted as to the hours of the day or day or days of the week during which it may be conducted.

(3) The act of owning land upon which a growing crop of trees is located, even if the tree growth is being managed passively and even if the owner does not indicate the land's status as a working forest, is considered to be a forest practice occurring on the land if the crop of trees is located on land that is capable of supporting a merchantable stand of timber that is not being actively used for a use that is incompatible with timber growing. If the growing of trees has been established prior to surrounding nonforestry activities, then the act of tree growth is considered a necessary part of any other subsequent stages of forest practices necessary to bring a crop of trees from its planting to final harvest and is included in the provisions of this section.

(4) Nothing in this section shall affect or impair any right to sue for damages.

RCW 36.70a Growth Management Act
http://apps.leg.wa.gov/RCW/default.aspx?cite=36.70a

The legislature finds that uncoordinated and unplanned growth, together with a lack of common goals expressing the public's interest in the conservation and the wise use of our lands, pose a threat to the environment, sustainable economic development, and the health, safety, and high quality of life enjoyed by residents of this state. It is in the public interest that citizens, communities, local governments, and the private sector cooperate and coordinate with one another in comprehensive land use planning. Further, the legislature finds that it is in the public interest that economic development programs be shared with communities experiencing insufficient economic growth.

RCW 36.70A.700 Voluntary Stewardship Program
http://app.leg.wa.gov/RCW/default.aspx?cite=36.70A.700

(1) The purpose of chapter 360, Laws of 2011 is to establish the voluntary stewardship program as recommended in the report submitted by the William D. Ruckelshaus Center to the legislature as required by chapter 353, Laws of 2007 and chapter 203, Laws of 2010.

(2) It is the intent of chapter 360, Laws of 2011 to:

(a) Promote plans to protect and enhance critical areas within the area where agricultural activities are conducted, while maintaining and improving the long-term viability of agriculture in the state of Washington and reducing the conversion of farmland to other uses;

(b) Focus and maximize voluntary incentive programs to encourage good riparian and ecosystem stewardship as an alternative to historic approaches used to protect critical areas;

(c) Rely upon RCW 36.70A.060 for the protection of critical areas for those counties that do not choose to participate in this program;

(d) Leverage existing resources by relying upon existing work and plans in counties and local watersheds, as well as existing state and federal programs to the maximum extent practicable to achieve program goals;

(e) Encourage and foster a spirit of cooperation and partnership among county, tribal, environmental, and agricultural interests to better assure the program success;

(f) Improve compliance with other laws designed to protect water quality and fish habitat; and

(g) Rely upon voluntary stewardship practices as the primary method of protecting critical areas and not require the cessation of agricultural activities.

RCW 26.25.010 Tribal Sovereignty

https://app.leg.wa.gov/rcw/default.aspx?cite=26.25.010

The legislature recognizes that Indian tribes are sovereign nations and the relationship between the state and the tribe is sovereign-to-sovereign.

RCW 42.30 Open Public Meetings Act

http://app.leg.wa.gov/rcw/default.aspx?cite=42.30

The legislature finds and declares that all public commissions, boards, councils, committees, subcommittees, departments, divisions, offices, and all other public agencies of this state and subdivisions thereof exist to aid in the conduct of the people's business. It is the intent of this chapter that their actions be taken openly and that their deliberations be conducted openly.

The people of this state do not yield their sovereignty to the agencies which serve them. The people, in delegating authority, do not give their public servants the right to decide what is good for the people to know and what is not good for them to know. The people insist on remaining informed so that they may retain control over the instruments they have created

Local Ordinances:

Yakima County Code

http://www.codepublishing.com/WA/YakimaCounty/

Yakima County Code Title 6.22 Rights of Farmers

A farm operation shall not be found to be a public or private nuisance if the farm or farm operation conforms to generally accepted agricultural and management practices.

Yakima County Code Title 16A Critical Areas

Title 16A establishes policies, standards, and other provisions pertaining to development of designated critical areas. Stream corridors, flood hazard areas, water resource and wetland areas, and wildlife habitat areas constitute part of Yakima County's critical areas. These areas are of special concern to the people of Yakima County and the state of Washington because they are environmentally sensitive lands which comprise an important part of the county's natural resource base.

Yakima County Code Title 16C Critical Areas

Title 16C establishes policies, standards, and other provisions pertaining to development within designated critical areas regulated under the provisions of the Growth Management Act (RCW 36.70A), and development regulated under the National Flood Insurance Program and RCW 86.16. Additional purpose and intent for the protection of critical areas is provided in the chapter on each subject. Stream corridors, frequently flooded areas, wetlands, critical aquifer recharge areas, geologically hazardous areas and fish and wildlife habitat areas constitute Yakima County's critical areas. These areas are of special concern to the people of Yakima County and the state of Washington because they are environmentally sensitive lands, or hazardous areas, which compose an important part of the county's natural resource base.

Yakima County Code Title 19 Unified Land Development Code

No development shall occur nor shall any building or other structure be constructed, erected, repaired, improved, altered, enlarged, moved, removed, converted, or demolished; nor shall any use or occupancy of premises within the County be commenced or changed; nor shall any condition of or upon real property be caused or maintained, after the effective date of this Title, except as authorized by this Title and

in conformity and full compliance with conditions established. It is unlawful for any person, firm or corporation to erect, construct, establish, move into, alter, enlarge, use or cause to be used, any buildings, structures, improvements or use of premises contrary to this Title. Where this Title imposes greater restrictions than those imposed or required by other rules, regulations or ordinances, this Title shall control.

Yakima County Code Title 19.25 Sewer and Water

This Chapter is intended to:

(1) Further the public health, safety and welfare by providing clear rules for when and how connection to public sewer and water is required or prohibited;

(2) Ensure that all required sewer and water connections and improvements are consistent with, and implement applicable goals and policies of, the Comprehensive Plan and this Chapter;

(3) Require development inside Urban Growth Areas to connect to available regional sewer and area-wide public water supply systems, and provide for full future extension of such services where they are presently unavailable to serve such development, in order to efficiently convert the land to urban uses within the 20 year planning period;

(4) Provide for expansion of existing regional sewer and area-wide water supply systems as a cost-effective means for infrastructure development;

(5) Prioritize use of community on-site sewage disposal systems, as defined in Section 19.01.070, when service from a regional sewer system is not available within Urban Growth Areas or the service area of a County sewer system or sewer district;

(6) Prioritize use of public water supplies from existing satellite utility systems and facilitate their use in all areas when service from an area-wide public water supply system is not available;

(7) Provide a framework for the future location of facilities to assist developers and property owners in design of their projects;

(8) Provide consumer protection for future third party purchasers of developed properties by requiring applicants to invest in site improvements such as dry-line sewer and double plumbing dry side sewer connections to reduce costs of connecting to regional sewer systems when they become available;

(9) Minimize the cost of such improvements to the taxpayers of this County and State; and

(10) Provide specific standards consistent with RCW 58.17.110 and 19.27.097 that will ensure that an adequate source of potable water will be provided prior to development approval.

Relevant Agencies & Organizations

- Yakama Nation
- U.S. Bureau of Reclamation
- U.S. Geological Survey
- U.S. Environmental Protection Agency
- U.S. Natural Resources Conservation Service
- WA State Dept. of Ecology
- WA State Dept. of Agriculture
    - Dairy Nutrient Management Program
    - Natural Resources Assessment Section
    - Commodity Commissions
- WA State Dept of Health
- WA State Dept of Fish and Wildlife
- Yakima County
    - Health District
    - Voluntary Stewardship Program
    - Water Conservancy Board
    - Yakima County Extension Service
- City of Grandview
- Port of Grandview
- City of Granger
- City of Mabton
- City of Sunnyside
- Port of Sunnyside
- Roza Irrigation District
- Sunnyside Irrigation District
- Roza Sunnyside Joint Board of Control
- South Yakima Conservation District
- Yakima Valley Conference of Governments
- Washington State University
- University of Washington
- Heritage University
- WA State Farm Bureau
- WA State Dairy Federation
- Community Association for the Restoration of the Environment
- Concerned Citizens of the Yakama Reservation
- Friends of Toppenish Creek
- Yakima Valley Farmworkers Clinics
- Neighborhood Health Services
- Astria Health Care
- Virginia Mason Memorial
- Northwest Communities Educational Center/Radio KDNA
  (See Attachment 69 for Stakeholder Descriptions)

Reasons for a Minority Report in Detail

Reason I - Does not comply with WAC 173-100

WAC 173-100-090(1) states:

> *The groundwater advisory committee shall be responsible for overseeing the development of the groundwater management program; reviewing the work plan, schedule and budget for the development of the program; assuring that the program is technically and functionally sound; verifying that the program is consistent with this chapter and with the respective authorities of the affected agencies; and formulating and implementing a public involvement plan.*

The official December 2018 proposed GWMA Plan is not technically and functionally sound. The basic analysis of causes is flawed because it:

1. Underestimates nitrogen leaching from alfalfa fields
2. Underestimates atmospheric deposition of reactive nitrogen
3. Ignores the "dairy cluster"
4. Ignores nitrogen leaching from composting operations
5. Ignores nitrogen inputs from application of bio-solids
6. Ignores industrial spray fields
7. Ignores runoff to surface waters

The program is not consistent with the authority of at least one affected agency

1. Washington State Department of Agriculture
   Recommended Alternative 41 says that WSDA *will Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of fertilizers and manures, including separation of solid and liquid wastes. (17 – WSDA)* and *construct GWMA administrative program.*

WSDA does not have authority under Chapter 43.23 RCW DEPARTMENT OF AGRICULTURE to construct a GWMA administrative program. WSDA does not have the expertise to design or construct such a program that would implement WA State Water Policy. The stated cost is $10 million to come from the WSDA Capital Budget. The GWMA does not have control over the WSDA capital budget.

2. Yakima Health District
   Recommended Alternative 2 says that YHD will *collect data from Ambient Groundwater Monitoring Wells. (42 – Yakima Health District)* and
   Study short-term seasonal variations in nitrate concentrations over next year or two and address effects of changes in nutrient application over the agricultural cycle. Study long-term trends that develop over several years to track whether time-based performance objectives are being met.

While YHD may have the authority, YHD does not have the requisite staff with sufficient expertise to study long-term trends and track whether objectives are being met. How can YHD demonstrate expertise when time based performance objectives have not been defined; when there is no plan for analysis of data from monitoring wells?

Experts from EPA, WSDA and Ecology state that the impact of changes in nutrient applications does not show up in the groundwater for a longer period of time than two or even several years.

In order to complete this task YHD would have to collect more data than just water samples. YHD would have to track the impact due to changes in nutrient management, etc. Funding of $20,000/year is insufficient to develop a survey instrument and gather data that the WSDA has not been able to acquire.

YHD does not have a good track record doing data gathering and survey work. See Reason for Minority Report IIIB, IV3, and V5. The YHD only has a staff of 27.7 FTE's and has other significant, important and mandatory tasks necessary to provide public health for a county of 250,000 people.

WAC 173-100-100(6) states:

Each program shall include, as appropriate, the following:

6(a) A detailed work plan for implementing each aspect of the groundwater management strategies as presented in the recommendations section.

6(b) A monitoring system for evaluating the effectiveness of the program;

6(c) A process for the periodic review and revision of the groundwater management program.

The GWM Plan is not consistent with WAC 173-100-100 (6). The plan lacks all three of these components. See Attachment 62, Attachment 63 and Attachment 82 for more details.

Reason II – Unbalanced Advisory Committee

In Brief: The dairy industry has maintained veto power over any and all GWMA actions. Advocates for dairy have controlled the agenda and marginalized other voices on the GWAC.

In the early years of the GWMA Charlie McKinney from Ecology oversaw the program development and selection of stakeholders. The Yakima Farm Bureau chose Steve George to represent them. Helen Reddout was one of three environmentalists on the GWAC.

Mrs. Reddout asked Mr. McKinney why Stuart Turner was chosen to participate. According to Mr. McKinney, Steve George had suggested that Mr. Turner could represent the fertilizer industry. Mrs. Reddout replied that Mr. Turner had no connections to fertilizer groups. Instead he was employed by the WA Dairy Federation and worked for several local dairies. Mr. George is likewise employed by the dairy federation. Mr. McKinney maintained the importance of bringing agriculture to the table and held out a promise of adding a second Hispanic representative and someone to speak for Environmental Justice. These last two additions did not happen. (Attachment 38)

GWAC Composition and Actions: There are six members of the GWAC who vote as a block to support the interests of the dairy industry. With six votes this block has vetoed every proposal that might adversely impact that special interest group. The block consists of:

- Yakima Farm Bureau – the farm bureau representative has been employed by the Dairy Federation for many years
- Yakima Dairy Federation
- Agronomist – this representative is employed by several LYV dairies
- WSDA – there have been several representatives from this agency. They all work directly with the WSDA Dairy Nutrient Management Program
- South Yakima Conservation District – this representative administers the dairy nutrient management program for SYCD and spends most of her time working with dairymen
- Community Representative II – this representative is, in fact, the wife of a dairyman

Some of the actions that this group has blocked include:

1. Consideration of the impact of cows per acre on water quality in Yakima County
2. Consideration of local regulation of concentrated animal feeding operations (CAFOs)
3. A technical workshop on Environmental Justice
4. Hiring an education and outreach worker to improve community engagement
5. Incorporation of LYV studies done by the EPA into the GWMA plan
6. A presentation on environmental law from a University of Washington professor of environmental law with 50 years of expertise on the subject.
7. A presentation on air emissions of nitrates in the LYV by the Dept. of Ecology
8. Analysis of the impact of nitrates on public health in Yakima County
9. Collaboration with the USGS on groundwater analysis in the LYV
10. Collaboration with the University of Washington School of Public Health
11. Approval of a listing of best management practices (BMPs) for animal agriculture. Natural Resource Conservation Service (NRCS) guidelines were substituted instead
12. Economic analysis of the impact of groundwater pollution on the LYV

A lack of diversity on the Groundwater Advisory Committee has allowed this group to focus almost entirely on the needs of the dairy industry while ignoring the needs of the people in the Lower Yakima Valley who rely on groundwater for drinking, the needs of fish in the polluted Lower Yakima River and the ecological consequences of nitrogen imbalance.

Background: The Lower Yakima Valley Groundwater Management Area (LYV GWMA) Request for Identification proposed a Groundwater Management Area Advisory Committee (GWAC) with 21 members. The actual number has ranged from 20 to 23. Benton County withdrew from the LYV GWMA in 2013 and this caused a re-configuration of the GWAC with the addition of three members from the community. The environmental group Community Association for the Restoration of the Environment (CARE) withdrew from the GWAC in 2014 and a representative from Heritage University joined in 2015. The U.S. Geological Survey withdrew in 2014 and returned in 2016.

Most of the GWMA work has been done by a GWAC that consisted of 22 representatives:

1. Yakama Nation
2. Yakima County
3. Yakima Health District
4. Yakima Farm Bureau
5. Yakima Dairy Federation
6. An Agronomist
7. Friends of Toppenish Creek
8. Concerned Citizens of the Yakama Reservation
9. South Yakima Conservation District
10. Port of Sunnyside
11. Washington State Department of Agriculture
12. Washington State Department of Health
13. Washington State Department of Ecology
14. Washington State University
15. United States Geological Survey

16. Environmental Protection Agency
17. Roza-Sunnyside Irrigation District
18. Hispanic Representative
19. Farmer – Irrigated Agriculture
20. Community Representative I
21. Community Representative II
22. Heritage University

Regarding decision making the GWMA Operating Guidelines state (page 4):

> *"Areas of agreement" on groundwater management plan elements will be developed by seeking consensus. Consensus has been reached when everyone agrees they can accept moving forward with the recommendation and will support the recommendation, and after every effort has been made to meet the interests of all members. If consensus cannot be reached, the decision will be made by a majority vote, with a majority requiring a minimum of 75% of those members or alternates present (assuming a quorum is present.) In those instances where agreement cannot be reached, the reasons for the disagreement will be noted in the project record and the dissenting voters may include a minority report. When a minority report is filed, a primary author will be identified for the purpose of representing the minority's viewpoint in discussions with the media.*

Here are the agenda topics for GWMA discussion from 2012 to 2018. Note the absence of public health, minority group concerns and environmental justice.

Table 2. GWMA Agenda Topics

Topic		2012	2013	2014	2015	2016	2017	2018
GWMA Programming								
Guidelines		2	2					
Time Frames/ Deliverables		1		2	3			
GWMA SOW/ Work Plan		6	4					

Budget			3	3		1		
Goals & Objectives			5				2	
Review Contracts & Agreements			1	5	1	3		2
Area Characterization						1	1	1
Inform the GWAC								
Informational Needs		2						
Yakima County Pilot Program			1					
Oregon GWMA			1					
Overview of Dairy NMP				1				
Nitrate Standards (EPA)				1				
Overview of Regulations				1		1		
Potential Requests to Legislature						2		
International Water Conference						1		
Alternative Management Presentation							1	
GIS Applications							3	1
Education & Outreach								
EPO Work Plan		3						
GWMA Outreach Materials			2					
Standardize Talking Points			1					
Billboards						1		
Research								
EPA Study		1	1					
USGS Research			1		1			
Heritage University Survey			1					
High Risk Well Assessment					1			
Nutrient Budget/NAA			2		2		4	
Deep Soil Testing			2	2	1			
BMP Study			1					
Data Collection/Modeling				1		2		
Groundwater Monitoring Plan				3	2	2	1	2
Solutions								
Alternative Strategies							10	4
Number of Meetings		7	12	8	5	6	14	4

Respect:

The official GWMA Plan states on page ix:

> *The diversity of the committee members' interests often made for contentious discussions, but the members were committed to resolving the issues and continued to participate, and were usually respectful.*

The Friends of Toppenish Creek have not felt respected during the past six years. We have endured a great deal of acrimony and, in our opinion, unfair treatment. See Attachment 84 for documentation.

Reason III – Missed Deadlines and Bungled Research

In Brief: The GWMA leadership has failed to provide research that is necessary in order for the GWAC to do the work. The GWMA has missed almost every deadline.

A. Missed GWMA deadlines include:

1. Submission of GWMA Work Plan by Dec. 31, 2012
2. Completion of GWMA Plan by June 30, 2015
3. Completion of GWMA Plan by Sept. 30, 2015
4. Completion of GWMA Plan by Dec. 31, 2017
5. Almost none of the deadlines in the Timeline from the Feb. 2013 GWMA Work Plan were met. We calculate that about 84 out of 219 tasks from the Work Plan have been completed as of June 15, 2018 (Attachment 34)
6. Almost none of the deadlines in the 1-29-2015 GWMA Timeline were met.
7. Approval of a Final Plan by June, 2018

B. Inadequate Research & Analysis: It is impossible for an advisory group to function without reliable information that is shared in a timely manner. Problems related to delivery of important research include:

1. The GWAC acknowledged early in the process that an Area Characterization is essential for scientific study of nitrate pollution. The GWAC received proposed tables of contents for an Area Characterization in March 2013 and June 2015,

nothing else. An incomplete Draft Area Characterization was finally delivered in March 2018. As of October, 2018 it had not been approved.

2. At the beginning of the GWMA Yakima County hired a hydrogeologist to lead the effort. The hydrogeologist left in mid-2013 and was not replaced. Thus the GWMA was left without scientific leadership for the next five years.
3. There was no follow up survey after a 2013 baseline assessment of public awareness regarding groundwater pollution and the LYV GWMA that was done by Heritage University. Consequently we do not know whether GWMA activities have improved public understanding of the problem.
4. In March 2015 Yakima County and WSDA signed a contract to deliver a Nitrogen Loading Assessment that is needed in order for the GWAC to evaluate contributions of nitrate to groundwater from various sources. The study was due on Dec. 31, 2015 with the possibility of a two month extension. But in fact the study was not delivered until April 2017. It was no longer a Nitrogen Loading Assessment (NLA) but morphed into a Nitrogen Availability Assessment (NAA). It still has not been approved by the GWAC because several groups have questioned the accuracy of the information. For example:
    a. The Scope of Work for the project was ignored
    b. There is no assessment of the contribution from bio-solids
    c. There is no assessment of the contribution from spray fields used by waste water treatment plants
    d. The authors promised to hold meetings with local farmers and conduct local surveys. Instead they conducted telephone interviews with a few managers, crop advisors and fertilizer salesmen. A single consultant spoke for:
        i. 81% of the surveyed alfalfa acreage
        ii. 85% of corn silage acreage
        iii. 78% of juice grape acreage
        iv. 80% of hops acreage
        v. 90% of mint acreage
    e. There was no comparison of the NAA results with the GWMA Deep Soil Sampling as promised

f. Nitrogen inputs from farm animals on pasture or beef feedlots were ignored
g. There was no literature review for leakage from manure lagoons as promised
h. Nitrogen leakage from composting areas (> 500 acres in the GWMA target area) was omitted
i. The study incorrectly stated that 77% of nitrogen availability from irrigated cropland comes from apple orchards
j. The study stated that the average apple orchardist applies 60 lb of nitrogen per acre at the beginning of the season and there are 90 LBs of nitrogen per acre on the land at the end of the season.
k. The study incorrectly stated that nitrogen from alfalfa fields does not leak below the root zone. The GWMA DSS clearly showed otherwise.
l. The study ignored nitrogen runoff to surface waters.

5. The GWAC began developing plans for a network of monitoring wells in 2013. As of October, 2018 none of these wells had been drilled. Here is a history of GWAC actions related to purpose built monitoring wells:
    a. Draft Potential Groundwater Monitoring Stations December 3, 2013 (4th Quarter Report 2013, page 200/236)
    b. Potential Groundwater Monitoring Stations document December 3, 2013 (1st Quarter Report 2014, page 90/162)
    c. Interim Final Groundwater Monitoring Plan Version 7 (4th Quarter Report 2014, page 82/157)
    d. Pacific Groundwater Group (PgG) Agreement with Yakima County for "Monitoring Well Network Design" dated December 8, 2015 (4th Quarter Report 2015, page 68/76)
    e. PgG Technical Memorandum "Draft Ambient Groundwater Monitoring Network Location Selection Method" dated March 18, 2016 (1st Quarter 2016, page 104/143)
    f. PgG's report "Draft Lower Yakima Valley GWMA Proposed Ambient Groundwater Monitoring Network June 8, 2016 (2nd Quarter Report 2016, page 152/211)

g. GWMA Ambient Monitoring Network Report for Final Approval (4th Quarter Report 2016, page 98/170)
h. Recommendation regarding Groundwater Monitoring from Data Work Group (4th Quarter Report 2016, page 160/170)
i. January 2017 the Pacific Groundwater Group signs a contract to facilitate installation of groundwater monitoring wells in the GWMA target area. Yakima County did not sign the contract until January 2018 and did not inform the GWAC.
j. When Ecology presented the conceptual idea of a groundwater monitoring plan to the GWAC in 2016 they said there would be 35 to 40 wells. The signed contract says there will likely be less than 20. (1st Quarterly Report 2018, page 394/398)
k. As of October, 2018 no monitoring wells had been drilled. There is no plan for analyzing any data we gather.

6. The GWMA conducted Deep Soil Sampling from the fall of 2014 to the spring of 2016. There was no plan for data analysis. In 2017 Ecology provided an analysis and Friends of Toppenish Creek provided another. Neither of these analyses has been shared or discussed in a meeting of the GWAC.

7. The Yakima Health District conducted High Risk Well testing of 460 domestic wells in the GWMA target area. The project included a two page survey related to the home owner's well and water supply. The results of those surveys have never been shared with the GWAC nor analyzed.

8. In 2017 the U.S. Geological Survey tested approximately 156 domestic wells every other month as requested by the GWMA program. There was no plan for data analysis. The Friends of Toppenish Creek performed a basic analysis of the data but that study has not been accepted by the GWAC or included in the GWMA Report.

C. Final Report*:* In late 2017 the GWMA was given an extension until Dec. 31, 2018 for completion of a plan. The GWAC committed to twice monthly meetings in order to accomplish this. To date there were meetings in February (1), March (1), April (1), May (2), June (1), August (1) and December (1).

1. In order to complete a plan the GWAC needs:
    a. Area Characterization
    b. Problem Definition
    c. Goals and Objectives
    d. Listing of Alternative Solutions
    e. Listing of Recommended Alternative
    f. Implementation Strategies

2. The GWAC received a draft document with a partial Area Characterization in March, 2018. The other components of the plan were missing.

3. The GWAC missed a June 30, 2018 deadline for completion of the GWMA plan. A draft document presented on June 21, 2018 prompted many concerns. Edits were requested and the draft plan was sent back for a re-write.

4. If the Goals and Objectives from the GWMA Work Plan are used for the final plan, there are some serious deficiencies. Unfulfilled objectives from the Request for Identification include:
    a. Establish a monitoring program to identify sources of nitrate contamination and their relative importance
    b. Establish and conduct long-term groundwater quality monitoring program and evaluate progress
    c. Establish educational programs to promote the protection of groundwater quality and provide a forum for stakeholders to discuss nitrate reduction methods and improvement of groundwater quality. This will include culturally-appropriate education and outreach

d. *Provide water quality and hydrogeologic data to assess needs and methods of expanding public water supplies, and provide a forum for initiation of these plans*
e. *Consider options to encourage appropriate expansion of public water supplies to areas that are currently dealing with contaminated private supplies*
f. *Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications*
g. *The GWMA will seek sustainable funding sources to carry out its mission*

5. In February, 2013, in order to achieve 100% GWAC support for the GWMA Work Plan a section on public health was added to the plan. That section reads:

Immediate Public Health Needs

Approximately 75,000 persons reside within the Lower Yakima Basin area. Of that amount, it is estimated that about 25,000 residents (34% of the population) obtain their drinking water from private wells. Water quality testing conducted by various entities during the last twenty years shows that up to twenty percent of the private drinking water wells may exceed drinking water standards for nitrate. Accordingly, a conservative calculation indicates that upwards of 1,800 private wells within the area may exceed nitrate drinking water standards.

The GWAC recognizes and supports the primary long-term goal of the GWMA to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards in order to protect the health and safety of the residents of the Lower Yakima Basin, The GWAC believes, based on similar efforts within the State of Washington and the Nation, that fulfillment of this goal will undoubtedly take many years to achieve. The GWAC is very concerned about the public health effects nitrates may have on the existing residents during this period of time. Accordingly, the GWAC will work with Federal, State, and Local governments to immediately seek funding and implement programs to provide clean drinking water to the residents of the Lower Yakima Basin.

In fact there was no follow-through. The LYV GWMA has done nothing to access programs to help the residents of the LYV access clean drinking water. In fact, in 2014 Yakima County

returned to the state $150,000 that was awarded to help private home owners access safe drinking water. In fact, the 2017 survey of 156 wells by U.S.G.S., found that 19.7% of the wells exceeded the safe standard of 10 mg/L nitrate. This suggests no decrease in nitrate pollution of LYV aquifers as a result of GWMA activity.

6. According to the GWMA Guidelines which are derived from WAC 173-100-100:

GWAC members will:

- *Review technical information and analyses to understand the scope of the problem, and potential approaches to the problem and their impact on the community.*
- *Serve as a liaison to the public and/or their agencies (as appropriate) by networking effectively outside the GWAC with people or groups with similar interests to provide broad input to the discussions.*
- *Bring a valuable and informed perspective, and contribute useful information to the process.*
- *Work collaboratively, constructively and creatively to help develop the groundwater management program.*
- *Attend meetings consistently. If an organization seat (member or alternate) is not represented at two consecutive meetings, the member will receive a reminder notification and a warning about absences. If an organization seat (member or alternate) is not represented for three consecutive meetings, the GWAC will consider whether to ask the Department of Ecology to vacate the seat and seek to refill it with a new representative from the same constituency group who will participate consistently.*
- *Come to meetings prepared (do the homework).*
- *Be willing and able to commit time and energy to the development of the groundwater management program.*
- *Abide by the ground rules.*

Yakima County will:

- *Provide available and newly developed information on data and monitoring, problem identification, measures to reduce groundwater contamination and education.*
- *Provide draft and/or final technical analyses to inform GWAC discussions.*
- *Support the GWAC in their decision-making.*
- *Prepare a work plan, schedule and budget for the development of the program.*
- *Support the GWAC's responsibilities as liaison to the public and/or their agencies by providing information in a timely fashion to allow for GWAC*

It is impossible for the GWAC to comply with these requirements without adequate information. At this late point in time there is no:

a. Nitrogen Loading Assessment
b. High Risk Well Assessment Analysis
c. Groundwater Monitoring Network
d. Detailed plan for implementing recommended solutions

As of February, 2018 this is a best estimate of task completion for the GWMA Work Groups. (See Attachment 34)

Table 22. Task Completion

1.0 Data Collection, Characterization, Monitoring	36 Tasks, 17 Completed
2.1 Livestock & CAFO – Yards, corrals, lagoons, manure field application	54 Tasks, 11 Completed
2.2 Irrigated Agriculture	50 Tasks, 25 Completed
3.0 Regulatory Framework	26 Tasks, 15 Completed - 10 Poorly Done & incomplete
4.0 Education and Outreach	32 Tasks, 26 Completed - 10 Poorly Done
5.0 Funding	21 Tasks, None Completed
Total	219 Tasks, 94 Complete, 20 Poorly Done

Reason IV - No Analysis of Research

In Brief: The GWMA gathered data and then, failed to analyze the data. The GWMA did no analysis of Deep Soil Sampling data, High Risk Well testing data, composting data, sampling of domestic wells and drains, or responses to a survey of public understanding.

1. Heritage Survey: In 2013 the GWMA contracted with Heritage University to conduct a survey of private well owners in the LYV in order to obtain a baseline assessment of how much people knew about nitrate contamination of the groundwater and the purpose of the LYV GWMA. Survey results were presented to the GWAC in September 19, 2013. The survey and results are available in the 3rd Quarter GWMA report for 2013.

Members of the GWAC reasonably assumed that the survey would be done by random sampling. This was not the case. Yakima County chose the homes to be surveyed. When community representatives asked the Education and Public Outreach (EPO) work group (WG) how many of the bilingual surveys were conducted in Spanish the work group leaders did not know.

The EPO WG presented the following tallies to the GWAC:

A. 69% (94) households are aware of the potential health risks associated with drinking water with high levels of nitrate.
B. Over half of those surveyed had their private wells tested for nitrate
C. 4% (6) households believed that someone in their home had become ill from drinking well water
D. 42% (57) of households had heard of the GWMA
E. 33% (45) households were interested in more in-depth well testing

There was no analysis of the data. Friends of Toppenish Creek subsequently performed a lengthy statistical analysis (Attachment 20) that was never shared with the GWAC. That analysis found:

A. In two of the major zip codes, 98944 - Sunnyside & 99350 - Prosser, less than half of those surveyed test well water for nitrates.

B. There is a statistical difference between home owners and renters regarding awareness of nitrate issues with drinking water. Renters are not as well informed as home owners.
C. 71% of renters were comfortable asking landlords to test well water and 29% were not.
D. There is a high correlation between being aware of nitrate issues and having well water tested for nitrates.
E. 43% of those with Spanish surnames purchase bottled water compared to 15% of those with non-Spanish surnames. There was no statistical difference in risks for those with Spanish surnames and those without.

There are no subsequent surveys to determine whether the GWMA work has improved public understanding of groundwater pollution in the LYV.

2. Deep Soil Sampling: On July 15, 2014 Yakima County contracted with the South Yakima Conservation District to administer a Deep Soil Sampling (DSS) study. The GWAC spent an extraordinary amount of time and effort to bring this project together in a way that protects the anonymity of farmers who were willing to volunteer their fields for testing.

Purposes of the DSS were:

1) Providing baseline data regarding the nitrogen content (nitrate, ammonium, and organic matter) of soils underlying a variety of soil, crop, and irrigation systems that represent a cross-section of agricultural activities.
2) Provide an initial assessment of current nitrogen and water management practices in place today and in the past.
3) Provide information regarding availability of soil nitrogen to crops.
4) Provide the foundation for a technically based education program.
5) Provide information about project design, practical realities, time requirements and costs that can be used in developing subsequent project scopes.

The GWAC reviewed a draft DSS Plan in late 2013 (See 4th Quarter GWMA Report 2013) and approved a final DSS plan in April 2014 (See 2nd Quarter Report 2014). The plan called for a distribution of samples across three parameters – soil type (revised to leaching potential), cropping type (revised to root depth) and irrigation types. There were 3 to 4 divisions within each category. This resulted in between 36 and 96 possible combinations. The plan called for sampling of the most common combinations and the GWAC agreed that this would provide sufficient data for an initial evaluation.

These stated objectives were not achieved. The final collection of 175 samples contained:

A. 15 categories or combinations of parameters. (5 of the 15 had only one sample).
B. 40% of the samples were in the category 2.5 to 4 ft root depth, sprinkler irrigation and moderately high to high leaching potential.
C. 19% of the samples were in the category > 4 ft root depth, sprinkler irrigation and moderately high to high leaching potential.
D. 12% of the fields were in the category 2.5 to 4 ft root depth, rill irrigation and moderately high to high leaching potential.

Descriptive information was missing from 12 of the samples in the last round of testing. The South Yakima Conservation District did not provide nitrate leaching potentials for individual sites in spite of the fact that this was part of the plan.

There were enough samples for analysis of fields planted in triticale/corn silage, the largest cropping group in the study.

Initially, no data analysis was performed. There were delays in sharing the raw data. In August of 2017 the Friends of Toppenish Creek performed analysis of the entire data set and analysis of the fields planted in triticale/corn silage. (Attachment 23 & Attachment 24)

In the spring of 2018 Ecology performed a separate and different analysis of the DSS and the two studies were discussed within the Data Work Group.

Conclusions from the Data WG discussion have never been shared with the GWAC. The DSS work was not included in the Nitrogen Loading Assessment/Nitrogen Availability

Assessment performed by WSDA and Yakima County, in spite of the fact that this was part of their scope of work (SOW). (See 4th Quarter GWMA Report 2014)

3. High Risk Well Testing: On June 25, 2013, on behalf of the GWMA, Yakima County signed an agreement with the Yakima Health District (YHD) to conduct a minimum of 250 and up to 320 household surveys of private well owners. Services were to include:

a. Site visits to test tap water with test strips, and take samples using laboratory bottles
b. Deliver the sample bottles to the designated testing laboratory
c. Take pictures of the well head to document site visit and findings
d. Obtain location and depth of the wells for GIS database
e. Fill out a questionnaire and provide the information to Public Services.

On August 21, 2014 a report with lab results from 172 samples was shared with the GWAC. Results were:

A. 0 to 2.5 mg/L nitrate – 29.7%
B. 2.5 to 5 mg/L nitrate – 28.5%
C. 5 to 10 mg/L nitrate – 25.6%
D. 10 to 15 mg/L nitrate – 8.1%
E. 15 to 20 mg/L nitrate – 7%
F. 20 to 25 mg/L nitrate – 1.2%

Results from the questionnaires were not presented.

On September 8, 2015 on behalf of the GWMA, Yakima County signed an agreement with the Yakima Health District (YHD) to conduct a second round of High Risk Wells testing.

On February 16, 2016 there was a contract amendment to add 80 additional samples with a total cost of $70,000.

The February 16, 2016 report to the GWMA showed 288 sample results:

A. 0 to 5 mg/L nitrate – 60%
B. 5.01 to 9.99 mg/L nitrate – 26%
C. 10 to 35 mg/L nitrate – 14%

On April 12, 2016, after the fact, there was a contract amendment that increased the number of samples by 10.

Approximately 460 High Risk Well Assessments were performed – 172 during Phase I and 288 during Phase II.

A two page questionnaire accompanied the High Risk Well Assessments. Questionnaire results have never been shared with the GWAC in spite of numerous requests. Consequently, there is no analysis of the High Risk Well surveys. In June 2018 the Friends of Toppenish Creek reluctantly submitted a public records request for the data. There were no completed questionnaires.

4. USGS Domestic Well Testing: On February 15, 2017, on behalf of the GWMA, Yakima County signed a $491,320 contract with the U.S. Geological Survey to:

A. Take and test water samples every two months during 2017 from 140 to 160 domestic wells
B. Take and test water samples every two months during 2017 from 24 agricultural drains in the LYV
C. Take and test water samples from each of 20 to 30 purpose built monitoring wells every two months during 2017

The first two tasks were completed. The third was not completed because the purpose-built monitoring wells have not been drilled.

U.S.G.S offered to analyze the collected data for an additional reimbursement of $60,000 to $75,000. Yakima County declined and no data analysis was performed. The Friends of Toppenish Creek performed a rudimentary analysis of the raw data and offered it to the GWAC. (Attachment 28) Some important findings are:

A. Nitrate levels are higher in wells near the middle and southern portions of the GWMA.
B. There is no statistical correlation between well depth and nitrate levels or ground surface elevation and nitrate levels.
C. There were wells with low nitrate levels close to wells with high nitrate levels.
D. There were a few wells with wide fluctuations in nitrate levels.
E. Wells near the Yakima River had much lower nitrate levels than those farther from the river.
F. There is a farmed area east of the Toppenish Wildlife Refuge with surprisingly low nitrate levels.
G. Drains showed wide ranges in values from zero nitrates to > 20 mg/L nitrates.
H. Drains showed major seasonal fluctuations.

The GWAC has not commented or accepted these findings. At this point in time the GWMA possesses this new source of data that is un-analyzed and not utilized for problem solving.

5. Composting:

Testimony in the case of CARE and CFS versus Cow Palace (2015) supports the high probability that nitrates and other nitrogen compounds leach from manure compost yards to the underlying aquifers. (Attachment 49 & Attachment 50)

Members of the GWAC from the agricultural community were not convinced and they conducted their own deep soil sampling on pens, corrals and compost yards in 2015 with support from the WSDA. (Attachment 13, Attachment 14 & Attachment 15) This data also shows significant leaching from these production areas.

In 2016 and 2017 Friends of Toppenish Creek engaged in an unsuccessful campaign to convince the SYCD to endorse stronger protective practices on compost yards. (Attachment 51, Attachment 52 & Attachment 53)

The agricultural groups on the GWMA continue to question the validity of the environmentalists' position. Consequently nitrogen input from composting yards was omitted from the 2018 Nitrogen Availability Assessment. WSDA stated on page 13:

> *Manure composting areas were identified and the acreage was calculated as part of this analysis. Differences between composting areas and pens include surface construction, the lack of animal movement compacting surfaces, and the difference in moisture inputs between composting areas and pens. Due to these differences, as well as the diversity of potential compost management practices, NRAS did not feel use of the dairy/nondairy CAFO pen rate was appropriate for compost areas. The diversity of composting practices could include composting in windrows, composting in bags, spreading material out over a large surface to dry, turning frequency, moisture additions to maintain optimal composting conditions, or the use of a concrete pad for composting. With no information available in scientific literature about potential loading from compost areas, NRAS did not attempt a calculation for these areas. With the locations and dimensions of composting areas already identified, nitrogen loss from compost areas could easily be calculated in the future if new information becomes available.*

Reason v – Contract Mismanagement

In Brief: The *GWMA and GWMA contractors have not complied with the terms of their contracts. There have been no consequences. Most egregious - A Nitrogen Availability Assessment, the center piece of the GWMA analysis, ignored bio-solids and waste water spray-fields, ignored the GWMA Deep Soil Sampling, ignored inputs from beef feedlots and animals on pasture, ignored composting yards, failed to do a promised literature review and incorrectly stated that there is no leaching from alfalfa fields.*

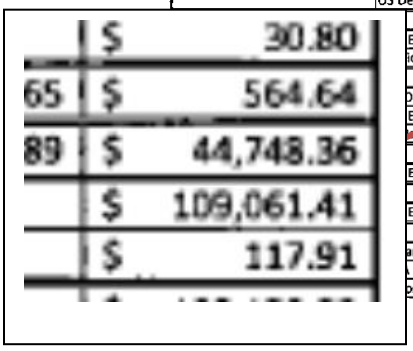
1. Work Plan: 2013 GWMA Work Plan spending projections:

Description	Low	Medium	High
Task 1. Plan Development and Administration	$300,000	$400,000	$500,000
Task 2. Monitoring and Characterization	$150,000	$575,000	$1,000,000
Task 3. Education and Public Outreach	$100,000	$250,000	$400,000
Task 4. BMP Redevelopment and Field Research	$200,000	$350,000	$500,000
TOTAL	$750,000	$1,575,000	$2,400,000

The projections were not taken seriously.

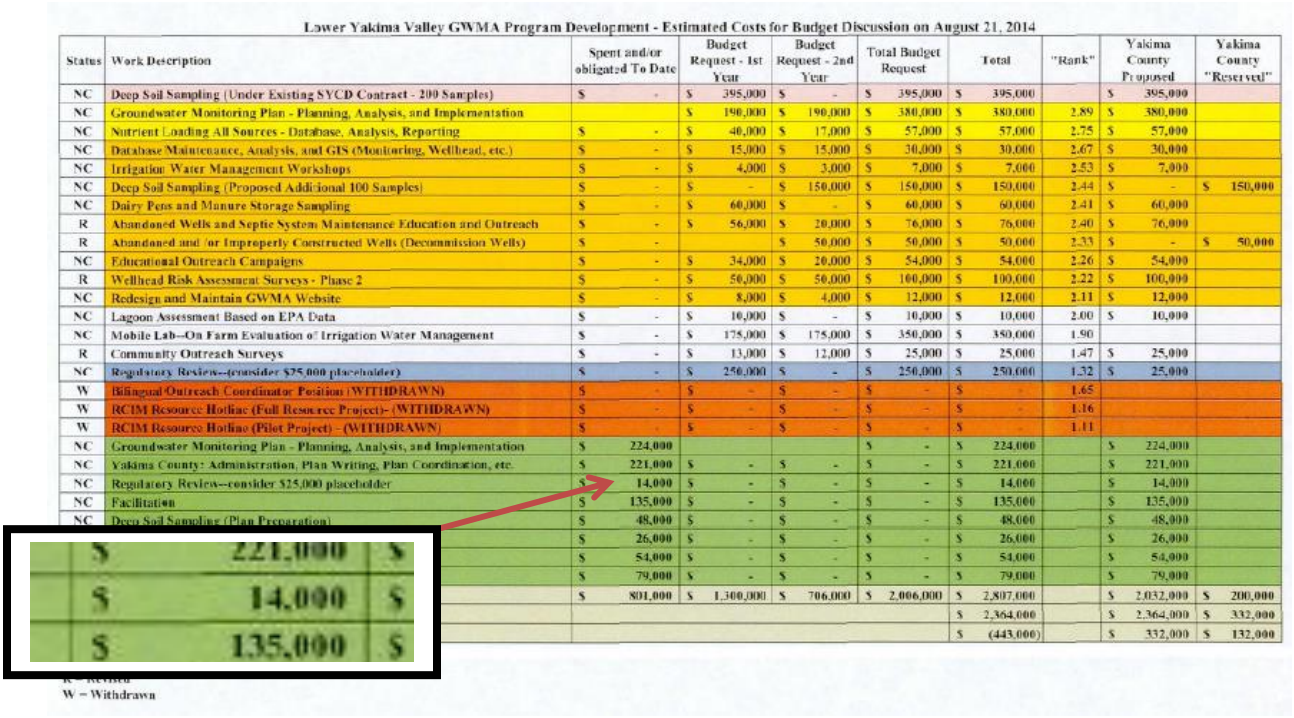
LYVGWMA Expenditures through December, 2017

Task Description	Subtask Description	VENDOR	2013	2014	2015	2016	2017	Grand Total
		Yakima Herald					$ 112.64	$ 112.64
	Program Support Total		$ 401.49	$ 1,666.43	$ 3,346.88	$ 3,696.27	$ 5,768.26	$ 14,879.33
	Public Survey	Brady, Roberta				$ 8.64		$ 8.64
		Ehlis, Carolyn	$ 855.01					$ 855.01
		Heritage University	$ 5,300.00					$ 5,300.00
		Nitrate Program - Postage		$ 139.38				$ 139.38
		Office Max				$ 23.78		$ 23.78
		POP UP BANNER				$ 325.34		$ 325.34
		SURVEYMONKEY				$ 288.13	$ 315.00	$ 603.13
	Public Survey Total		$ 6,155.01	$ 139.38		$ 645.89	$ 315.00	$ 7,255.28
	Travel	03 FORD F350					$ 56.98	$ 56.98
		Freund, Lisa	$ 25.99					$ 25.99
		Saunders, Christopher				$ 413.20	$ 37.67	$ 450.87
		Wurtz, Mary		$ 30.80				$ 30.80
	Travel Total		$ 25.99	$ 30.80		$ 413.20	$ 94.65	$ 564.64
Education and Outreach Total			$ 11,665.81	$ 13,259.24	$ 3,346.88	$ 6,194.54	$ 10,281.89	$ 44,748.36
Facilitation	GWAC Meetings	Enviroissues Inc.	$ 67,256.26	$ 41,805.15				$ 109,061.41
		U S Bank		$ 117.91				$ 117.91
	GWAC Meetings Total		$ 67,256.26	$ 41,923.06				$ 109,179.32
Facilitation Total			$ 67,256.26	$ 41,923.06				$ 109,179.32
Monitoring and Assessment	Data Analysis	Oliver-Murdock, Lee Ann			$ 3,123.46			$ 3,123.46
	Data Analysis Total				$ 3,123.46			$ 3,123.46
	Data Collection	Sedighi, Ali	$ 68,113.79					$ 68,113.79
		U S Bank			$ 43.26			$ 43.26
		US Dept of the Interior					$ 337,000.00	$ 337,000.00
			$ 68,113.79		$ 43.26		$ 337,000.00	$ 405,157.05
		Engineering Inc.	$ 43,080.07	$ 20,001.02				$ 63,081.09
		ic Groundwater Group Inc.				$ 37,485.00		$ 37,485.00
			$ 43,080.07	$ 20,001.02		$ 37,485.00		$ 100,566.09
		ORD ESCAPE 4x4	$ 44.08					$ 44.08
		Engineering Inc.	$ 33,626.01	$ 20,450.81				$ 54,076.82
			$ 1,406.60					$ 1,406.60
			$ 35,076.69	$ 20,450.81				$ 55,527.50
		Engineering Inc.	$ 10,422.87					$ 10,422.87
			$ 10,422.87					$ 10,422.87
		Engineering Inc.		$ 10,047.42				$ 10,047.42
				$ 10,047.42				$ 10,047.42
		ante Media Group		$ 900.00				$ 900.00
		Enterprises		$ 120.00	$ 280.00			$ 400.00
		os Media			$ 925.00			$ 925.00



At the end of 2017 the GWMA had spent $44,748.36 on Education and Public Outreach, about 11% of the projected expenditure. (1st Quarter Report 2018, Page 70/398) This estimate was part of the LYV GWMA Work Plan (page 20) that was submitted to Ecology for approval in February, 2013.

2. Regulatory Review: In August 2014 Yakima County reported paying $14,000 to HDR Engineering for a Regulatory Review. (See the 3rd Quarterly Report 2014, pages 77/169 and 78/169)



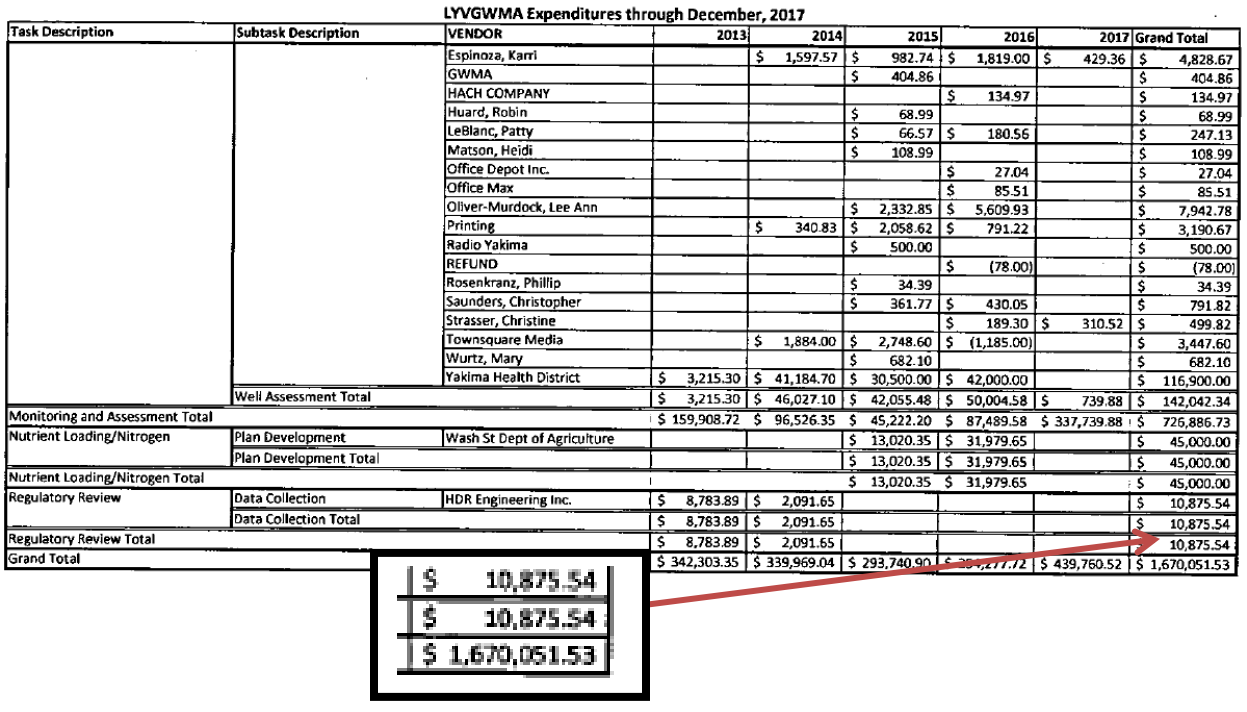
Lower Yakima Valley GWMA Program Development - Estimated Costs for Budget Discussion on August 21, 2014

Status	Work Description	Spent and/or obligated To Date	Budget Request - 1st Year	Budget Request - 2nd Year	Total Budget Request	Total	"Rank"	Yakima County Proposed	Yakima County "Reserved"
NC	Deep Soil Sampling (Under Existing SYCD Contract - 200 Samples)	$ -	$ 395,000	$ -	$ 395,000	$ 395,000		$ 395,000	
NC	Groundwater Monitoring Plan - Planning, Analysis, and Implementation		$ 190,000	$ 190,000	$ 380,000	$ 380,000	2.89	$ 380,000	
NC	Nutrient Loading All Sources - Database, Analysis, Reporting	$ -	$ 40,000	$ 17,000	$ 57,000	$ 57,000	2.75	$ 57,000	
NC	Database Maintenance, Analysis, and GIS (Monitoring, Wellhead, etc.)	$ -	$ 15,000	$ 15,000	$ 30,000	$ 30,000	2.67	$ 30,000	
NC	Irrigation Water Management Workshops	$ -	$ 4,000	$ 3,000	$ 7,000	$ 7,000	2.53	$ 7,000	
NC	Deep Soil Sampling (Proposed Additional 100 Samples)	$ -	$ -	$ 150,000	$ 150,000	$ 150,000	2.44	$ -	$ 150,000
NC	Dairy Pens and Manure Storage Sampling	$ -	$ 60,000	$ -	$ 60,000	$ 60,000	2.41	$ 60,000	
R	Abandoned Wells and Septic System Maintenance Education and Outreach	$ -	$ 56,000	$ 20,000	$ 76,000	$ 76,000	2.40	$ 76,000	
R	Abandoned and /or Improperly Constructed Wells (Decommission Wells)	$ -		$ 50,000	$ 50,000	$ 50,000	2.33	$ -	$ 50,000
NC	Educational Outreach Campaigns	$ -	$ 34,000	$ 20,000	$ 54,000	$ 54,000	2.26	$ 54,000	
R	Wellhead Risk Assessment Surveys - Phase 2	$ -	$ 50,000	$ 50,000	$ 100,000	$ 100,000	2.22	$ 100,000	
NC	Redesign and Maintain GWMA Website	$ -	$ 8,000	$ 4,000	$ 12,000	$ 12,000	2.11	$ 12,000	
NC	Lagoon Assessment Based on EPA Data	$ -	$ 10,000	$ -	$ 10,000	$ 10,000	2.00	$ 10,000	
NC	Mobile Lab--On Farm Evaluation of Irrigation Water Management	$ -	$ 175,000	$ 175,000	$ 350,000	$ 350,000	1.90		
R	Community Outreach Surveys	$ -	$ 13,000	$ 12,000	$ 25,000	$ 25,000	1.47	$ 25,000	
NC	Regulatory Review--(consider $75,000 placeholder)	$ -	$ 250,000	$ -	$ 250,000	$ 250,000	1.32	$ 25,000	
W	Bilingual Outreach Coordinator Position (WITHDRAWN)	$ -	$ -	$ -	$ -	$ -	1.65		
W	RCIM Resource Hotline (Full Resource Project)- (WITHDRAWN)	$ -	$ -	$ -	$ -	$ -	1.16		
W	RCIM Resource Hotline (Pilot Project) - (WITHDRAWN)	$ -	$ -	$ -	$ -	$ -	1.11		
NC	Groundwater Monitoring Plan - Planning, Analysis, and Implementation	$ 224,000			$ -	$ 224,000		$ 224,000	
NC	Yakima County: Administration, Plan Writing, Plan Coordination, etc.	$ 221,000	$ -	$ -	$ -	$ 221,000		$ 221,000	
NC	Regulatory Review--consider $25,000 placeholder	$ 14,000	$ -	$ -	$ -	$ 14,000		$ 14,000	
NC	Facilitation	$ 135,000	$ -	$ -	$ -	$ 135,000		$ 135,000	
NC	Deep Soil Sampling (Plan Preparation)	$ 48,000	$ -	$ -	$ -	$ 48,000		$ 48,000	
		$ 26,000	$ -	$ -	$ -	$ 26,000		$ 26,000	
		$ 54,000	$ -	$ -	$ -	$ 54,000		$ 54,000	
		$ 79,000	$ -	$ -	$ -	$ 79,000		$ 79,000	
		$ 801,000	$ 1,300,000	$ 706,000	$ 2,006,000	$ 2,807,000		$ 2,032,000	$ 200,000
						$ 2,364,000		$ 2,364,000	$ 332,000
						$ (443,000)		$ 332,000	$ 132,000

$ 221,000
$ 14,000
$ 135,000

W = Withdrawn

Later, in reported expenditures through December 2017 (1st Quarterly Report for 2018, page 74/398) Yakima County reported the costs at $10,875.54.



LYVGWMA Expenditures through December, 2017

Task Description	Subtask Description	VENDOR	2013	2014	2015	2016	2017	Grand Total
		Espinoza, Karri		$ 1,597.57	$ 982.74	$ 1,819.00	$ 429.36	$ 4,828.67
		GWMA			$ 404.86			$ 404.86
		HACH COMPANY				$ 134.97		$ 134.97
		Huard, Robin			$ 68.99			$ 68.99
		LeBlanc, Patty			$ 66.57	$ 180.56		$ 247.13
		Matson, Heidi			$ 108.99			$ 108.99
		Office Depot Inc.				$ 27.04		$ 27.04
		Office Max				$ 85.51		$ 85.51
		Oliver-Murdock, Lee Ann			$ 2,332.85	$ 5,609.93		$ 7,942.78
		Printing		$ 340.83	$ 2,058.62	$ 791.22		$ 3,190.67
		Radio Yakima			$ 500.00			$ 500.00
		REFUND				$ (78.00)		$ (78.00)
		Rosenkranz, Phillip			$ 34.39			$ 34.39
		Saunders, Christopher			$ 361.77	$ 430.05		$ 791.82
		Strasser, Christine				$ 189.30	$ 310.52	$ 499.82
		Townsquare Media		$ 1,884.00	$ 2,748.60	$ (1,185.00)		$ 3,447.60
		Wurtz, Mary			$ 682.10			$ 682.10
		Yakima Health District	$ 3,215.30	$ 41,184.70	$ 30,500.00	$ 42,000.00		$ 116,900.00
	Well Assessment Total		$ 3,215.30	$ 46,027.10	$ 42,055.48	$ 50,004.58	$ 739.88	$ 142,042.34
Monitoring and Assessment Total			$ 159,908.72	$ 96,526.35	$ 45,222.20	$ 87,489.58	$ 337,739.88	$ 726,886.73
Nutrient Loading/Nitrogen	Plan Development	Wash St Dept of Agriculture			$ 13,020.35	$ 31,979.65		$ 45,000.00
	Plan Development Total				$ 13,020.35	$ 31,979.65		$ 45,000.00
Nutrient Loading/Nitrogen Total					$ 13,020.35	$ 31,979.65		$ 45,000.00
Regulatory Review	Data Collection	HDR Engineering Inc.	$ 8,783.89	$ 2,091.65				$ 10,875.54
	Data Collection Total		$ 8,783.89	$ 2,091.65				$ 10,875.54
Regulatory Review Total			$ 8,783.89	$ 2,091.65				$ 10,875.54
Grand Total			$ 342,303.35	$ 339,969.04	$ 293,740.90	$ [illegible]	$ 439,760.52	$ 1,670,051.53

$ 10,875.54
$ 10,875.54
$ 1,670,051.53

The June 26, 2013 contract with HDR Engineering specifies payment for the Regulatory Review in the amount of $6,646.00. (2nd Quarter Report for 2013 page 100/142)

Compensation

The estimated total contract amount to complete the professional services identified in this Scope of Services is two-hundred fifteen thousand, one hundred and nine dollars ($215,109.00). If the optional tasks described in Attachment 1 are included, the estimated total contract amount to complete the professional services identified in this Scope of Services is two-hundred sixty-six thousand, four hundred and two dollars ($266,402.00). A summary of the costs by task is presented below.

Scope Tasks	HDR Labor	Expenses	Subtotal
Base Scope Tasks:			
Task 1 - Project Management	$8,952	$796	$9,748
Task 2 - Regulatory Review	$6,081	$465	$6,546
Task 3 - Develop BMP Database	$11,374	$610	$11,984
Task 4 - BMP Effectiveness Evaluation	$20,305	$3,968	$24,273
Task 5 - Reports and Presentations	$25,333	$5,212	$30,545
Task 6 - GWMA Meetings and Workshops	$8,000	$2,000	$10,000
Task 7 - Initial Characterization Assessment (PGG)	$2,232	$119,781	$122,013
Task 8 - BMP Implementation Assistance and Monitoring (TBD)	$ -	$ -	$ -
Task 9 - Monitoring Plan Implementation (TBD)	$ -	$ -	$ -
Base Scope Total	$82,277	$132,832	$215,109

$6,546.00 for Regulatory Review

The Regulatory Review is an eight page document that a college freshman could have compiled in a few days using the Google search engine. (See Technical Memorandum #1 – Regulatory Review on page 79/161 of the 3rd Quarter Report for 2013). It has been essentially useless for the GWMA work. Very relevant rules and regulations, such as RCW 70.95 – Solid Waste Management, were omitted.

3. High Risk Wells. In 2013 the WA State Department of Health said they could perform high risk well testing for about $200 per well. The Yakima Health District (YHD) said they

could do the work for $80 per well and the GWAC selected YHD. A contract was signed for $100 per well plus $27.50 for lab testing.

Here is the history in detail of what happened next:

1. On June 25, 2013 Yakima County and YHD signed a $50,000 contract that required the health district to conduct a minimum of 250 and up to 320 high risk well assessments and surveys in the GWMA target area by October 31, 2013.
2. On November 25, 2013 the deadline was extended to March 31, 2014.
3. On March 25, 2014 the deadline was extended to May 31, 2014.
4. This Phase I of High Risk Well Testing resulted in surveys of 172 domestic wells, not 250 as required
5. YHD received $45, 400 for this work and the calculated cost was $264 per site visit
6. On September 8, 2015 Yakima County and YHD signed a contract that authorized the health district to conduct Phase II of High Risk Well Testing. The costs were not to exceed $50,000 and payments were $250 per site. The GWAC approved Phase II but was not informed about the doubling of costs.
7. By February 15, 2016 YHD had conducted 288 High Risk Well Assessments. Payment at $250 per site would exceed the $50,000 limit.
8. Yakima County and YHD signed a contract amendment on February 16, 2016 that increased the contract amount to $70,000.
9. The GWAC met on February 18, 2016 and received the test results.
10. On April 12, 2016 Yakima County and YHD signed a contract amendment that provided for up to 10 additional samples.
11. The GWAC has yet to see the results of survey questions.

4. Deep Soil Sampling: The LYV GWMA spent a great amount of time and effort designing a Deep Soil Sampling (DSS) project in order to access important information while providing anonymity for growers. At one time the GWAC approved costs for the DSS were over $400,000. Here is the history:

A. February 2013 - Stuart Turner and Kevin Lindsey estimate that deep soil testing can be done for $40,000 to $60,000. Kirk Cook from WSDA felt this was grossly underestimated. (From GWMA Summary Notes, February 3, 2013)
B. February 2013 - The Groundwater Area Committee agrees to dedicate $11,000 from the original $300,000 budget for deep soil testing.
C. June 2013 - Yakima County submits a budget to Ecology for the $750,000 allocated at that time. They ask for $117,000 for deep soil sampling.
D. June 2013 - "HDR Engineering was asked for a proposal to conduct Optional Task 10 which includes deep soil monitoring. Their cost estimate was $51,293. They would be doing 20 locations of analysis and digging 8 - 10 feet, sampling at one foot increments until the total depth is reached. We need to do 20 cropping systems with 6 - 10 samples per cropping system." (From Summary Notes, June 20, 2013)
E. June 19, 2013 - Contract signed between Yakima County and HDR for $266,402, includes $51,293 for Optional Task 10 - "Communication, Source Mapping, Deep Soil Sampling, and Data Publishing Assessment"
F. August 2013 - Technical Memorandum from Pony Ellingson to Don Gatchalian re *Considerations for Further Scoping of Deep Soil Sampling (DSS), Lower Yakima Valley GWMA* under Summary of Deep Soil Sampling (DSS) for the Columbia Basin GWMA says, "Educational sampling programs were conducted in 2000 and 2001. In 2000, 73 growers participated and 376 fields were sampled. The (Columbia) GWMA spent $43,640 for that task in 2000. In 2001 99 growers participated and 458 fields were sampled. . . . The plan was for five years of DSS, with funding in 2001 at $100,000 and additional money sought for subsequent 4 years."
G. August 2013 - Lower Yakima Valley Program Development - Estimated Costs - Submitted as 2013 Funding Request lists $175,500 for DSS with $30,173 spent and/or obligated.
H. September 2013 - Technical Memorandum from Pony Ellingson to Don Gatchalian and Jim Trull presents an approach for obtaining soil samples that reflect existing practices in the GWMA target area. Three parameters to be analyzed were N leaching type, crop type and irrigation type. Here are the five options:

CALCULATION OF NUMBERS OF FIELDS SAMPLED DEPENDING ON DESIGN OF ALLOCATION PROCESS

	hypothetical sample allocation				
	A	B	C	D	E
number of NRCS N Leach Potential values	4	4	3	3	3
number of crop types	6	6	5	4	4
number of irrigation types	4	4	3	3	3
number of categories:	96	96	45	36	36
number of fields sampled for first quintile	0	0	0	0	3
number of fields sampled for second quintile	0	0	0	0	3
number of fields sampled for third quintile	3	2	2	3	3
number of fields sampled for fourth quintile	5	4	4	4	3
number of fields sampled for fifth quintile	8	6	6	6	3
total number of fields sampled	307	230	108	94	100

I. September/October 2013 - The estimated budget for deep soil sampling is $216,925 to sample 150 sites at a cost of $422 per field. SYCD time is billed at $75 per hour. This estimate is soon increased to $239,680. SYCD time is now billed at $100 per hour.

J. Oct. 3, 2013 - Draft Deep Soil Sampling Plan: GWAC Review version 1 is presented. (See 4th Quarter Report 2013, Page 98/236)

K. February 29, 2014 - The GWAC approved the DSS plan by consensus.

L. March 2014 - *Deep Soil Sampling Plan for the Lower Yakima Valley Groundwater Management Area – Version 6, March 28, 2014* is unveiled. It differs significantly from the previous, approved versions. UIN numbers are now part of the project. SYCD is no longer required to utilize the NRCS N-leaching potential tool to evaluate fields prior to selection. SYCD is no longer required to select individual fields that will promote sampling across a broad spectrum of field cropping systems, irrigation systems and soil types. SYCD is no longer required to screen applicants against criteria. GIS mapping of sites has been eliminated. At some point crop type was changed to grouping by root depths.

M. April 2014 - According to the document *GWMA Expenditures Through April, 2014* the GWMA had spent $36,880 out of a contracted $47,965 with HDR for a Deep Soil Sampling Plan Development. According to that document the GWMA had already contracted with the South Yakima Conservation District to spend $245,025 for DSS data collection.

N. June 2014 - The Irrigated Ag Work Group (not the entire Groundwater Area Committee) receives a copy of an unsigned Interlocal agreement between the South Yakima Conservation District and Yakima County to collect and analyze 300 samples from 50 sites (6 samples per site) per season for four seasons. Cost not to exceed $245,025

O. August 2014 - The Irrigated Ag Work Group (not the entire Groundwater Area Committee) receives a copy of a signed contract between the South Yakima Conservation District and Yakima County to collect and analyze deep soil samples. The agreed payment is $394,563, an increase of almost $150,000.

P. August 2014 - A document entitled, "Lower Yakima Valley GWMA Program Development – Estimated Costs for Budget Discussion on August 21, 2014" says that the total cost for deep soil sampling is $443,000 and that 200 samples (sites?) will be collected. The spread sheet says this money has been spent or obligated. In addition Yakima County has "reserved" $150,000 for further deep soil sampling. (3rd Quarter Report 2014, page77).

Q. September, 2014 - A document entitled, "Lower Yakima Valley GWMA Program Development – Estimated Costs for Budget Discussions on August 21, 2014 – Revised Proposed List – Distributed to GWAC September 18, 2014" says that $48,000 has been spent or obligated for DSS plan development and requests $395,000 with $150,000 requested as a reserve for further testing.

R. Spring 2016 - At the completion of the GWMA DSS project 175 sites had been sampled. We do not know whether any were sampled twice. There was no description of NRCS leaching categories, a selling point in early presentations. Instead there was documentation of soil type. Twelve (12) of the samples in the spring 2016 phase lack survey data. The SYCD either lost the data or failed to gather the surveys.

The maximum amount approved for the DSS project was $245,025.00. When bids came in over budget Yakima County simply signed a new agreement for $394,563.40. The documents are available in the 3rd Quarterly GWMA Report for 2014. The GWAC was not

consulted regarding the increase in cost. The GWAC was simply informed of the decision. The GWAC was asked to approve contracts after they were already signed.

Conversion of crop type to root depth means that dissimilar crops are grouped together. For example, the 2.5 to 4 ft root depth includes both grapes and corn. The > 4 ft root depth includes tree fruit, hops and alfalfa. This change was not part of the approved plan but it was included in a South Yakima Conservation District/Sunnyside Irrigation District Power Point presentation to the GWAC. FOTC questions the wisdom of this decision.

The plan and contract with SYCD called for sampling of 50 sites in Fall 2014, Spring 2015, Fall 2015 and Spring 2016 for a total of 200 sites. The end result was a study with 175 sites. Survey data was missing for 13 of the sites in Spring 2016.

The GWMA spent $238,681 on DSS data collection or $1,364 per site. The DSS data was not compared to other survey data in the Nitrogen Availability Assessment as promised.

5. Health Care Providers Survey: On June 25, 2013 Yakima County signed a contract with YHD to conduct a two page survey of health providers that was designed by a physician and nurse from the GWMA Education and Public Outreach (EPO) Work Group. The purpose was two-fold: to assess the knowledge of providers in the area and to educate them about nitrate issues. The contract specified:

> *1. The HEALTH DISTRICT shall distribute Survey No. 3, with cover letter, methemoglobinemia fact sheet and GWMA program map to the health providers within the GWMA area.*
> *2. Estimated Cost – There are approximately 600 health providers in the GWMA area. It is estimated this effort will cost approximately $1,000 which includes labor, telephone, mailing and postage, etc.*
> *3. Deliverables:*
> *a. Completed survey forms*

Instead of mailing surveys to the 600 providers as required, the YHD simply faxed the surveys to 249 points of contact that included ambulance services, pharmacies, eye doctors, labs and nursing homes. Not surprisingly there were no responses.

In fact there are over 800 physicians, physician assistants and advanced practice nurses in the area. But YHD did not send the survey to individuals. Surveys were faxed to offices and received by secretaries. A single survey was sent to the YVMH ER where there are at least 22 doctors on staff. A single survey was sent to the Toppenish Farmworkers Clinic where there are four physicians who practice family medicine, four internists, four obstetricians, six pediatricians, and six primary care practitioners. (Attachment 48)

Non-providers received over 40% of the surveys. Here are the numbers:

Table 23. Health Care Survey Targets

Home Health Agencies	17
Eye Doctors	21
Ambulance Service	2
Podiatry	4
Pharmacies	7
Mental Health	12
Dialysis	3
Nursing Homes & Rehab	12
Laboratories & Radiology	16
Occupational & Worker Health	10
Dental Services	4
Hospital (Administration & General)	8
Hospital Infection Control	6
Hospital ER	4
Hospital Hospitalists & Physician Services	4
Residential & Correctional Facilities	4
School Nurses	1
Medical & Nursing Schools	2
Physicians' Offices & Clinics	112
Total	249

It is standard procedure when conducting surveys to send a numbered survey to each person in the sampling set along with a stamped return envelope. This is a very basic

component of Public Health theory and practice. The surveys, as distributed, could be filled out by any staff person with the most minimal qualifications.

6. Best Management Practices: On June 25, 2013, on behalf of the GWMA, Yakima County signed a contract with HDR Engineering that included $11,984 to develop a Best Management Practice database and $24,273 to evaluate Best Management Plan (BMP) effectiveness. (See 2nd Quarter Report 2013)

By the end of 2014 expenditures for a BMP Database QA/QC Plan and a BMP Effectiveness Evaluation totaled $76,500. (See LYVGWMA Expenditure through December 2017 in 1st Quarter Report 2018)

Most of the BMPs for irrigated agriculture were cut and pasted from *Technical Report 3: Nitrogen Source Reduction to Protect Groundwater Quality,* written by a team from the University of California, Davis. (Harter et al, 2012) 39 BMPs were taken verbatim from a paper by Canessa & Hermanson (1995) that was commissioned by the WA State Dept. of Ecology in 1994. The draft GWMA Plan, as of July, 2018 contains 80 BMPs for irrigated agriculture in tabular form with comments from the Irrigated AG Work Group for each listed BMP. There is no plan for distribution in a reader friendly format.

The GWMA CAFO/Livestock Work Group chose to reject the BMPs provided by HDR and substitute Guidelines from the Natural Resource Conservation Service for BMPs.

HDR also listed BMPs for Residential, Commercial, Industrial and Municipal (RCIM) sources, as well as BMP's for Turf grass & Landscaping, Sewer Leakage, and Septic Systems. (Fourth Quarterly GWMA Report for 2013) These were never reviewed, accepted or rejected. The BMPs for these minor sources were not incorporated into the GWAC analysis and selection of strategies.

7. EnviroIssues: In April, 2013, on behalf of the GWMA, Yakima County signed a contract with EnviroIssues of Seattle to facilitate and support GWMA meetings. The amount was not to exceed $80,980 and included 48 hours of travel time at $175 per hour. (Second Quarterly GWMA Report, 2013, page 140)

8. Nitrogen Loading Assessment: As early as January 2013 the GWAC acknowledged the need to develop a Nitrogen Loading Assessment in order to clearly understand the approximate contribution of nitrogen loading to groundwater from the major sources in the LYV. The EPA had performed a Nitrogen Budget Screening Analysis in 2012 (Attachment 35) and various members of the GWAC demanded a more in-depth, LYV specific study.

On October 17, 2013 WSDA made a power point presentation to the GWAC that described the methods and content of a proposed NLA. (Fourth Quarterly GWMA Report, 2013)

At the August 2014 GWMA meeting the GWAC considered a $57,000 bid from WSDA to develop an NLA. (Third Quarterly GMA Report, 2014) FOTC filed a minority report arguing that the funding was insufficient for the purpose of the project. (Attachment 39)

A modified Nitrogen Loading Assessment Scope of Work and Budget was approved by the GWAC in December 2014. (Fourth Quarterly GWMA Report, 2014) Yakima County signed an agreement with WSDA to do the work on March 31, 2015. The agreement assigned payment of $45,000 to WSDA and $12,000 to Yakima County. The agreement called for completion of the NLA by December 31, 2015 with a potential extension for up to 60 days.

December 31, 2015 came and went. February 28, 2016 came and went. December 31 2016 came and went. Finally, in April 2017 the report arrived. Members of the GWAC were shocked to find major deficiencies. WSDA and Yakima County had not followed the agreed upon scope of work. There was a process for sending comments and those comments are attached. (Attachment 27, Attachment 30, Attachment 40, Attachment 41, & Attachment 42) WSDA and Yakima County responded to comments in the fall of 2017 but made no modifications to the NLA/NAA at that time.

This document was supposed to provide a foundation for GWMA selection of the most helpful recommended solutions to the problem of nitrates in LYV groundwater. As of July, 2018 there was no approved document and the GWAC planned to evaluate a GWMA plan without this information. Since April 2017 Yakima County has posted inaccurate information on the GWMA GIS web page that is based upon the inaccurate information in this NAA.

Among other deficiencies:

A. There was no assessment of the contribution from bio-solids
B. There was no assessment of the contribution from spray fields used by waste water treatment plants
C. The authors promised to hold meetings with local farmers and conduct local surveys. Instead they conducted telephone interviews with a few managers, crop advisors and fertilizer salesmen
D. There was no comparison of the NAA results with the GWMA Deep Soil Sampling as promised
E. Nitrogen inputs from farm animals on pasture or beef feedlots were ignored
F. There was no literature review for leakage from manure lagoons as promised
G. Nitrogen leakage from composting areas was omitted
H. The study incorrectly stated that 77% of nitrogen availability from irrigated cropland comes from apple orchards
I. The study stated that the average apple orchardist applies 60 lb of nitrogen per acre at the beginning of the season and there are 90 lbs of nitrogen per acre on the land at the end of the season.
J. The study incorrectly stated that nitrogen from alfalfa fields does not leak below the root zone. The GWMA DSS clearly showed otherwise.
K. There was no mention of nitrogen runoff to surface waters

9. Purpose Built Monitoring Wells: Since the early stages the GWAC has agreed upon the need for a network of monitoring wells. Discussions have been ongoing. The GWAC has repeatedly supported the concept and approved successive plans by consensus.

According to the document *LYVGWMA Expenditures through December, 2017* (1st Quarter Report 2018, Page 73) the GWMA has spent $584,885 ($726,887 minus $142,042 for High Risk Well assessment) on Monitoring and Assessment. Since then the GWMA has contracted with the Pacific Groundwater Group (PgG) to facilitate monitoring well installation for an additional $147,706. PgG signed this agreement in January, 2017. Nothing happened for the rest of 2017. Yakima County signed the agreement in January, 2018.

As of October, 2018 there was no network of purpose built wells in the GWMA target area. There was no plan on paper for analysis of data from the purpose built monitoring wells.

Here is the history:

A. The third objective listed in the GWMA Work Plan is to "Establish and conduct (a) long-term groundwater quality monitoring program and evaluate progress."
B. On December 3, 2013 the Pacific Groundwater Group (PgG) delivered to the GWMA a document entitled *Potential Groundwater Monitoring Station Yakima Groundwater Management Area.*
C. During the 2nd quarter of 2014 the GWAC studied the document and submitted comments and PgG responded.
D. At the October 16, 2014 meeting the GWAC approved a budget with $380,000 for a groundwater monitoring plan with planning, analysis and implementation. At the same meeting the GWAC approved the *Interim Final Groundwater Monitoring Plan – version 7* prepared by PgG.
E. At the February 19, 2015 meeting the GWAC agreed to the design of an ambient groundwater monitoring system. A Timeline that was approved concurrently (item 177) called for the GWMA to "Establish (a) Monitoring System to measure the effectiveness of (the) Work plan" by 6/19/2015
F. On December 8, 2015 Yakima County signed a contract with PgG in the amount of $37,500 to design an ambient groundwater monitoring system for the LYV GWMA.

G. PgG delivered a Technical Memorandum entitled "Draft Ambient Groundwater Monitoring Network Location Selection Method" on March 18, 2016.
H. PgG delivered a "Draft Lower Yakima Valley GWMA Proposed Ambient Groundwater Monitoring Network" on June 8, 2016.
I. During the 4th quarter of 2016 the GWAC considered the proposed Ambient Groundwater Monitoring Plan. At the November 2016 meeting the GWAC approved the plan and authorized Yakima County to move forward with contracting.
J. In January, 2017 PgG signed a $147,000 contract to facilitate placement of monitoring wells. Yakima did not sign this contract until January, 2018.
K. Throughout 2017 the GWAC anticipated the drilling of purpose built monitoring wells needed to implement the Ambient Groundwater Monitoring Plan. As of August, 2018 those wells have not been drilled. In addition there is no real plan for analysis of the data from those wells. The contract with PgG says that organization will be paid $9,150 to support that work but PgG will not be the primary author. We do not know who will lead that effort.

There is currently no way to measure GWMA success by monitoring the LYV aquifers.

10. Project Advisor: In 2014 the Work Group Chairs agreed that the GWMA work required more than part time leadership. They recommended hiring a professional to do this work. Subsequently Yakima County contracted with retired attorney Jim Davenport to fill this role. (2nd Quarter Report 2014, Page 139/139) The GWAC was not asked to participate in this decision making.

A contract signed on June 12, 2014 specifies that Consultant (Mr. Davenport) "shall assist the Director of Public Services in the performance of the County's activities as Lead Agency in the Lower Yakima Valley Groundwater Management Area (LYV GWMA), management and coordination of the Lower Yakima Valley Groundwater Management Committee (LYV GWAC), and preparation of the Lower Yakima Valley Groundwater Management Program (LYV GWMP). Consultant "shall act as Yakima County's 'project director' of the LYV GWMA, GWMC and GWMP. Payment is $4,500 per month."

Yakima County has never shared a breakdown of tasks performed by this Consultant/Project Director. Members of the GWAC have asked. As of December 31, 2017 Mr. Davenport had received $173,099.59.

Under Mr. Davenport's leadership the GWAC has examined about 260 potential solutions to the nitrate problem that were developed by Mr. Davenport. There are significant problems with the process that are described elsewhere. (See Attachment 62, Attachment 63, Attachment 82)

The first four chapters of the Groundwater Management Plan (GWMP) were presented to the GWAC on December 7, 2017:

- Introduction (Draft VI)
- Characterization of the Area (Draft VI)
- Sources of Nitrate and the Regulatory Environment (Draft VI)
- Yakima County's Role in Groundwater Quality Protection (Draft VI)

The remaining chapters required by WAC 173-100-100 were:

- A Problem Definition Section
- A Section defining Water Quantity and Quality Goals & Objectives
- A Section outlining various land and water management strategies for addressing the problems identified in the Problem Definition Section
- A Section that recommends strategies chosen from the list of identified strategies
- An Implementation Section that includes a plan for periodic review of the program

These additional chapters were released on June 18, 2018 and are now available at https://wa-yakimacounty.civicplus.com/DocumentCenter/View/16501/LYVGWMA-Program-JHD-02-26-18

The draft GWMP was evaluated by the GWAC on June 21, 2018. The plan lacks substance. For example, here is the GWMA plan, in its entirety, for a required *Monitoring System for Evaluation of Effectiveness of Recommended Action*

The Ambient Water Quality Monitoring System is intended to be comprised of at least 30 randomly placed, water-table elevation groundwater quality monitoring wells. Data from these wells will be collected sufficiently often to track seasonal variation and general water quality over time.

However . . . .
The wells have not been drilled. There is no plan for analysis of the data gathered from these wells. And a contract with the Pacific Groundwater Group to oversee the well installation states:

PGG has budgeted for installation of 20 wells, which is expected to exceed the number to be drilled.

(See 1st Quarterly GWMA Report, page 394/398)

In summary the Friends of Toppenish Creek believe that the GWMA leadership has performed inadequate oversight of contractors. This leaves the GWMA with a superficial and inadequate plan for addressing groundwater problems in the LYV.

Reason VI - Ignored Impact on the People

In Brief: The GWMA has not addressed the impact of groundwater pollution on the health and well-being of the people who live in the Lower Yakima Valley. The GWAC has ignored Environmental Justice.

Safe Drinking Water: The *Request for Identification* that Yakima County submitted in order to establish the Lower Yakima Valley Groundwater Management Area states (Attachment 2, page 6):

The primary long-term goal of the GWMA is to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards. Reductions in nitrogen loading will be demonstrated within 5 years. Progress towards identifying

and reducing the sources of groundwater contamination will be evaluated by 2013 and shared with the public. Specific objectives are listed below.

This was the promise that brought members of the GWAC to the table, the promise that we would clean up the aquifer and provide safe drinking water to the people who live in the lower valley – and we would see results in five years.

The GWMA Work Plan states:

The primary long-term goal of the GWMA is to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards.

Drinking Water System Objectives from the Work Plan are:

- *Provide water quality and hydrogeologic data to assess needs and methods of expanding public water supplies, and provide a forum for initiation of these plans.*
- *Consider options to encourage appropriate expansion of public water supplies to areas that are currently dealing with contaminated private supplies.*
- *Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications.*

Section IV of the Work Plan, Immediate Public Health Needs, states:

Approximately 75,000 persons reside within the Lower Yakima Basin area. Of that amount, it is estimated that about 25,000 residents (34% of the population) obtain their drinking water from private wells. Water quality testing conducted by various entities during the last twenty years shows that up to twenty percent of the private drinking water wells may exceed drinking water standards for nitrate. Accordingly, a conservative calculation indicates that upwards of 1,800 private wells within the area may exceed nitrate drinking water standards.

The GWAC recognizes and supports the primary long-term goal of the GWMA to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards in order to protect the health and safety of the residents of the Lower Yakima Basin, The GWAC believes, based on similar efforts within the State of Washington and the Nation, that fulfillment of this goal will undoubtedly take many years to achieve. The GWAC is very concerned about the public health effects nitrates may have on the existing residents during this period of time.

Accordingly, the GWAC will work with Federal, State, and Local governments to immediately seek funding and implement programs to provide clean drinking water to the residents of the Lower Yakima Basin.

The last paragraphs above were added in February, 2013 at the request of community and environmental representatives. The GWAC was struggling to compile the Work Plan and members complained that public health was missing. We asked for measures to address public health. The GWMA leadership obligingly wrote some nice words . . . and proceeded to ignore the commitment.

To be clear:

1. The GWAC has not sought funding to provide clean drinking water to the residents of the Lower Yakima Basin
2. Yakima County returned $150,000 that was appropriated to help residents of the LYV access clean drinking water
3. People who live in the LYV probably spend $1 million ever year on bottled water
4. The adverse impact of elevated nitrates in LYV drinking water is unknown

Failure to Inform: To educate children about a dangerous situation it is sufficient to give explicit instructions:

- Wash your hands after you go to the bathroom

- Put on a coat, it is cold outside
- Eat your vegetables

To educate adults it is important to explain why certain actions are important.

- It is important to send your children to school every day so they won't miss important lessons and fall behind
- Vote for this bond so the public works department can fix the roads

The GWMA Education and Public Outreach worked hard to convince people to maintain their septic systems and protect their wells – to prevent nitrate contamination of drinking water. But the EPO failed to tell people about the elephant in the room.

The GWMA has failed to inform the public about the real reason for the groundwater contamination in the valley:

A. 35% of all the milk cows in Washington State are confined in the 273 square area that comprises the LYV GWMA. This is like having a city of 2.5 million people with no sanitation.
B. Dairies in the GWMA target area do not follow their nutrient management plans and this means that nitrate from the dairies leaches to the groundwater
C. 61% of domestic wells one mile downgradient from the "dairy cluster" have water that is unsafe for drinking. Septic system maintenance and water testing will not change this. The only way to change that fact is for dairies to properly manage their manure.
D. Pollution of the groundwater is illegal, but no one is charged with a crime

The GWMA has failed to inform the public about studies that connect high nitrate levels in drinking water to a number of adverse health issues.

A. We know with certainty that high nitrate levels cause reproductive problems in cattle (Ozmen et al, 2005)
B. There are case histories of spontaneous abortions among women whose well water has high nitrates (Ward et al, 2005)

C. There are case histories of blue baby syndrome in children who drank formula made with well water that had nitrates around 20 mg/L (Knobeloch et al, 2000)
D. Epidemiological studies show a correlation between elevated nitrates and birth defects, heart disease and some cancers (Ward et al, 2005; Brender et al, 2004)
E. A 2009 study in south central Washington found higher levels of methemoglobin in infants from homes with nitrate contaminated well water (VanderSlice, 2009)
F. FOTC submitted a list of credible research that describes the health impacts from elevated nitrate levels in water. The GWMA ignored that list and has not posted it on the GWMA website. (Attachment 29)

Environmental Justice:

> *Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.*
>
> (EPA, 2018f)

This means that in a community such as the LYV where most residents are people of color, where many live in poverty, there should not be a heavier burden such as polluted water. And . . . when problems are identified the people who are impacted must be involved in seeking solutions.

In 2010 when the EPA came to the Yakima Valley to study our issues they designated us an Environmental Justice Showcase Community. This meant that we would be a shining example of Environmental Justice at work. Sadly, the word Environmental Justice is absent from all the GWMA proceedings. Some members of the GWAC have openly rejected the concept. (Attachment 43)

In early 2012, as the GWMA began to take shape, this writer arranged for a meeting between Commissioner Rand Elliott and three women of color who then worked for Radio KDNA, the only public radio station for farmworkers in the United States. The hope was

that he would get to know them and consider them for membership on the GWAC. On the scheduled day we waited for an hour and the commissioner never arrived. We called the courthouse and he responded that he had failed to put the meeting on his official calendar. End of story. The commissioner did not re-schedule and the meeting never took place.

FOTC asked to have meeting summaries translated into Spanish for the large LYV population that speaks English less than well. The EPO Work Group rejected the idea as not cost effective. FOTC asked to have GWMA meetings recorded for accuracy. The request was denied.

Meeting announcements are published in the county's largest English language newspaper. They are not published in any of the Spanish language newspapers and are not announced on either English or Spanish radio.

In 2013 the GWAC went to great lengths to develop and approve a Power Point for community presentations. The purpose was to agree on language that presented the situation without bias. The Power Point was never translated into Spanish.

Two women of color from Radio KDNA volunteered to serve on the EPO work group. They spent a great deal of time working with a professor from the University Of Washington School Of Public Health on a project that would bring ten graduate students to the valley to assist the GWMA with public outreach. A dairywoman on the committee organized resistance to the plan and defeated the project. Why? She did not like the text book for the class, *Fresh Fruit, Broken Bodies,* which chronicled the experience of a physician and anthropologist who traveled with a group of Oaxacan farmworkers on their journeys from California to Washington.

In early 2017 FOTC asked the EPO to develop educational information in Spanish that explained concepts that are central to understanding the GWMA work. We composed several one page pieces that talk about the roles of EPA and Ecology, movement of groundwater through the soils, and a description of agronomic rates. The EPO never even discussed the proposal.

The only Hispanic representative on the GWAC missed all GWMA meetings for 2017. Late that year FOTC brought this to the attention of the GWMA leadership and introduced two people who are well connected in the Latino community and were willing to take his place. There were meetings and conversations. David Bowen, Ecology's GMWA oversight manager, elected to contact the absent representative and bring him back to the group.

As of July, 2018 there are no plans to educate the public in English or in Spanish about the GWMA activities in preparation for public meetings on the final GWMA plan. People will be invited, with translators present, and they will be quickly overwhelmed with technical jargon.

Reason VII – Funding Failure

In Brief: The GWMA has used up $2.3 million and left a program with no funds for implementation and no road map for how to obtain funds.

Early in the GWMA project several members of the GWAC signed up for the Funding Work Group but the GWMA leadership did not schedule meetings. The Funding Work Group did not meet until the summer of 2017 and then for only three meetings. None of the identified tasks were completed.

Now the GWMA Plan is awaiting approval and 43 out of 54 the proposed alternative solutions will require the implementing agencies to find their own source of funding. This is hard work that the GWMA was supposed to facilitate by laying the groundwork, writing model ordinances, policy statements, interagency agreements, and proposed legislative changes.
It is easy to say, for example, in Recommended Solution RCIM 2:

> *Yakima County should "Perform an engineering study of water supply alternatives."*

It is something else to provide the implementing agencies with the tools to follow through. There is no road map for how to acquire funding; no description of what a study would

look like, not even supporting statements to justify the need. If we wanted a study of water supply alternatives we were supposed to perform one.

Beginning on page 18, the GWMA Work Plan describes the role of the Funding Work Group.

5.0 Funding

5.1 Problem Definition — Determine funding short-term and long-term needs

a. Data Collection, Characterization, Monitoring (DCCM)

b. Livestock & CAFO - Yards, corrals, lagoons, manure field application

c. Irrigated Agriculture

d. Pollutants from Residential, Commercial, Industrial, Municipal and Domestic

e. Regulatory Framework

f. Education and Outreach

g. Prepare and submit funding needs to GWAC

h. Incorporate GWAC comments and prepare final report

5.2 Funding Strategy - Determine and develop short-term and long-term funding Strategy

a. Data Collection, Characterization, Monitoring (DCCM)

b. Livestock & CAFO - Yards, corrals, lagoons, manure field application

c. Irrigated Agriculture

d. Pollutants from Residential, Commercial, Industrial, Municipal and Domestic

e. Regulatory Framework

f. Education and Outreach

g. Prepare and submit funding needs to GWAC

h. Incorporate GWAC comments and prepare final report

5.3 Implementation - Seek and apply for all funding opportunities local, state, federal including private-public venture

a. Seek aid obtain private, local, state, federal and tribal financial assistance

b. Prepare and submit preliminary funding strategy status report to GWAC

c. Incorporate GWAC comments, finalize final grant report and submit to Ecology

5.4 Monitoring - Develop a long-term monitoring system for evaluating the effectiveness of each strategy and where to spend effort, time and funding

5.5 Review - Develop a plan and process for the periodic review of funding needs and where to obtain funding

5.6 Develop GWMA Program Report (combine with other workgroups)

5.7 Submit Final GWMA Program Report (combine with other workgroups)

The Funding Work Group has failed to do this.

WAC 173-100-100 (4) requires a GWMA plan to include:

An alternatives section outlining various land and water use management strategies for reaching the program's goals and objectives that address each of the groundwater problems discussed in the problem definition section. If necessary, alternative data collection and analysis programs shall be defined to enable better characterization of the groundwater and potential quality and quantity problems. Each of the alternative strategies shall be evaluated in terms of feasibility, effectiveness, cost, time and difficulty to implement, and degree of consistency with local comprehensive plans and water management programs such as the coordinated water system plan, the water supply reservation program, and others. The alternative management strategies shall address water conservation, conflicts with existing water rights and minimum instream flow requirements, programs to resolve such conflicts, and long-term policies and construction practices necessary to protect existing water rights and subsequent facilities installed in accordance with the groundwater management area program and/or other water right procedures.

Summary

Nitrate contamination of groundwater in the Lower Yakima Valley is a worsening problem that threatens the well-being of people who live in the area on many levels. Nitrates in groundwater endanger the health of humans and animals, are linked to other pollutants, and contribute to pollution of surface waters. Efforts to address the problem often lead to worsening air quality.

Since 2012 the LYV Groundwater Management Area has studied the problem through research that includes a public survey of rural LYV residents, deep soil sampling, domestic well testing and a nitrogen availability assessment. The data has not been well analyzed.

There are several potential nitrate sources but one stands out from all the others – Concentrated Animal Feeding Operations. Dairy CAFOs at one LYV hot spot have caused 61% of domestic wells one mile down gradient to be unsafe for human consumption. Nitrate levels in CAFO monitoring wells have been measured as high as 234 mg/L. The likely routes for nitrate movement to groundwater are leaching from manure lagoons, pens and compost areas, along with over-application of manures to cropland.

Efforts to address nitrate pollution of groundwater began in the 1990's with the development of best management practices for agriculture and the institution of a regulatory approach under the WA State Dairy Nutrient Management Act, RCW 90.64. These efforts span at least 25 years. In spite of the allocation of public and private resources and much hard work the trend of increasing nitrate levels continues.

Dairies are financially unable to take all the measures necessary for groundwater protection under this intensive form of agriculture. Indeed, some dairies are going bankrupt and medium sized dairies in Yakima County are being absorbed by mega-dairies. It is difficult to ask the many low income people who live in the GWMA target area to support allocation of public monies for continued support of this struggling industry when there are so many other pressing needs; when other forms of agriculture cause fewer side effects.

A cost effective solution is to control the number of animals per acre in the LYV. The soils, water and air can absorb a certain level of nitrate contamination. There is a tipping point after which the costs to address associated problems exceed any benefits from sale of milk products. We have passed that tipping point.

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BOCC307-2014 Interlocal Agreement with South Yakima Conservation District for Deep Soil Sampling dated July 15, 2014 (Page 161/169)

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Interlocal Agreement between Yakima Health District and Yakima County (Page 74/80)

Fourth Quarter 2015

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Pacific Groundwater Group (PgG) Agreement with Yakima County dated December 8, 2015 (Page 68/76)

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Second Quarter 2016

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Landau Associates "Deep Soil Sampling Program Fall 2014; Spring 2015; Fall 2015; Spring 2016 Preliminary Data Analysis PP (page 123/211)

PgG's report "Draft Lower Yakima Valley GWMA Proposed Ambient Groundwater Monitoring Network June 8, 2016 (Page 152/211)

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Draft Nitrogen Availability Assessment and Attachments (Page 116/302)

Jean Mendoza's May 18 Alternatives Presentation (Page 218/302)

"What You Can Do to Protect Well Water" English/Spanish Flyer (Page 241/302)

RCIM Final Report to the GWAC (Page 244/302)

Groundwater Quality Regulation in Washington (Page 252/302)

Draft Livestock/CAFO Working Group Report to the GWAC (Page 283/302)

LYV GWMA Groundwater Management Plan – Livestock/CAFO (Page 290/302)

GWAC Work Plan Excerpt – Funding Working Group (Page 302/302)

Third Quarter Report 2017

http://www.yakimacounty.us/DocumentCenter/Home/View/15497

Includes:

Work Group alternatives with WG recommendations 6-22-17 (The original alternatives list presented to the GWAC) (Page 113/140)

Copy of the GWMA Survey Report after GWAC 9.21.17(GWAC's September 21 version) (Page 127/140)

Fourth Quarter Report 2017

https://www.yakimacounty.us/DocumentCenter/View/16458/2017-4th-Quarter-Report

Includes:

GWMA Strategies Spreadsheet – Comprehensive List of Blue Alternatives before 10-5-17 meeting

GWMA Strategies 12-1-17 JHD

First four GWMA program chapters presented to the GWAC on December 7, 2017:

- Introduction (Draft VI)
- Characterization of the Area (DRAFT VI)
- Sources of Nitrate and the Regulatory Environment (Draft VI)

- Yakima County's Role in Groundwater Quality Protection (Draft VI)

GWAC member comment form

2017_1102 Summary of NAA Comments

October 19 presentation Map, Identifying the GIS layers in the GWMA

First Quarter Report 2018

https://www.yakimacounty.us/DocumentCenter/View/17248/2018-1st-Quarter-Report

Includes:

Master GWMA Strategies, 1-29-18

Horizon 2040_YC Comprehensive Plan – Water Quality Goals and Objectives

GWMA LTD-2017, 12-13-17 Prelim

PGG Preliminary Drill Sites 1-30-18

Index for 3.1.2018 Program Release to GWAC

LYVGWMA Program JHD, 02-26-18

MR_Deep Soil Sampling (DSS) in the Lower Yakima Valley GWMA

MR_Draft Deep Soil Sampling Analytical Analysis

Analysis of DSS Attachment 1 – 204 03 28 Deep Soil Sampling Plan

Analysis of DSS Attachment 2 – DSS PowerPoint

DSS Presentation to LYV GWMA Data WG

Soil Types and GWMA DSS

Amendment Number 1 to Agreement C1600074

Contract between Yakima County and PGG for the Monitoring Well Installation

PACIFIC groundwater GROUP

Request For Identification
Lower Yakima Valley
Groundwater Management Area

June 2011

REQUEST FOR IDENTIFICATION
LOWER YAKIMA VALLEY GROUNDWATER MANAGEMENT AREA

Prepared for:

Yakima County
128 N. Second Street
Yakima, WA 98901
(509) 574-2300
www.yakimacounty.us/PublicServices

Prepared by:

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2377 Eastlake Avenue East, Suite 200
Seattle, Washington 98102
206.329.0141
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June 2011

GWMA Petition Draft v8.doc

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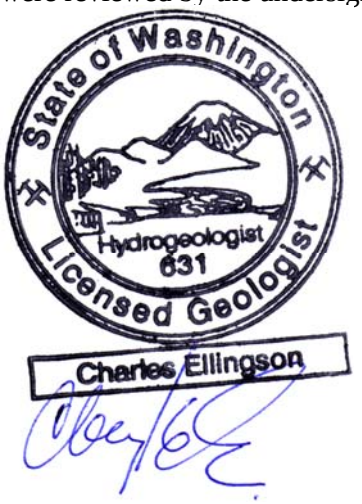
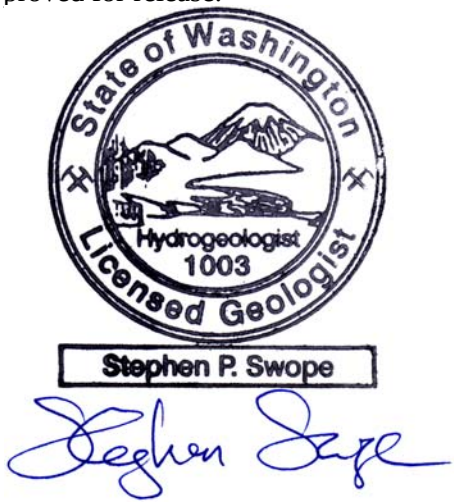
SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.





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1.0 INTRODUCTION

This report serves as a request to the Department of Ecology from Yakima County to form the Lower Yakima Valley Groundwater Management Area (GWMA). This report contains all elements required under WAC 173-100 (Groundwater Management Areas and Programs) including supporting data, the proposed GWMA boundary and rationale, goals and objectives of the GWMA, estimated costs, potential funding sources, recommended members of the Groundwater Advisory Committee (GWAC), and the recommended lead agency.

The proposed GWMA is a response to elevated nitrate concentrations in groundwater in Lower Yakima Valley (LYV). The concentrations detected in groundwater indicate impact by human activity and are significant to human health. This issue was first identified by grass roots organizations such as Community Association for Restoration of the Environment (CARE) and Concerned Citizens for the Yakima Reservation (CCYR) as early as 1997. The issue was more recently publicized in a series of articles entitled "Hidden Wells, Dirty Water" which ran in the Yakima Herald Republic in 2008. These articles detailed the Valley's nitrate issues affecting public and private wells. The reporter suggested that the issue should be addressed by United States Environmental Protection Agency (EPA) via Section 1431 of the Safe Drinking Water Act (SDWA). Section 1431 is an emergency order to address water supply hazards[1]. The articles cited a lack of coordination between local, state and federal agencies which aggravated the problem. The county permits land use, Department of Agriculture permits most dairies and agricultural activities, and under authority delegated by EPA, the Department of Ecology oversees water quality programs and the permitting of some dairies.

EPA responded by facilitating public meetings along with other state and local agencies in December 2008, February and October 2009, and June 2010. In November 2009, the Yakima Valley was designated as an EPA Environmental Justice Community. Also, on January 25, 2010, EPA issued a finding in support of the use of SDWA Section 1431 to address the contamination. EPA found that groundwater in the Yakima Valley is an underground source of drinking water which is contaminated, and that this contamination may present an imminent and substantial endangerment to human health. Sampling was conducted by EPA in February and April, 2010, under the authority of SDWA Section 1431.

The Washington State Department of Ecology along with four other county, state, and federal agencies published a report (Ecology, February 2010) titled Lower Yakima Valley Groundwater Quality Preliminary Assessment and Recommendations Document. The report summarized the nitrate and coliform issue in the LYV and was based on earlier technical reports and technical data obtained by:

- The Washington Department of Ecology
- The Washington State Department of Agriculture
- The Washington State Department of Health

[1] The EPA's enforcement authority to protect and clean up contaminated drinking water is codified in Section 301i of the Safe Drinking Water Act (SWDA) but is generally referred to as Section 1431.

- The Yakima County Public Works Department
- The United States Environmental Protection Agency

Much of the information provided in this report is derived from the February 2010 Preliminary Assessment report.

The report identified a number of regulatory options for addressing the elevated nitrate concentrations including establishment of a Groundwater Management Area (GWMA), Special Protection Area, Aquifer Protection Area, Sole Source Aquifer, Watershed Management Plan, and Total Daily Maximum Load (TMDL). Of these options, the Yakima County Commissioners selected to establish a GWMA and signed an interagency agreement with Ecology in September of 2010.

GWMA is focused on groundwater quality with the primary focus as nitrate contamination. However, the GWAC may elect to add other groundwater constituents such as bacterial contamination at a later date.

2.0 POTENTIAL HEALTH EFFECTS OF NITRATE

The Preliminary Assessment report estimated that over 2,000 people in the LYV are exposed to nitrate over the maximum contaminant level (MCL) through their drinking water. (Population of area is 71,400, 34% of these residents are on private wells, and about 12% of private wells exceed the nitrate MCL).

Nitrate is an acute contaminant, which means a single exposure can affect a person's health. It reduces the ability of red blood cells to carry oxygen. In most adults and children these red blood cells rapidly return to normal. However, in infants it can take much longer for the blood cells to return to normal. Infants who drink water with high levels of nitrate (or eat foods made with nitrate-contaminated water) may develop a serious health condition due to the lack of oxygen and, if untreated, may die. This condition is called methemoglobinemia or "blue baby syndrome."

Studies have found an increased risk of spontaneous abortion or certain birth defects if the mother drank water high in nitrate. Women who are pregnant or trying to become pregnant should not consume water with more than 10 mg/L of nitrate. Low levels of nitrate have been found in breast milk, but the levels are not high enough to cause "blue baby syndrome." Adults with reduced stomach acidity, and individuals deficient in the enzyme that changes methemoglobin back to normal hemoglobin are susceptible to methemoglobinemia.

For more information about the health effects of nitrate in drinking water, see Appendix B, Nitrates and Drinking Water of the Lower Yakima Valley Groundwater Quality Preliminary Assessment and Recommendations Document (Ecology 2010).

3.0 LOCAL HYDROGEOLOGY

Lower Yakima Valley is the valley surrounding the Yakima River between Union Gap and Benton City (Figure 1). On the north it is bounded by the Rattlesnake Hills, and on the south it is bounded by the Horse Heaven Hills and Toppenish Ridge. Politically it is composed of unincorporated Yakima County, the Yakama Nation reservation, and the Cities of Benton City, Prosser, Grandview, Mabton, Sunnyside, Granger, Zillah, Toppenish and Wapato. Land and water use is dominated by agriculture on and off the reservation.

Groundwater in the LYV originates as precipitation, infiltration from streams, and from irrigation and stock water that infiltrates into the ground from canals, fields and spray-fields. Infiltration of septic tank effluent and stock water overflow also recycles water locally and results in groundwater recharge. Annual precipitation ranges from about 6 to 9 inches, while groundwater recharge is estimated to range from 7 to over 25 inches per year in irrigated areas and an inch or less in unirrigated areas (Vaccaro and Olsen, 2007,). With much of the land in the LYV used for irrigated agriculture, local recharge rates are significantly higher than precipitation due to the application and leakage of irrigation water.

Recharge water may be contaminated by human activities. After recharge, the groundwater and possible contaminants move laterally and vertically toward wells, drainage ditches, and the Yakima River and its tributaries. The US Geological Survey has mapped shallow groundwater flow paths (Figure 1).

If not intercepted by wells, shallow groundwater generally moves toward the Yakima River and its tributaries from the uplands on both sides of the valley (Figure 1). Where the river water level is lower than the adjacent groundwater elevation, groundwater will flow into the river from both sides. In these cases the river is a hydrologic boundary for shallow groundwater and shallow groundwater does not pass to the other side of the river. However, the boundary effect depends on the relative elevations of the river and groundwater; therefore, changes in recharge, pumping, river level changes, and the basin-and-ridge geology of the valley affect the boundary relationship. USGS research suggests that in some river reaches in some seasons, the groundwater level is lower than the river and the river therefore loses flow to the ground. In those cases the river may not be a regional hydrologic boundary (groundwater may move laterally below the river). Finally, deeper aquifers are less influenced by the river than are shallow aquifers.

Drinking water supplies in LYV are met primarily by wells that pump groundwater. Individual domestic wells tap permeable portions of a surficial sedimentary aquifer, while most municipal wells tap deeper aquifers in basalt (lava bedrock) and sedimentary interbed layers that underlay the sediments.

Shallow layers of the sedimentary aquifer (less than ~100 ft below ground) may not be overlain by protective (low permeability) layers (ie: they may be “unconfined”) whereas deeper layers of the sedimentary aquifer and the basalt aquifers are usually overlain by protective layers (ie: they are “confined”). Confined aquifers are usually deeper and are more protected by low permeable layers than are unconfined aquifers; however, they may nonetheless be subject to contamination by human activities. In the case of LYV, the Preliminary Assessment Report of 2010 identified that wells up to 300 feet deep were much

more likely to contain groundwater with nitrate concentration above the MCL of 10 mg/L than were deeper wells. Because of the slow movement of groundwater, deeper aquifers may become contaminated in the future, and take more time to recover after reductions in nitrogen loads.

Deeper wells in the area are generally completed in lower portions of the sediments and in the Columbia River Basalts (bedrock aquifer) and interbed layers. Some wells completed in basalt are shallower than wells completed in sediments due to differences in sediment thickness. The basalt aquifer is generally semi-confined and is composed of numerous distinct aquifers present in zones between the basalt flows. The extent of connection between the basalt aquifers at different interflow zones is documented in recent and pending published reports (Vaccaro et al, 2009) by the USGS. Most municipal and irrigation wells are completed in the deeper sedimentary and bedrock aquifers.

4.0 NITROGEN LOADING AND GROUNDWATER CONTAMINATION

Agriculture is the primary economic and land use activity in the LYV. Approximately 70 to 80 % of the LYV (including Yakama Nation lands) is used for agriculture. Most cropland in the area is irrigated. Major irrigation districts include the Roza, Sunnyside Valley, Grandview, Zillah, and the Wapato Irrigation Project. Major agricultural commodities produced in the valley include fruit (apples, pears, cherries, peaches, grapes), vegetables, hay, mint, corn, milk, and hops. Nitrogen is an essential nutrient for growing crops. It is taken up by roots along with water. It occurs naturally in soil, but to increase plant growth it is added to soil by farmers in the form of chemical fertilizer, manure, and compost.

As noted above, manure contains abundant nitrogen. In LYV, manure is produced primarily by cattle, many of which are concentrated in dairies and feedlots. Dairy operations were greatly expanded starting in the late 1980's. Also, animal feeding operations operate at various sizes from small home lots to large commercial feedlots. The dairies and animal feeding operations are concentrated in the lower parts of the valley in and around the cities of Zillah, Sunnyside, Grandview, Mabton and Granger, although some occur in more dispersed parts of the valley on the Yakama Reservation.

Agricultural practices, the use of fertilizer, and the management of manure are linked to nitrogen loading and incidents of nitrate contamination in groundwater. They can be significant inputs of nitrogen into the environment, but they may not be the only source. Other sources include on-site waste disposal systems, and residential and urban use of fertilizers.

The natural level of nitrate in groundwater is generally less than 0.3 mg/L. Many samples from pristine areas of the Yakima Valley have results in this range or below. Concentrations above 0.3 mg/L indicate additional nitrate has been introduced from some land use that involves organic waste or fertilizer or, less commonly, natural processes. With the introduction of agriculture over the last 100 years nitrate levels have risen above the natural level in a wide area of LYV (Figure 1). Based on the 2010 Preliminary Assessment report, approximately 12% of wells sampled in the LYV exceeded the maximum contaminant level (MCL) for nitrate of 10 mg/L. Approximately 21% of wells

sampled showed elevated nitrate levels in the range of 3-9.9 mg/L, and 67% of wells were less than 3 mg/l.

Subsequent to publication of the Preliminary Assessment, EPA reported sampling 337 private wells (approximately 1% of ground-water users in the Valley) for nitrate and bacteria between February 22nd and March 6th 2010 (USEPA, 2010). EPA reports that 21 percent of the wells sampled (70 wells) had nitrate levels greater than the EPA drinking water standard of 10 mg/L and that concentrations up to four times the drinking water standard were documented.

The population in the LYV is served by a mix of public and private water supplies. The public systems primarily serve the communities and the private wells are used in the more rural areas. It is estimated that approximately one third of valley residents rely on private wells for drinking water (Ecology, February 2010).

Many private wells in the area draw from the shallow portion of the sedimentary aquifer, while public systems tend to rely on deeper wells or a mix of sources. The historical water quality data reviewed as part of the 2010 study (Figure 1) suggests that 12 percent of residents who rely on individual private wells in the LYV may drink water which exceeds the nitrate-nitrogen drinking water MCL of 10 mg/l. It is not lawful for public water utilities to serve water with a nitrate concentration above the MCL; however, private water supplies are unregulated, and often not measured. There is some data to suggest that in addition to nitrate contamination, the most vulnerable wells are also at risk of bacterial contamination (Total coliform and fecal coliform bacteria).

5.0 DESCRIPTION OF PROPOSED BOUNDARY

Yakima County proposes the area of Lower Yakima Valley from Union Gap to Benton City, minus the Yakama Reservation, be designated as the Ground Water Management Area (GWMA). Areas outside LYV were not included regardless of environmental and hydrogeologic characteristics. The GWMA boundary is presented in Figure 2. This region of Yakima County has an area of approximately 512 square miles.

Yakima County proposes to facilitate the formation of a GWMA on non-reservation land. It is expected and important that the Yakama Nation be an active participant in Yakima County's GWMA process. The Yakama Nation plans to develop a program similar to the GWMA to reduce nitrate groundwater contamination on the reservation, and Yakima County expects to participate in that process. Coordination of the efforts will make the efforts more effective, and recognizes that political boundaries are typically not hydrologic boundaries.

5.1 BOUNDARY DEFINITION PROCESS

Most of the southwestern boundary of the proposed GWMA is defined by the Yakama Nation reservation (Figure 2), which is coincident with the Yakima River in this part. At the southeastern end of the reservation near Mabton, the proposed GWMA boundary extends south of the river to the Horse Heaven Hills using the geologic, water quality, and land use process described below.

The northern and southeastern boundaries were established to surround the portion of LYV that has a potential for elevated groundwater nitrate. That potential was evaluated using a number of data sources including:

- US Geological Survey nitrate vulnerability map (USGS, 2008)
- Surficial Geology (Department of Natural Resources, 100K map)
- Extent of irrigated agriculture
- Nitrate concentrations in groundwater from Washington State Department of Health, Valley Institute for Research and Education (Sell and Knutson, 2002), Yakima County, and the US Geological Survey NWIS database.

Most wells with elevated nitrate concentrations in the three water quality studies referenced above are completed in shallow portions of the sedimentary aquifer. The extent of elevated groundwater nitrate concentrations roughly coincides with the extent of the sedimentary aquifer and the agricultural land uses above it. This extent also coincides with the 40 percent probability that the nitrate concentration will be greater than 2 mg/l as defined by the US Geological Survey (2008). Where the boundary suggested by one data source extended further than others in a particular area, the boundary was defined conservatively in that the greatest extent was used as the boundary (within the confines of the LYV). The process was conducted at a precision of one mile and thus used the closest section line that encompassed the extent of nitrate concentrations greater that 1 mg/l, the 40 percent probability line, the area of irrigated agriculture as determined by topography and aerial photography, and as much of the sedimentary aquifer in the LYV as possible as determined by geologic mapping.

6.0 GOALS AND OBJECTIVES

The GWMA will be a multi-agency, citizen-based, coordinated effort to reduce groundwater nitrate contamination in the lower Yakima Valley. It will receive input from people affected or interested in the problems and solutions and will coordinate their energies toward action. It will work to achieve credibility with the general public and the farming community.

6.1 GWMA GOAL

The primary long-term goal of the GWMA is to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards. Reductions in nitrogen loading will be demonstrated within 5 years. Progress towards identifying and reducing the sources of groundwater contamination will be evaluated by 2013 and shared with the public. Specific objectives are listed below.

6.2 PROPOSED OBJECTIVES

Objectives have been divided into six categories: Data and Monitoring, Problem Identification, Measures to Reduce Groundwater Contamination, Education, Drinking Water Systems, and General objectives. Input from the GWAC and citizen input will be used to

refine and prioritize objectives. In general, refinement of objectives in each category will begin with an updated assessment of the current status of work. For instance, pending work includes publication of EPA sampling data and evaluations.

DATA AND MONITORING

- Collect and incorporate existing nitrate and nitrogen data into a shared data management system or data sharing site to improve understanding of the sources and extent of contamination.
- Establish a monitoring program to identify sources of nitrate contamination and their relative importance.
- Establish and conduct long-term groundwater quality monitoring program and evaluate progress.

PROBLEM IDENTIFICATION

- Characterize the nature and extent of nitrate concentrations in Lower Yakima Valley groundwater.
- Identify and rank the sources of elevated nitrate in groundwater, with site-specific characteristics developed for "hot spots" as appropriate.
- Identify and describe activities contributing to groundwater contamination based on scientific data and evaluation. Scientific and other data will be shared among the partners to facilitate development of effective programs and strategies.

MEASURES TO REDUCE GROUNDWATER CONTAMINATION

- Develop effective and coordinated best management practices (BMPs) to address specific nitrate sources.
- Develop strategies for implementing best management practices such as technical assistance, education, ordinances and coordination with other regulatory and non-regulatory programs.
- Support enforcement of new and existing laws and ordinances.

EDUCATION

- Establish educational programs to promote the protection of groundwater quality and provide a forum for stakeholders to discuss nitrate reduction methods and improvement of groundwater quality. This will include culturally-appropriate education and outreach.
- Establish a clearinghouse for pertinent public health, environmental, and business information.
- Educate private well owners on water quality testing methods, frequencies, interpretation of results, and funding sources.

DRINKING WATER SYSTEMS

- Provide water quality and hydrogeologic data to assess needs and methods of expanding public water supplies, and provide a forum for initiation of these plans.
- Consider options to encourage appropriate expansion of public water supplies to areas that are currently dealing with contaminated private supplies.
- Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications.

GENERAL

- Pollution prevention will be a guiding principle for all work done by the GWMA.
- Participation by the Yakama Nation will be requested and encouraged in a way that is consistent with their sovereignty.
- Participating agencies will maintain their regulatory authority using their own discretion as appropriate. They will also seek opportunities to coordinate actions and address regulatory gaps.
- The GWMA will seek sustainable funding sources to carry out its mission.

7.0 RECOMMENDED ADVISORY COMMITTEE MEMBERS

The following list presents the recommended GWAC members. The final list will be determined by the Department of Ecology.

CITIZENS

- Environmentalist
- Environmental Justice representative
- Hispanic Community Leader
- Group B groundwater user groups or systems

GOVERNMENTAL

- Yakima/Benton County Commissioners
- Yakama Nation
- Representative for cities – Sunnyside, Granger, Zillah, Mabton, Grandview, Prosser, Benton City

AGENCIES

- Farm Bureaus of Yakima/Benton County
- Department of Ecology

- Department of Agriculture
- South Yakima/Benton Conservation Districts
- Department of Health
- Yakima/Benton County Planning Agencies
- County Health Districts (Yakima/Benton)
- Environmental Protection Agency
- USGS
- USDA Natural Resource Conservation Service

BUSINESS

- Washington Dairy Federation and/or Cattlemen's Assn
- Crop or Fertilizer Group
- Representative for Port Districts
- Sunnyside-Roza Joint Board of Control representative

8.0 ESTIMATED TWO YEAR COSTS AND FUNDING SOURCES

This section provides an estimated cost for the first two years of development and administration of the Ground Water Management Program for the Lower Yakima Valley GWMA. The estimate includes many assumptions, including that GWAC members volunteer their time or are paid for their participation through other budgets. The subsequent section presents potential funding sources. Note: Coordination with the parallel Yakama Nation process is important and expected.

Task 1. Plan Development and Administration **$300,000**

Establish GWAC - Interview Members (21)

Produce quarterly status reports (8)

SEPA checklist (existing info only)

Develop GWMA plan elements

Develop draft and final plan

Seek adoption by County Commissioners

Grant funding application and administration

Coordinate with Yakama Nation nitrate pollution reduction process

GWAC meeting facilitation by neutral third party (8)

Project Communication

Invoicing and accounting

Task 2. Monitoring and Characterization **$150,000**

Collect and organize existing data
Design and implement area-wide database
Identify needs for additional data (SAP/QAPP)
Design, establish, and commence long term monitoring program
Conduct groundwater sampling
Analyze data and evaluate progress
Produce draft and final report on nitrate
Assess needs for expanding public water systems

Task 3. Public Information and Outreach **$100,000**

Conduct periodic public meetings (four semiannual) including interpretation
Develop and distribute informational materials
Coordinate outreach with community and stakeholder groups
Coordinate with potential sources not represented on GWAC
Develop/support educational programs
Maintain stakeholder and community contact list
Conduct media relations including 4 news releases
Attend fairs and festivals (4)

Task 4. BMP Implementation and Field Research **$200,000**

Evaluate/ Facilitate implementation of BMP's
Characterize priority locations for BMP applications
Evaluate existing permits and mandatory protection measures
Evaluate available BMPs (includes field evaluation)
Identify research needs & begin projects
Recommend mandatory BMPs if necessary
Develop comprehensive BMP guidance for GWMA
Recommend rulemaking activities, enforcement strategies, and/or legislation

Total Cost (2-year budget) **$750,000**

The budget above is an estimate based on experience with other GWMAs, the actual scope and budget will likely be modified by the GWAC once it is convened.

8.1 POTENTIAL SOURCES OF FUNDING

The cost of developing the program over a two-year period is estimated at $750,000. Funds may be made available through special allocations or competitive grants such as Centennial Clean Water grant program, the Clean Water Act Section 319 grant program, and the Revolving Fund loan program. Additionally, the Washington State Departments of Agriculture, Ecology, and Health; the Conservation Commission; Washington State University; and the U.S. EPA will be encouraged to actively seek additional funding as may be needed during pursuit of GWMA goals. Some percentage will likely be funded by the local participating agencies either in the form of money or in-kind services. The budget shown only covers plan development and early action implementation during the first two years. Full scale implementation costs will be based on the plan developed and funds available.

During the course of the Ground Water Management Area process, Yakima County will serve as the lead fiscal agent through which state and federal money will pass.

9.0 REFERENCES

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USEPA. 2010. Summary of EPA Sampling Activities, June 2010. Accessed at http://yosemite.epa.gov/R10/WATER.NSF/GWPU/lyakimagw on May 30, 2011.

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Vaccaro, J.J., and Olsen, T.D., 2007, Estimates of ground-water recharge to the Yakima River Basin aquifer system, Washington, for predevelopment and current land-use and land-cover conditions: U.S. Geological Survey Scientific Investigations Report 2007-5007, 30 p.

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Figure 1

Lower Yakima Valley Groundwater Management Area Vicinity Map

PgG

Union Gap
Wapato
Zillah
Toppenish
Granger
Sunnyside
Grandview
Mabton
Prosser
Benton City
Yakama Nation
Toppenish Ridge
Rattlesnake Hills
Snipes Mountain
Horse Heaven Hills
Rattlesnake Mountain
Red Mtn
Yakima County
Benton County
Yakima R
Toppenish Cr
Satus Cr
Mule Dry Cr
Spring Cr
Cold Cr
Glade Cr
Glade Cr E Br
82
24
241
240
223
97
224
22
221
950
900
850
800
750
650
1000
775
700
600
550
500
450

Wells with Nitrate Sample Results
- 10.0 - 20.0
- 20.1 - 100.0

Nitrate data souces included in Section 5.1

- Yakama Nation Boundary (from WSDOT)
- Extent of USGS Structural Subbasin*
- Generalized Groundwater Elevations (feet)*
- Flow Direction*

* from USGS SIR 2006-5116

N

0 Miles 5

Image derived from Landsat 7 data (1999 - 2002)

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Figure 2

Proposed Boundaries of Lower Yakima Valley Groundwater Management Area

PgG

Union Gap
Wapato
Zillah
Toppenish
Granger
Sunnyside
Grandview
Prosser
Mabton
Benton City
Yakama Nation
Yakima County
Benton County
Rattlesnake Hills
Rattlesnake Mountain
Snipes Mountain
Toppenish Ridge
Horse Heaven Hills
Yakima R
Toppenish Cr
Satus Cr
Mule Dry Cr
Spring Cr
Cold Cr
Red Mtn
Glade Cr
Glade Cr, E Br
82
24
240
241
223
97
224
22
221

GWMA Boundary (Proposed)
Yakama Nation Boundary (from WSDOT)

N
0 Miles 5

Image derived from Landsat 7 data (1999 - 6/2011)

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Technical Memorandum #1

To: **Don Gatchalian (Yakima County)**

From: **Mike Murray (HDR)**
David Kuhns (HDR)
Jay Decker (HDR)

Date: **August 27, 2013**

Subject: **Scope 1, Task 2 - Regulatory Review**

Purpose

The Lower Yakima Valley Groundwater Advisory Committee (GWAC) through Yakima County Public Services selected HDR Engineering (HDR) and Pacific Groundwater Group (PGG) to assist in accomplishing two Scopes of Work. The first scope (lead by HDR) is a study to identify applicable local, state, and federal regulatory requirements that control and manage nitrates in groundwater, identify Best Management Practices (BMPs), and evaluate the effectiveness of these BMPs. The second scope (lead by PGG) focuses on completing the initial site assessment activities begun by the GWAC and others.

The purpose of the Regulatory Review is to identify local, state, and federal regulations, policy, and guidance on control and management of nitrates for groundwater protection. The review is summarized below in this technical memorandum (Technical Memorandum #1).

The baseline document for the review is the Washington State Department of Ecology (Ecology) report "Lower Yakima Valley Groundwater Quality: Preliminary Assessment and Recommendations Document," (Ecology 2010). The report summarizes information regarding nitrates and bacteria pollution in groundwater in the Lower Yakima Valley. A brief overview of existing regulatory framework is given in Table 3 of the report. This table provided a starting point for HDR's regulatory review.

Background

Elevated concentrations of nitrate have been quantified in groundwater in the Lower Yakima Valley. The nitrate concentration levels in groundwater indicate impacts by human activity and levels in some areas of the Valley are a concern to human health. In response to these elevated concentration levels and concerns raised by citizens, regulatory agencies, and others, Yakima County submitted a request to Ecology to designate the Lower Yakima Valley as a groundwater management area (GWMA) under state code pertaining to Groundwater Management Areas and Programs (WAC 173-100). In November 2011, Ecology authorized and provided startup funds for Yakima County to develop a groundwater management program. In April 2012, the GWAC was appointed to oversee management activities with the goal of reducing nitrate concentrations in groundwater to below the Washington State drinking water standards. The GWAC includes a diverse set of individuals representing local, state, and federal agencies, private citizen groups, and local industry.

The area comprising the Lower Yakima Valley GWMA is shown in the figure on page 3. The area spans from Union Gap to Grandview and includes the cities of Sunnyside, Zillah, Granger, Grandview, and Mabton, as well as the small communities of Outlook, Buena, and Crewport.

Regulatory Review

HDR has initiated the identification and gathering of data pertaining to federal, state, and local agency regulatory requirements regarding nitrates in the GWMA. The review includes requirements for 'nitrogen management' not just regulations that specifically address nitrates. This Technical Memorandum is presented to the GWAC with the intent that the committee will provide additional input on regulatory, policy, and guidance from the array of federal, state, and local agencies that have authority on overall nitrogen management in the Valley.

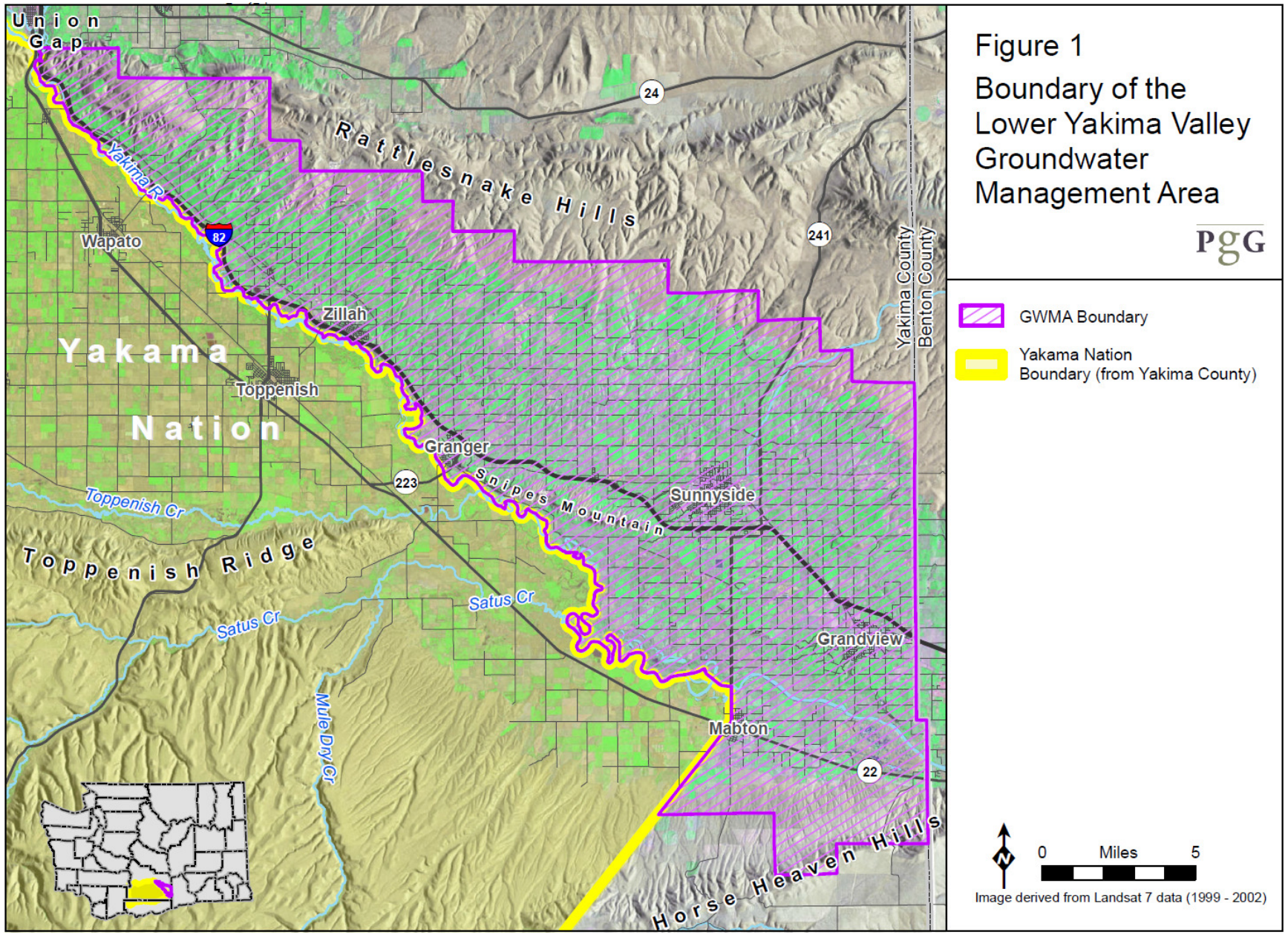
A summary of the review is provided in a table on the following pages. The table is broken into regulations that have local, state, or federal involvement, and is organized by listing the potential source of nitrogen, the regulating agency, a brief description of the regulatory requirement, and the applicable responsibilities of the regulating agency.

Several institutions located outside of the GWMA boundaries are presented in the table along with their applicable regulatory requirements. These institutions, including the City of Toppenish, although located outside of the GWMA, are located within the Lower Yakima Valley and may have a potential connection with the groundwater within the GWMA.

References

Ecology. 2010. Lower Yakima Valley Groundwater Quality, Preliminary Assessment and Recommendations Document. Publication No. 10-10-009. Washington State Department of Agriculture, Washington State Department of Ecology, Washington State Department of Health, Yakima County Public Works Department, and US Environmental Protection Agency. February 2010.

WAC 173-100, Washington State Department of Ecology, "Groundwater Management Areas and Programs," Olympia, Washington.



Lower Yakima Valley Groundwater Management Area Boundary

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Regulatory Framework and Authority

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
Local Agencies				
Private sewage disposal, unlawful wastes disposal	City of Sunnyside	SMC 13.12 - Sewers	Chapter 13.12 primarily addresses discharges and management of municipal and industrial wastewater associated with the publically owned treatment works (POTW). It includes requirements for connection to the POTW. Where a public sewer line is not available, under the provisions of Sunnyside Municipal Code (SMC) 13.12.180 a private sewer and sewage disposal system shall be constructed, in accordance with the specifications and applicable provisions of the Yakima Health District requirements. The type, capacities, location and layout of a private sewage system shall comply with all recommendations and regulations of the Washington State Department of Health and the Uniform Plumbing Code.	• City may issue cease and desist orders on violations • City may issue fines for violations
Illicit stormwater discharges and connections	City of Sunnyside	SMC 13.30A – Stormwater Illicit Discharge	This chapter applies to all water or pollutants entering the municipal separate storm sewer system (MS4) and public Underground Injection Control (UIC) wells generated on any developed and undeveloped lands unless explicitly exempted by the City of Sunnyside Public Works Department. The code provides the City of Sunnyside authority to regulate illicit discharge of pollutants and illicit connections to the stormwater system.	• City may issue cease and desist orders on violations • City may issue fines for violations
Private water wells (not a direct nitrogen source but could provide migration pathway if well not constructed properly and also well restrictions would prevent ingestion of nitrate impacted groundwater)	City of Grandview	GMC 8.32 - Wells	No person shall hereafter drill or install, or cause to be drilled, a private water well within the city.	• City may issue cease and desist orders on violations • City may issue fines for violations may issue fines for violations
Septic tanks, private sewage disposal	City of Grandview	GMC 13.20 –Private Sewage Disposal Systems	Chapter covers the permitting and inspection of private sewage disposal systems (septic tanks). The chapter requires all disposal systems to comply with the county health standards. If a public sewer becomes available, the chapter requires abandonment of private sewage disposal system and connection to public sewer.	• City inspects and issues permits under the direction of the public works director • City may issue fines for violations
Miscellaneous development and use within Critical Aquifer Recharge Areas	City of Grandview	GMC 18.06 – Critical Areas GMC 18.40 – Enforcement and Penalties GMC 18.90 – Critical Aquifer Recharge Areas	Grandview Municipal Code (GMC) 18.06 describes Critical Areas and includes designation and mapping of critical aquifer recharge areas (CARAs) and general requirements if a project is located within a CARA. Developments must be designed and constructed in accordance with surface/stormwater management requirements of the Eastern Washington Stormwater Management Manual as published by Ecology. GMC 18.40 covers enforcement of Chapter 18 of the GMC. GMC 18.90 covers CARAs and states the City's protection of CARAs shall be accomplished through normal project permit review under various city codes, especially the stream protection standards in Chapter 18.60 GMC, Fish and Wildlife Habitat and the Stream Corridor System, including GMC 18.60.100, Prohibited uses; the shoreline use table in GMC 18.100.050; and GMC Title 15, Buildings and Construction, which provides detailed construction, use, and fire/life-safety standards for the storage and handling of dangerous and hazardous substances to a greater extent than most existing state and federal laws.	• City maintains and updates mapping of CARAs • Update/maintain comprehensive plan • City controls development in CARAs through permitting and inspection • City inspects surface/ stormwater management for compliance with the Eastern Washington Stormwater Management Manual • City may issue cease and desist orders on violations • City may issue fines for violations
Animal and human waste, garbage, miscellaneous waste	City of Toppenish	TMC 13.28 – Public Sewers TMC 13.48 – Powers and Authority	It is unlawful for any person to place, deposit, or permit to be deposited in any unsanitary manner on public or private property within the city, any human or animal excrement, garbage, or other objectionable waste.	• City may issue cease and desist orders on violations • City may issue fines for violations
Septic tanks, private sewage disposal	City of Toppenish	TMC 13.30 – Private Sewer Disposal TMC 13.48 – Powers and Authority	TMC 13.30 states that where connection to public sewers is required, but public sewers are more than 400 feet away from a property line, property owner may request a "special private sewage disposal use permit" from the city council. Application for the permit shall be accompanied by proof of compliance of all county health district rules and regulations and approval of State Department of Ecology. The city may require the installation of a public sewer for future use as a condition of issuance of a special private sewage disposal use permit. TMC 13.48 covers enforcement of Chapter 13.	• City inspects and issues permits under the direction of the public works director • City may issue cease and desist orders on violations • City may issue fines for violations

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
Sewer systems, septic tanks, On-site Sewer Systems (OSS)	Yakima County and Yakima Health District	YCC 6.04 YCC 12.05 WAC 246-272A RCW 43.20.050	Yakima County Code (YCC) 12.05 covers sewer systems. It is unlawful to discharge to any natural outlet within the county, or in any area under the jurisdiction of the county, any sewage or other polluted waters, except where suitable treatment has been provided in accordance with county codes. The type, capacities, location and layout of a private sewage disposal system shall comply with all recommendations of the State Department of Health. Washington Administrative Code (WAC) 246-272A is a state code (statutory authority given by Revised Code of Washington (RCW) 43.20.050) with the purpose of protecting the public health by minimizing: (a) The potential for public exposure to sewage from on-site sewage systems (OSS); and (b) Adverse effects to public health that discharges from on-site sewage systems may have on ground and surface waters. OSS are systems handling less than 3,500 gal/day. The chapter includes general requirements, design requirements, required permitting, and enforcement of OSSs. Enforcement is to be carried out by the local health officer which for Yakima County falls under the jurisdiction of the County Health District given authority by RCW 70.05 YCC 6.04 establishes the County Health District which has local authority for the enforcement of OSSs.	• Yakima Health District performs inspection and permitting of on-site sewer systems (<3,500 gal/day) • County may issue cease and desist orders on violations • County may issue fines for violations
Stormwater	Yakima County	YCC 12.10	YCC 12.10 creates a stormwater authority for Yakima County. The purpose of this chapter is to provide for the health, safety, and welfare for Yakima County through the regulation of discharges to county stormwater control facilities and UIC wells consistent with local, federal, and state law. Chapter includes stormwater requirements, stormwater design criteria, prohibition of illicit discharges, violations and enforcement, and civil infractions. Chapter states no person shall discharge or cause to be discharged into county stormwater facilities or a public UIC any materials, including but not limited to pollutants or waters containing any pollutants other than stormwater. (See Yakima County guidance documents listed below relating to stormwater management)	• Maintain county stormwater standards • County may issue cease and desist orders on violations • County may issue fines for violations
Concentrated feeding operations outside of urban growth area zoning	Yakima County	YCC 15.18 YCC 15.12	YCC 15.18 covers permitted land uses within Yakima County. Concentrated animal feeding operations (CAFOs) are permitted in agricultural, remote, and industrial zones as a Type II land use; and are permitted in valley rural zones as a Type III land use. In other zones, CAFOs are not permitted. As a Type II or Type III land use, special conditions may be given for approval as described in YCC 15.12. The application process also includes public notice and a public hearing.	• County maintains zoning and land use maps • Update/maintain comprehensive plan • When a CAFO is requesting a permit, County sends out public notice, holds a public hearing, and conductions a land use review.
Concentrated feeding operations within urban growth area zoning	Yakima County	YCC 15A.04 YCC 15A.15	YCC 15A.04 covers permitted land uses within Yakima County's urban growth area. Concentrated animal feeding operations (CAFOs) are permitted only in suburban residential as a Class (3) land use. As a Class (3) land use, a Type 3 review public hearing is required by the county Hearing Examiner. YCC 15A.15 covers Type (3) reviews. The Type (3) review includes a staff report prepared by the county planning division	• County maintains zoning and land use maps • Update/maintain comprehensive plan • When a concentrated feeding operation is requesting a permit, county sends out public notice, holds a public hearing, and conductions a land use review.
Miscellaneous development and use within Critical Aquifer Recharge Areas	Yakima County	YCC 16C.09 YCC 16C.04	Any development within a CARA is reviewed by Yakima County. Applications for any development activity or division of land which requires review by Yakima County and which is located within a mapped CARA or Wellhead Protection Area shall be reviewed by the Administrative Official to determine whether hazardous materials will be used, stored, transported, or disposed of in connection with the proposed activity. Activities may only be permitted in a CARA if the applicant can show that the proposed activity will not cause contaminants to enter the aquifer and that the proposed activity will not adversely affect the recharging of the aquifer.	• County maintains and updates mapping of CARAs • Update/maintain comprehensive plan • County controls development in CARAs through permitting and inspection • County may issue cease and desist orders on violations • County may issue fines for violations
Fertilizer	Yakima County	YCC 16C.09.06	YCC 16C.09 covers CARAs. YCC 16C.09.06 states that application of household pesticides, herbicides, and fertilizers shall not exceed times and rates specified on the packaging for the residential use of pesticides and nutrients.	• County may issue cease and desist orders on violations • County may issue fines for violations

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
AFOs, CAFOs, agriculture	South Yakima Conservation District	RCW 90.64 RCW 89.08 WAC 16-611	The South Yakima Conservation District is the local conservation district for the Lower Yakima Valley. Conservation districts are created under RCW 89.08. The district serves as a source of management practice technical assistance and can be used as a liaison between the Washington State Department of Agriculture and Ecology and the farmer/ landowner. The management practice technical assistance including helping to evaluate site specific conditions that may threaten resources such as soil, water, air, plants, animals, and public health. This may also include assistance is selecting appropriate BMPs or a suite of BMPs to protect resources and provide a cost share when available. The conservation districts have no regulatory function and serve only in an educational role. RCW 90.64 is known as the Dairy Nutrient Management Act and has sections describing the participation of local conservation districts regarding dairies. WAC 16-611 gives the framework to provide a fair and uniform determination of civil penalties issued for violations of RCW 90.64.	• May accompany WSDA inspectors on any scheduled inspection • Provide management practice technical assistance to WSDA or Ecology in identifying and correcting existing water quality problems resulting from dairy farms • Provide management practice technical assistance to dairy producers in developing and implementing a dairy nutrient management plan • Provides management practice technical assistance to farmers
Miscellaneous development and use in aquifer recharge area	Cities, Yakima County, local agencies, the public. This has formed into the Lower Yakima Valley GWMA and GWAC.	WAC 173-100	WAC 173-100 allows for the creation of Groundwater Management Areas and Programs under the authority pursuant to RCW 90.44.400, 90.44.410, 90.44.420, 90.44.430 and 90.44.440. Ecology would, in cooperation with local government, designate specific groundwater management areas and appoint a lead agency to develop a groundwater management program and an advisory committee to oversee the development of the program for each designated area. The program will then be implemented through state regulations and local ordinances. The program would identify sources of degradation to the area's groundwater and alleviate those problems. The advisory committee represents a broad spectrum of the public.	• Development of advisory committee • Development and implementation of groundwater management program • Enforcement through existing regulation and possibly local ordinances.
Miscellaneous development and use in aquifer recharge area	Yakima County	RCW 36.36	RCW 36.36 gives the county legislative authority of a county the ability to create aquifer protection areas for the purpose of funding the protection, preservation, and rehabilitation of subterranean water. When creating an aquifer protection area, a public hearing is held by the county. After the public hearing, a public ballot of those within the area is conducted and if passed by a simple majority, a protection area can be created. Fees can be collected from those within the area for use in activities to protect and preserve groundwater quality.	• Hold public hearing and issue ballots for creation of aquifer protection areas • Collect fees in protection areas for conducting aquifer protection programs • Issue liens for delinquent fees
Miscellaneous development and use in aquifer recharge area	Yakima County	Educational Program	Yakima County has a Nitrate Treatment Pilot Program with the goal of providing water treatment systems, education, and management practice technical assistance to households with individuals at high public health risk from nitrate contaminated wells. The program was established using money provided by the state legislature in 2010 and was administered by Department of Health (DOH), and the Yakima Health District.	• Continue to implement Nitrate Treatment Pilot Program
Miscellaneous development and use in aquifer recharge area producing surface runoff	Yakima County	Guidance Document	Yakima County publishes the "Yakima County Regional Stormwater Manual." Yakima County and the Cities of Yakima, Union Gap, and Sunnyside entered into an Interlocal Governmental Agreement (ILA) for coverage under the Eastern Washington Phase II Municipal Stormwater Permit. Under the ILA, the county and cities developed the stormwater manual to have consistent approach to stormwater management between the entities. The manual provides guidelines, procedures and local information for the planning, design and maintenance of stormwater facilities throughout the county. The manual is equivalent to Ecology's Stormwater Management Manual for Eastern Washington but has been specifically tailored for use within Yakima County.	• Updating of the manual as required
Miscellaneous development and use in aquifer recharge area producing surface runoff	Yakima County	Guidance Document	Yakima County publishes the "Yakima Regional Low Impact Development Stormwater Design Manual." The manual provides design guidance that is specific to the Yakima regions semi-arid climate. The manual includes technical guidance for LID BMPs including: bioretention, soil amendments, pervious pavement, vegetated roofs, rainwater harvesting, and minimal excavation foundations.	• Updating of the manual as required

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
State Agencies				
Dairy operations on non-tribal lands	WSDA	RCW 90.64 RCW 90.48 WAC 16-611	RCW 90.64, the Dairy Nutrient Management Act, requires all licensed grade "A" dairies to develop and implement nutrient management plans, register with the WSDA, and participate in a program of regular inspections and compliance. WSDA is responsible for implementing RCW 90.64 and is required to follow RCW 43.05 (provide regulatory technical assistance when water quality is impacted or threatened) and may refer dairy operations to local conservation districts for additional technical assistance to implement BMPs that will protect water quality. WSDA is responsible for inspections and compliance actions for all dairies. All dairy farms must: ▪ Maintain records for 5 years to demonstrate that applications of nutrients to crop land are within acceptable agronomic rates. ▪ In accordance with RCW 90.64.010 (17)(c) and 90.64.102, failure to maintain all records necessary to show that applications of nutrient to the land were within acceptable agronomic rates may be subject to a civil penalty. WAC 16-611 gives the framework to provide a fair and uniform determination of civil penalties issued for violations of RCW 90.64.	• Conduct inspections of licensed dairies every 22 months • Responsible for inspections and compliance actions for all dairies
Fertilizers	WSDA	RCW 15.54 WAC 16-200	RCW 15.54, known as the Commercial Fertilizer Act, covers fertilizers, minerals, and limes. The chapter requires the creation of a fertilizer database of commercially available fertilizers in the state and requires a sampling and testing program of commercial fertilizers. Fertilizers are required to meet the nutrient value guaranteed by the fertilizer. Penalties for not meeting the guarantee can be applied to the fertilizer seller. Further details on requirements for commercial fertilizer producers is provided in WAC 16-200 including labeling, claims by fertilizer, and penalties.	• Maintain a fertilizer database • Sample and test commercial fertilizers distributed with the state • Enforcement of chapter and issuance of penalties.
Fertilizer	WSDA	WAC 16-201	WAC 16-201 covers the bulk storage and operational area containment rules for fertilizer. The chapter gives facilities requirements for storing fertilizer and the adoption of a spill response plan, Civil penalties can be issued for violating storage requirements.	• Conduct inspections for compliance as necessary • Issue permits waiving requirements when needed • Issue civil penalties for infractions
Chemigation and fertigation	WSDA	WAC 16-202	WAC 16-202 givens general provisions, general requirements, and safety requirements for chemigation and fertigation for agriculture. Any person who fails to follow the requirements of the chapter is subject to denial of permits and /or a civil penalty.	• Issue civil penalties for infractions

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
CAFOs on non-tribal lands	Ecology and WSDA (inspections)	RCW 90.48.130 RCW 90.64 WAC 173-220	RCW 90.48 is the Water Pollution Control Act. The chapter gives Ecology the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, water courses, and other surface and underground waters of the state of Washington and the ability to take enforcement actions. The chapter includes the issuance of waste disposal permits to entities discharging waste into waters of the state. Any discharge without a permit is prohibited. A state waste disposal permit is required for industrial, commercial, and municipal discharges of pollutants into surface and groundwaters and discharges of pollutants into the ground or a public sewage system. Pursuant to authority granted by the federal Clean Water Act, the discharge of pollutants from point sources to surface waters of the state requires a National Pollutant Discharge Elimination System (NPDES) permit from the Department. WAC 173-220 covers the implementation of the state's NPDES permit program including the application process, public notices, public hearings, and enforcement. Any designated CAFO or medium Animal Feeding Operation (AFO) that has a confirmed discharge to state waters must get a permit. A site specific nutrient management plan must be developed and implemented by the permittee. Ecology is responsible for issuing NPDES CAFO permits. There is a Memorandum of Agreement between Ecology and WSDA, where WSDA performs inspections, review of nutrient management plans, and provides regulatory technical assistance. When providing regulatory technical assistance, the agency notifies land user of the activities under their control that must be corrected to meet water quality standards or to protect water quality. Currently, Ecology covers 6 CAFOs (5 of which are dairies) under the NPDES General CAFO permit. The last 5-year permit cycle has expired and Ecology is currently unable to issue new General Permits. A new permit is being drafted by Ecology but has not yet been officially completed.	• Issue CAFO permits and determine when a AFO requires a CAFO permit • Review nutrient management plans submitted as part of an application for CAFO coverage and final approval of plans (WSDA) Other responsibilities: • Development, issuance, cancellation and revocation of both federal NPDES permits and state waste discharge permits to all facilities and entities • Develop fact sheets for NPDES permits
Food processor's land application of waste, municipal wastewater discharge to land, dairies with state waste discharge permits, other entities with state waste discharge permits	Ecology	WAC 173-216 – State Waste Discharge Permit	WAC 173-216 covers the State Waste Discharge Permit Program which was created to satisfy the requirements of RCW 90.78, the Water Pollution Control Act. The permit program does not cover point source discharges into navigable waters of the state which is covered by the NPDES Permit Program (WAC 173-220), or discharges covered under the general permit program (WAC 173-226). Any entity who proposes to discharge waste materials into waters of the state must file an application with Ecology.	• Implementation of a state waste discharge permit program, applicable to the discharge of waste materials from industrial, commercial, and municipal operations into ground and surface waters of the state • Review and approval of permits • Public hearings if applicable
Large On-site Sewage Systems (LOSS)	DOH	WAC 246-272B	WAC 246-272B covers large on-site sewage systems (LOSS) and implements RCW 70.118B. The Chapter covers the approval and permitting process, site and environmental requirements, engineering requirements, design and technical standards, LOSS operations requirements, and enforcement. LOSS are on-site sewer systems that handle more than 3,500 gal/day. LOSS may not be installed or operated without a permit issued by DOH. As part of the permitting process for LOSS, DOH requires a site risk survey that includes a nitrate balance. DOH publishes "Level 1 Nitrate Balance Instructions for Large On-site Sewage Systems" (Publication #337-069) to assist in performing the required calculations.	• Review of LOSS applications and permit approval • Enforcement of regulation
	DOH	WAC 246-290-135	WAC 246-290-135 covers source water protection for Group A public water supply systems. The chapter establishes that all systems must maintain a sanitary control area (SCA) around all drinking water sources. For wells, the SCA must have a radius of at least 100 ft from the well. DOH may require a larger SCA given site conditions and may require additional monitoring if a potential risk exists to a water source. The SCA prevents constructing, storing, disposing, or applying any source of potential contamination within the area. The chapter also requires water systems to develop a wellhead protection program as part of the system's water system plan. This includes delineating wellhead protection areas and creating a database of known or potential sources of pollution within the wellhead protection area.	• Review SCA and Wellhead Protection Programs • Enforcement of regulation

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
Domestic and industrial wastewater facilities	Ecology	WAC 173-240 WAC 173-221 WAC 173-221A	WAC 173-240 covers the submission of plans and reports for the construction of wastewater facilities which are classified as handling more than 100,000 gal/day. Unlike LOSS which are regulated by DOH (with local jurisdiction given to the County Health Department), wastewater facilities are regulated by Ecology. The chapter, which implements RCW 90.48.110, includes requirements for domestic wastewater facilities and industrial wastewater facilities. This includes requirements for design, reports, plans and specs, and operation and maintenance manuals. WAC 173-221 covers discharge standards and effluent limitations for domestic wastewater facilities while WAC 173-221A covers discharge standards and effluent limitations for industrial wastewater facilities.	• Review and approval of wastewater facility construction documents • Enforcement of discharge and effluent limitations for wastewater facilities
Underground injection control (UIC) wells	Ecology	WAC 173-218	WAC 173-218 is the state regulation for the state's UIC Program. Ecology was delegated authority by the EPA to administer a UIC program per 40 CFR 144 and by statutory authority by RCW 43-21A.445. The program requires that a non-endangerment performance standard must be met, prohibiting injection that allows the movement of fluids containing any contaminant into groundwater. In Washington, all ground water is considered a potential source of drinking water. Any UIC well owner must also provide inventory information to register their well with Ecology. The chapter covers UIC well classifications, operating requirements, permit terms for wells that are not rule authorized, UIC well decommissioning, and enforcement.	• Management of a UIC program • Maintaining UIC inventory • Reviewing and issuing of permits for wells not rule authorized • Enforcement of regulation
Miscellaneous development and use in aquifer recharge area	Ecology	WAC 173-200 RCW 90.48	WAC 173-200 covers the water quality standards for groundwaters within the state and is an implementation of authority granted in RCW 90.48. The chapter introduces the state's antidegradation policy. The policy prevents the degradation of groundwater that interferes with existing and future beneficial use. Degradation is not allowed of high quality groundwaters constituting an outstanding national or state resource, such as waters of national and state parks and wildlife refuges, and waters of exceptional recreational or ecological significance. The chapter states that when the quality of groundwater exceeds the assigned criteria for groundwater, then the higher existing groundwater quality is to be protected and any contaminants that reduce that quality cannot be introduced into the groundwater. The only exception to where degradation is allowed is if an overriding consideration of public interest will be served and all contaminants for entry into the groundwater is provided with all known, available, and reasonable methods of prevention, control, and treatment (AKART) prior to entry. The chapter provides a table of groundwater quality criteria that establishes a maximum contaminant concentration for the protection of a variety of beneficial uses of Washington's groundwater. For nitrate (as N) that criteria is 10 mg/L. The chapter presents procedures for establishing enforcement limits and point of compliance locations for when a permit is issued for an activity effecting groundwater quality. Ecology has the ability of creating special protection areas for areas that require special consideration or increased protection.	• Establishing enforcement limit, point of compliance, and early warning concentration value for permits • Review of AKART used in permits • Establishment of special protection areas • Implementation and enforcement of groundwater quality rules
Wells	Ecology	WAC 173-160	WAC 173-160 covers minimum standards for the construction and maintenance of wells under statutory authority of RCW 18.104. The chapter includes standards for the construction and decommission of wells. Any violations of the sections in the chapter may be enforced by issuance of regulatory orders under RCW 43.27A.190, civil penalties under RCW 90.03.600 and 18.104.155, and criminal penalties under RCW 18.104.160.	• Update design requirements as required • Review variance applications to chapter • Issuance of well drilling permits • Review of water well reports • Enforcement of rules in chapter
Land application of solid waste, anaerobic digesters	Ecology	WAC 173-350 RCW 70.95	WAC 173-350 covers standards for the handling of solid waste under statutory authority given under RCW 70.95. The section includes the land application of solid waste (WAC 173-350-230) and anaerobic digesters (WAC 173-350-250). The chapter does not apply to land application of manures and crop residues at agronomic rates, or agricultural composting when all agricultural wastes are generated, processed, and applied on-farm at agronomic rates in accordance with accepted agricultural practices.	• Issue permits for the beneficial use of solid waste • Enforcement of rules in chapter
Miscellaneous development and use adjacent to surface water	Ecology	WAC 173-27 RCW 90.58	WAC 173-27 covers shoreline management permit and enforcement procedures. The chapter is given authority under RCW 90.58 known as the Shoreline Management Act of 1971. The chapter requires local governments to establish a program, consistent with rules adopted by Ecology, for the administration and enforcement of the permit system for shoreline management. The local program should be integrated with other local government systems for administration and enforcement of land use regulations. The chapter requires local governments to only authorize development along shorelines that is consistent with the policy and provisions of the Shoreline Management Act. A person who fails to conform to a permit issued under RCW 90.58 may be imposed a penalty by Ecology filed jointly with the local government or filed alone.	• Enforcement of rules in chapter and issuance of penalties.

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
Solid waste	Ecology	WAC 173-304	WAC 173-304 covers the minimum functional standards for solid waste handling and is promulgated under the authority of RCW 70.95 to protect public health, to prevent land, air, and water pollution, and conserve the state's natural, economic, and energy resources. The chapter includes: setting minimum functional performance standards for the proper handling of all solid waste materials originating from residences, commercial, agricultural and industrial operations and other sources, identification of those functions necessary to assure effective solid waste handling programs at both the state and local level, describes the responsibility of persons, municipalities, regional agencies, state and local government under existing laws and regulations related to solid waste, and requires use of the best available technology for siting, and all known available and reasonable methods for designing, constructing, operating and closing solid waste handling facilities.	• Enforcement of rules in chapter and issuance of penalties
Biosolids	Ecology	WAC 173-308	WAC 173-308 covers biosolids management and is given authority under RCW 70.95. The chapter considers biosolids as sewage sludge or septage that has been or is being treated to meet standards so that it can be applied to the land. The chapter includes requirements for those who prepare, transport, or apply solid waste. The law requires biosolids monitoring and sampling which includes nitrate. The chapter also includes requirements for the storage of biosolids which states that biosolids cannot be stored in a manner that would likely result in contamination of groundwater. The chapter includes requirements for recordkeeping for those preparing or applying biosolids, and the submittal of annual reports by certain facilities. All treatment works treating domestic must apply for a permit for the final use or disposal of biosolids.	• Review of annual reports • Issuance of permits • Collection of permit fees
Miscellaneous development and use in aquifer recharge area producing surface runoff	Ecology	Guidance Document	Ecology publishes the "Stormwater Management Manual for Eastern Washington" (Publication 04-10-076). The objective of the manual is to provide guidance in stormwater design and management for eastern Washington by providing methodologies and technical guidance. The manual identifies eight Core Elements for managing stormwater runoff from new development and redevelopment projects of all sizes. Many counties and municipalities in eastern Washington require the manual to be followed for development	• Updating of the manual as required
Miscellaneous development and use in aquifer recharge area producing surface runoff	Ecology	Guidance Document	Ecology publishes the "Eastern Washington Low Impact Development Guidance Manual". The manual is currently still in the draft phase and not yet been released in its final form. The manual covers low impact development methodologies for handling stormwater in developments.	• Completion of manual • Promote awareness of new guidance manual • Updating of manual as required
Miscellaneous development and use in aquifer recharge area	Ecology	Guidance Document	Ecology publishes "Implementation Guidance for the Ground Water Quality Standards" (Publication 96-02). The guidance is a document that explains and interprets WAC 173-200 which covers Ground Water Quality Standards.	• Updating of guidance as required
Nutrient application from municipal and industrial wastewater sources.	Ecology	Guidance Document	Ecology publishes "Guidance on Land Treatment of Nutrients in Wastewater, with Emphasis on Nitrogen" (Publication 04-10-081). The guidance provides a brief guidance on land treatment of nutrients in wastewater, with emphasis on nitrogen in relation to Ecology's Water Quality Program. This guidance is used to support state waste discharge permits under WAC 173-216.	• Updating of guidance as required
Miscellaneous development and use in critical aquifer recharge areas	Ecology	Guidance Document	Ecology publishes "Critical Aquifer Recharge Areas: Guidance Document" (Publication 05-10-28). The document provides guidance for local jurisdictions on the laws and rules of the state for water quality, pollution prevention, and water resources in relation to CARA protection. This includes guidance on how local jurisdictions can use planning and ordinances to help protect critical aquifer recharge areas.	• Updating of guidance as required
Nutrient application, agriculture	Ecology	Guidance Document	Ecology publishes "Irrigation Management Practices to Protect Ground Water and Surface Water Quality - State of Washington" (Publication EM4885). The manual presents overall management objectives for irrigated agriculture in Washington. A series of implementation practices is listed for each management objective outlined with the goal of reducing point and non-point pollution sources. A particular focus of the manual is on nutrients including nitrogen.	• Updating of manual as required
Miscellaneous pollutants from surface runoff entering underground injection control (UIC) wells	Ecology	Guidance Document	Ecology publishes "Guidance for UIC Wells that Manage Stormwater" (Publication 05-10-067). The document provides design and pretreatment BMPs for UIC wells handling stormwater and explains the UIC rule, WAC 173-218.	• Updating of guidance as required

Potential Nitrogen Source	Institution	Regulation	Description	Authority of Institution
Federal Agencies				
Agriculture, AFOs, and CAFOs located on tribal lands	EPA	33 USC §1311	33 USC §1311 gives EPA the authority to issue NPDES permits on tribal land. In areas outside of tribal lands, Ecology has responsibility for issuing and enforcing NPDES permits.	• Issuance and enforcement of NPDES permit
Underground injection control (UIC) wells located on tribal lands	EPA	40 CFR Part 144	UIC program requirements are found in 40 CFR Parts 144, 146, and 147. In tribal areas, EPA is the primary enforcement mechanism of the regulations. Outside of tribal areas, Ecology has been granted primacy for enforcement under the states own UIC program.	• Enforcement of federal UIC regulations
Miscellaneous development and use in aquifer recharge area posing a significant endangerment to human health	EPA	SDWA §1431	Section 1431 of the SDWA gives the EPA emergency powers to take action to protect the public health if substantial endangerment of the underground sources of drinking water is imminent. This could include the issuance of orders and civil actions.	• Use of Section 1431 to issue orders and civil actions
Miscellaneous development and use receiving federal funding within aquifer recharge area	EPA	SDWA §1424(e)	Section 1424(e) of the SDWA authorizes for the designation of an aquifer by the EPA administrator that the aquifer is the sole source for drinking water in the area. The process for designating an aquifer as a sole source can be initiated by the EPA or upon petition by another entity (individual, company, state, municipality, etc.). If an aquifer is designated as a sole source for drinking water, no federal funding may go to projects in the recharge area of aquifer that may cause contamination of the aquifer. The Safe Drinking Water Act Amendments, enacted June 1986, established the Sole Source Aquifer Demonstration Program, which is separate from, but dependent upon, the Sole Source Aquifer program. The Sole Source Aquifer Demonstration Program establishes procedures for developing, implementing and assessing demonstrations designed to protect critical aquifer protection areas (CAPAs). A CAPA is an area that: ▪ Must be located with an area designated as a Sole Source Aquifer by June 19, 1986 and has a Clean Water Act, Section 208, ground water quality protection plan approved prior to that same date; or ▪ Must be located within an area that is designated as a Sole Source Aquifer no later than June 19, 1988, and which satisfies the CAPA criteria EPA must establish by June 19, 1987.	• Initiation or review of petitions for designating aquifer as a sole source for drinking water • Determination of aquifer as sole source for drinking water
Agriculture, dairies, and CAFOs	USDA-Natural Resources Conservation District (NRCS)	Nutrient Management (Code 590)	The NRCS is charged with developing and updating the Nutrient Management (Code 590) conservation practice standard for nutrient planning. The plans are developed on a state by state basis. While not a regulation, the standard is used by EPA and state agencies for nutrient management planning. Furthermore, for farmers receiving federal assistance through the USDA, implementation of a nutrient management plan is required.	• No regulatory authority, but responsible for developing and updating Nutrient Management Code 590, which is adapted by several regulatory agencies.

PACIFIC groundwater GROUP

GROUNDWATER MONITORING QUALITY ASSURANCE/QUALITY CONTROL PLAN LOWER YAKIMA VALLEY GWMA INITIAL CHARACTERIZATION

September 16, 2013

GROUNDWATER MONITORING
QUALITY ASSURANCE/QUALITY CONTROL PLAN
LOWER YAKIMA VALLEY GWMA
INITIAL CHARACTERIZATION

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Figure 1: Boundary of the Lower Yakima Valley Groundwater Management Area
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QA/QC APPROVALS

This Groundwater Monitoring QA/QC Plan, developed September 16, 2013 for the Lower Yakima Valley Groundwater Management Area, has been reviewed and approved by the undersigned. Copies of the completed and signed QA/QC Plan shall be distributed to the undersigned and all field personnel.

Lower Yakima Valley Groundwater Management Committee	Date
Project Manager	Date
Analytical Lab Project Manager	Date
QC Coordinator	Date
Field Manager	Date

This Groundwater Monitoring Quality Assurance/Quality Control Plan has been prepared as an appendix to the forthcoming Groundwater Monitoring Plan, which has an anticipated publication date of March 2014. References to the Groundwater Monitoring Plan within this appendix should be understood as information that will be available in the future.

Project Background, Project Objectives, Scope of Work, and Sampling Protocols will be detailed in the Groundwater Monitoring Plan and are not included herein.

This work was performed under HDR contract #CON0082545 and partially fulfills scope Item 1a. The QA/QC Plan was prepared in accordance with hydrogeologic practices generally accepted at this time in this area, for the exclusive use of the Lower Yakima Valley Groundwater Advisory Committee and HDR, for specific application to the Initial Characterization. No other warranty, express or implied, is made.

1.0 INTRODUCTION

This Quality Assurance/Quality Control (QA/QC) Plan has been developed as an appendix to the Groundwater Monitoring Plan for the Lower Yakima Valley Groundwater Management Area (LYV GWMA) Initial Characterization. The QA/QC Plan has been prepared in general accord with U.S. Environmental Protection Agency (EPA) (EPA, 2002) and Washington State Department of Ecology (Ecology) (Ecology, 2004) guidelines and specifications. This document addresses:

- Data Quality Objectives for stations (groundwater and drain-water quality sampling stations) and analytical data
- Quality Control Checks for field and laboratory
- Analytical methods
- Data Validation and Usability

While this QA/QC Plan is intended to be comprehensive, revisions and/or amendments may be required as the project evolves. Descriptions of the project background, project objectives, scope of work, and field protocols are provided in the Groundwater Monitoring Plan.

1.1 OBJECTIVE

The Initial Characterization will be developed from existing water quality data collected during previous investigations, and future water quality data that will be collected as described in the Groundwater Monitoring Plan. The Initial Characterization will be used by the LYV Groundwater Advisory Committee (GWAC) to make administrative decisions and policy recommendations; therefore, the data inputs must be reliable and defensible. This QA/QC Plan defines the quality of data necessary for various uses within the Initial Characterization.

"Core data" as used in this project is the information that Pacific Groundwater Group recommended for inclusion in the project database related to groundwater and drain-water quality samples (PGG, 2013). These data include analytical and field test results for parameters of concern (Section 1.2), station location, and well construction information.

QA/QC data for the project consists of information that documents the accuracy and precision of the analytical results. Each analytical batch should have associated QA/QC data, which may include results of method blanks, laboratory replicates, and field duplicates. QA/QC data, where available, will also be uploaded to the project database for the parameters of concern.

Data Quality Objectives (DQO) for the project are described in Section 2.0 of this QA/QC Plan. Station DQOs will be used to evaluate lateral and vertical distribution of the sampling network and to evaluate potential bias that could be introduced from treatment or wells with poor surface seals. Analytical DQOs will be used to evaluate representativeness, precision, and potential bias from sampling or lab artifacts. Stations

and analytical sets that do not meet DQOs may be qualified or considered unacceptable for some or all project needs.

1.2 PARAMETERS OF CONCERN AND PROJECT MCLS

As described in the Groundwater Monitoring Plan, the LYV GWMA was formed in response to elevated nitrate concentrations in groundwater in Lower Yakima Valley. The boundaries of the GWMA are presented in Figure 1. The concentrations of nitrate detected in groundwater indicate impact by human activity and may pose significant risk to human health in localized areas. The LYV GWMA was formed with the stated purpose of reducing nitrate concentrations in groundwater to below drinking water standards.

Based on previous investigations and the LYV GWMA's purpose, the parameters of concern for this study are:

- Nitrate
- Nitrite
- Ammonia-nitrogen
- Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen)

These parameters are a subset of inorganic parameters that are referred to as conventionals. Analytical methods and holding times (from sample collection to analysis) are summarized in Table 1. The analytical method list in Table 1 was derived from Ecology's *Methods and Analytes Table* on their environmental lab accreditation website (Ecology, n.d.). If there are discrepancies regarding preservation or holding time between Table 1 and the analytical method, the analytical method shall be considered correct.

Method detection limits (MDLs) are the minimum concentration of an analyte that can be identified, measured, and reported with 99 percent confidence that the analyte concentration is greater than zero. Analytical methods may specify MDLs or may describe procedures for establishing MDLs. Practical Quantitation Limits (PQLs) or lab Reporting Limits are the minimum concentration of an analyte that can be reliably achieved during routine laboratory operating conditions within specified limits of precision and accuracy. PQLs and Reporting Limits are greater than MDLs and are statistically determined by individual labs. Because the analytical labs for this project have not been identified, PQLs and lab Reporting Limits cannot be specified in this QA/QC Plan. PQLs and lab Reporting Limits must be less than the LYV GWMA Project Maximum Contaminant Levels (MCLs) defined below.

Water quality standards or criteria established by regulatory agencies will be used to evaluate analytical results for the parameters of concern listed above. Standards applicable to the LYV GWMA groundwater studies are EPA MCLs, Washington State Public Water Supply MCLs (WAC 246-290-310), and Washington State Groundwater Quality Criteria (WAC 173-200-050). Established standards for the LYV GWMA parameters of concern are generally consistent between these regulations (Table 2). LYV GWMA Project MCLs are based on the most stringent relevant regulatory water quality standards and are summarized in Table 2.

Water quality standards have not been established for ammonia-nitrogen or the sum of organic nitrogen + ammonia + ammonium under the regulations cited above; however,

these analytical results may be useful for trend evaluation and for understanding nitrogen speciation.

2.0 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative criteria established to limit uncertainty in analytical results. They are established to create analytical data sets that will support the study objectives. It is important to meet DQOs in order to produce analytical results that are considered defensible and reliable.

2.1 STATION DATA QUALITY OBJECTIVES

"Station Metadata" for this project refers to physical and access details about sampling stations, including the type of station (well or drain), location, owner and/or tenant name and contact information, well construction, and sampling point. Station DQOs will be used to:

- Understand the lateral distribution of the stations
- Understand what aquifer system (e.g. shallow or deep) the stations represent
- Understand potential bias in samples from surface contamination
- Understand potential bias in samples from treatment
- Identify stations for long-term monitoring consideration

A decision tree for evaluating Station Metadata against DQOs is presented in Figure 2. The DQOs may be used to evaluate those stations acceptable for Data Gap and Trend Analyses, and those acceptable for Long-Term Monitoring.

Data Gap and Trend Analyses DQOs. Station location and indication of completion depth for wells are the DQOs for a station to be considered for Data Gap and Trend Analyses. Locations must be available by either coordinates in a known datum (preferred) or by a current parcel number. Station location information may be refined during field work. For wells, documented depth information must be available either for the open interval (preferred) or for the total depth of the well. Well depth should be documented on a well log, video log, maintenance log, pump installation records, or similar means of documentation. An owner's recollection of total depth will not be considered valid documentation. Depth information is not required for drain stations.

Long-Term Monitoring Consideration DQOs. To be considered for Long-Term Monitoring, stations must meet the Data Gap and Trend Analyses DQOs plus long-term access to the station must be available. For well stations, the sampling port should be upstream of treatment and an adequate surface seal should be documented. Long-term access and information about available sampling ports may be collected during field work. Special consideration may be given to wells that do not meet the sampling port relative to treatment criterion and surface seal criterion in areas with limited stations; however, comparison of analytical results relative to project MCLs would not be valid.

2.2 ANALYTICAL DATA QUALITY OBJECTIVES

QA/QC data associated with water quality samples can be used to assess the accuracy and precision of the analytical results. This QA/QC Plan stipulates the QA/QC data required for water quality samples, and the DQOs to evaluate the QA/QC data against. However, it is likely that some water quality data from previous investigations will not have available QA/QC data.

The availability and acceptability of QA/QC data will affect how sample results may be used in the GWMA Initial Characterization. A decision tree to assess usability of the analytical metadata is presented in Figure 3. If station location and depth information is available (Section 2.1), all existing analytical data will be considered in the evaluation of Data Gaps and Trends, regardless of whether associated QA/QC data are available. Water quality results with available QA/QC data that meet DQOs described in this section and water quality results associated with the Washington State Department of Health (DOH) compliance monitoring of public water systems will be considered in the evaluation of Data Gaps and Trends, and in addition will be used to establish Baseline Water Quality, evaluate Compliance with project MCLs, and establish Long-Term Monitoring Data. While QA/QC data associated with DOH compliance monitoring are not available, the data will be considered acceptable for the additional evaluations because the analytical labs are required to be accredited by Ecology; and samples are required to be collected and transported according to EPA or DOH approved methods (WAC 246-290-300 and WAC 246-291-300).

DQOs for analytical data are typically expressed in terms of accuracy, precision, representativeness, completeness, and comparability. Definitions of these terms follow.

Accuracy. Accuracy is how close an analytical result is to the true concentration in the sample. For conventional parameters, accuracy is analytically evaluated with spike samples.

A spike QA sample is prepared by adding a known concentration of an indicator parameter to an environmental sample. The indicator parameter should be the same or similar (for isotopically labeled compounds) as the target analyte. The spike should increase the concentration in the environmental sample by a predictable amount.

The analytical lab shall calculate and report the percent recovery (%R) of the target analyte in the spiked sample by:

$$\%R = \left(\frac{SSR - SR}{SA}\right) \times 100$$

Where:

SSR = measured value of analyte concentration in sample after addition of spike
SR = measured value of analyte concentration in sample before addition of spike
SA = value of spike added

The LYV GWMA QA Reviewer (QA Reviewer) shall evaluate accuracy by comparing the %R to acceptable limits statistically determined by the laboratory (Section 4).

Precision. Precision measures the reproducibility of results and can be evaluated through field duplicate (collocated samples collected in the field that are analyzed independently) and lab replicate (aliquots prepared in the lab of the same sample that are analyzed independently).

Field duplicates will be collected on at least a 10 percent frequency (1 duplicate per 10 samples collected). At least one field duplicate shall be collected each event (Section 3.1). Lab replicates may be analyzed according to an individual lab's Standard Operating Procedure (SOP). Lab replicates are prepared in the lab by taking an aliquot of an environmental sample and treating that aliquot throughout the analytical method as though it were another sample.

Relative Percent Differences (RPD) values between field duplicates shall be calculated by the QA Reviewer and RPD values between lab replicates shall be calculated and reported by the lab. RPDs are calculated by:

$$RPD = \frac{|(D1 - D2)|}{\frac{D1 + D2}{2}} \times 100$$

Where:

D1 = measured concentration of duplicate or replicate 1

D2 = measured concentration of duplicate or replicate 2

The QA Reviewer shall evaluate precision by comparing the RPD to acceptable limits (Section 4). For this study, the acceptable RPD limits for field duplicates shall be 20 percent or ± the lab reporting limit if the concentration of either the sample or duplicate is less than 5 x the lab reporting limit. The acceptable RPD limits for lab replicates shall be statistically established by the analytical lab.

Representativeness and Comparability. Representative samples accurately represent the environmental matrix being tested. Comparable samples are collected during different sampling events, but at the same station. For this study, representativeness and comparability shall be achieved by following the field sampling protocols and methods described in the Groundwater Monitoring Plan, using the same analytical methods, and to the degree possible, the same analytical lab.

As described in the Groundwater Monitoring Plan, the majority of water samples collected for this study will be collected directly into laboratory-provided bottles without the use of non-dedicated or non-disposable sampling devices such as bailers, portable pumps, dippers, or grab samplers. When non-dedicated or non-disposable sampling devices are used, representativeness and comparability will be evaluated using rinsate or decontamination blanks (Section 3.1). These blanks will be collected following decontamination of the sampling device, on at least a 10 percent frequency (1 blank per 10 samples collected with a non-dedicated or non-disposable sampling device) and a

minimum of 1 blank will be collected per event where non-dedicated sampling devices are used.

Completeness. Completeness is the percentage of valid results obtained from a given sampling event. For this study, completeness is anticipated to be equal or better than 85 percent.

3.0 QUALITY CONTROL CHECKS

Quality control checks will be performed by project field staff and by the analytical lab as described below.

3.1 FIELD QUALITY CONTROL

Field quality control checks are summarized in Table 3.

Field Duplicates will be collected at a rate of at least 10 percent as described in Section 2.0. After collection of the original sample, a duplicate shall be collected by filling another set of laboratory-provided bottles using the same sampling procedure. Field duplicates shall be analyzed for each parameter of interest. Field duplicates will be labeled with a unique sample ID and collection date/time. Field sample forms shall document the stations where field duplicates were collected, the duplicate ID, and duplicate sample time.

Rinsate or decontamination blanks will be collected at a rate of at least 10 percent of samples collected per sampling team with non-disposable or non-dedicated equipment. After the non-dedicated equipment is decontaminated following procedures described in the Groundwater Monitoring Plan, a rinsate or decontamination blank shall be collected by transferring commercially available distilled water from the sampling equipment to a set of laboratory-prepared bottles, or by pouring distilled water over the equipment and collecting the water that that rinses off in a set of laboratory-prepared bottles. The rinsate or decontamination blank shall be labeled with a unique sample ID and collection date/time. Field sample forms shall document the stations where field blanks were collected, the blank ID, and blank sample date/time.

Matrix Spike and Matrix Spike Duplicates (MS/MSD) will be analyzed per batch of samples. If groundwater and ditch-water samples are collected in a single sampling event, MS/MSDs should be analyzed for both station types. MS/MSDs prepared from samples collected for the LYV GWMA project are preferred over MS/MSDs prepared from samples collected for another project that may be part of the same analytical batch. This may require additional volume to be collected in the field. The Field Sampling Manager or Lead should confer with the analytical lab about additional volume requirements when placing the bottle order. Sample bottles for MS/MSD analysis will be labeled with the station ID followed by "-MS/MSD" and field forms will document where the MS/MSD are collected.

3.2 LABORATORY QUALITY CONTROL

Analytical services for this study will be provided by labs accredited by Ecology for drinking water or non-potable water analyses of the parameters of concern (there are currently no drinking water accredited labs for analyses of ammonia or TKN, there are non-potable water accredited labs for these parameters). Prior to mobilization to the field, the lab will provide proof of Ecology accreditation for analytical methods and matrices related to this QA/QC Plan. Labs routinely perform performance checks and each analytical method requires specific QA/QC protocols that must be complied with by the lab. No additional audits will be performed on the analytical labs for this study.

The analytical lab will follow their written QA/QC Plan and Standard Operating Procedures (SOP) to assure data quality. Lab QC samples will be analyzed in accordance with the lab QA/QC Plan, SOP, and analytical method and may include the following:

- Method blanks are used to assess contamination that may be introduced in the lab during sample preparation. Method blanks are prepared, extracted, digested, and analyzed in the same manner as field samples. Analytical results will be included in lab reports.
- Laboratory control samples (LCS) are used to evaluate the performance of the total analytical system, including all preparation and analysis steps. They contain known concentrations of the analytes of interest and the percent recovery reflects the accuracy of the analysis. Analytical results will be included in lab reports.

Lab QA/QC also typically includes instrument-related calibration blanks and performance checks. Instrument-related QA/QC results will not be included in lab reports, but will be made available on request if other QA/QC results are considered unacceptable.

4.0 DATA VALIDATION AND USEABILITY

Data validation will be performed by the lab in accordance with their QA/QC plan and SOP prior to the release of the analytical results. The lab shall document their data validation in a case narrative, identifying any QA/QC recoveries that were outside the lab's acceptance criteria, and potentially flagging or reanalyzing unacceptable results.

The QC Reviewer will review field notes for compliance with sampling protocols described in the Groundwater Monitoring Plan and will validate the analytical data in accordance with the QA/QC requirements specified in this QA/QC Plan and the analytical methods. The analytical reports shall be checked for completeness that the data requested has been delivered. They shall also be checked for compliance of the analytical QA/QC results with acceptance limits. Data validation will also include review of the method blanks, holding times, and lab reporting limits.

DQOs or acceptance limits for Percent Recoveries (%R) of spike samples, including matrix spikes, shall be established statistically by the lab and provided in the lab reports. In the event that statistical acceptance limits are not available, the following limits from the Quality Assurance Project Plans for the Yakima Basin Nitrate Study Phase 3 (U.S.

EPA, 2010b) and Lower Yakima Valley Dairy Investigation (SAIC, 2012) shall be applied:

- Accuracy (percent recovery of spikes including laboratory control samples and matrix spikes): 80-120 percent
- Precision (lab replicate and matrix spike duplicate): ± 20 percent

For this study, the acceptable RPD limits for field duplicates shall be 20 percent or ± the lab reporting limit if the concentration of either the sample or duplicate is less than 5 x the lab reporting limit.

Data associated with QA/QC results that fall outside acceptance limits may be qualified or rejected. The EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (EPA 2010a) generally do not extend to conventional parameters; however, the guidelines may be referred to for qualification guidance. Findings and conclusions of the Data Validation will be summarized in a narrative by the QC Reviewer.

As presented in Figure 3 and described in Section 2.2, all existing analytical data will be considered in the evaluation of Data Gaps and Trends, regardless of whether associated QA/QC data are available or whether associated QA/QC data meet Analytical DQOs (acceptance limits) described in this Plan. Analytical results with QA/QC data that meet DQOs and analytical data associated with DOH compliance monitoring of public water systems will be considered to meet project needs to be valid for: Data Gaps and Trend analyses, establishing Background Water Quality, evaluating Compliance with project MCLs, and establishing Long-Term Monitoring Data.

5.0 REFERENCES

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Washington State Department of Ecology, 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030. Revision of Publication No. 01-03-003. July 2004.

Washington State Department of Ecology, n.d. Methods and Analytes Table. http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html. Web. September 4, 2013.

Table 1. Water Quality Parameters of Concern and Analytical Methods

Parameter	Analytical Method	Preservative	Holding Time	Bottle Type
Ammonia-N	EPA 350.1 / SM 4500 / USGS 1-2522-90 / USGS 1-3520-85	H2SO4	28 days	Lab Provided
Nitrate+Nitrite	EPA 353.2 / EPA 300.0 / EPA 300.1 / SM 4500 / SM 4110	H2SO4 (see holding time)	48 hours (unpreserved) 28 days (preserved)	Lab Provided
Nitrate	EPA 353.2* / EPA 300.0 / EPA 300.1 / SM 4500 / SM 4110		48 hours	Lab Provided
Nitrite	EPA 353.2* / EPA 300.0 / EPA 300.1 / SM 4500 / SM 4110		48 hours	Lab Provided
Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen (TKN))	EPA 351.1 / EPA 351.2 / SM 4500	H2SO4	28 days	Lab Provided

*Method may be used to determine nitrite or nitrate singly, or nitrate+nitrite. If nitrate is determined singly, nitrite may be calculated from the nitrate+nitrite result. Similarly, if nitrite is determined singly, nitrate may be calculated from the nitrate+nitrite result.

Analytical Methods consistent with Ecology's Methods and Analytes Table at:
http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html

Discrepancies between Preservation/Holding Time between this table and the Analytical Methods should be resolved in favor of the Analytical Method

Practical Quantitation Limits/Lab Reporting Limits for these methods are determined by individual labs and are therefore not specified in this QA/QC Plan. Practical Quantitation Limits/Lab Reporting Limits must be less than Project MCLs.

Table 2. Relevant Regulatory Water Quality Standards and LYV GWMA Project MCLs

Parameter	Relevant Regulatory Water Quality Standards			**LYV GWMA Project MCLs**
	EPA MCLs	WA Public Water Supply MCLs	WA Groundwater Quality Criteria	
Ammonia-N	Not Established	Not Established	Not Established	**Not Established**
Nitrate+Nitrite	Not Established	Not Established	Not Established	**Not Established**
Nitrate (as N)	10 mg/L	10 mg/L	10 mg/L	**10 mg/L**
Sum of organic nitrogen + am	1 mg/L	1 mg/L	Not Established	**1 mg/L**
Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen (TKN))	Not Established	Not Established	Not Established	**Not Established**

EPA MCLs established by Safe Drinking Water Act (SDWA)

WA Public Water Supply MCLs established by WAC 246-290-310

WA Groundwater Quality Criteria established by WAC 173-200-050

Practical Quantitation Limits/Lab Reporting Limits for these methods are determined by individual labs and are therefore not specified in this QA/QC Plan. Practical Quantitation Limits/Lab Reporting Limits must be less than Project MCLs.

Table 3. Field Quality Control Summary

Type of Quality Control Check	Minimum Frequency	Bottle ID	Process
Field Duplicates	1 per 10 samples collected	Station ID + 200	After collection of the original sample, fill a second set of laboratory-provided bottles using the same sampling procedure. Label the duplicate uniquely and analyze for all sampling event parameters.
Rinsate/ Decontamination Blank	1 per 10 samples per team collected with non-disposable or non-dedicated equipment	Station ID + 100	Decontaminate the non-dedicated/non-disposable equipment following procedures described in the Work Plan. Transfer commercially available distilled water from the sampling equipment to a set of laboratory-prepared bottles, or pour DI water over the equipment and collect the water that rinses off in a set of lab-prepared bottles. Label the blank uniquely and analyze for all sampling event parameters.
MS/MSD	1 for each station type (well or drain) per event	Station ID + "-MS/MSD"	After collection of the original sample, fill a second and third set of laboratory-provided bottles using the same sampling procedure. Label the bottles with the addition of "-MS/MSD" and analyze for all sampling event parameters.

K:\PONY\Yakima Basin GWMA\GIS\mxds\GWMA_bndy_updated.mxd 8/26/2013

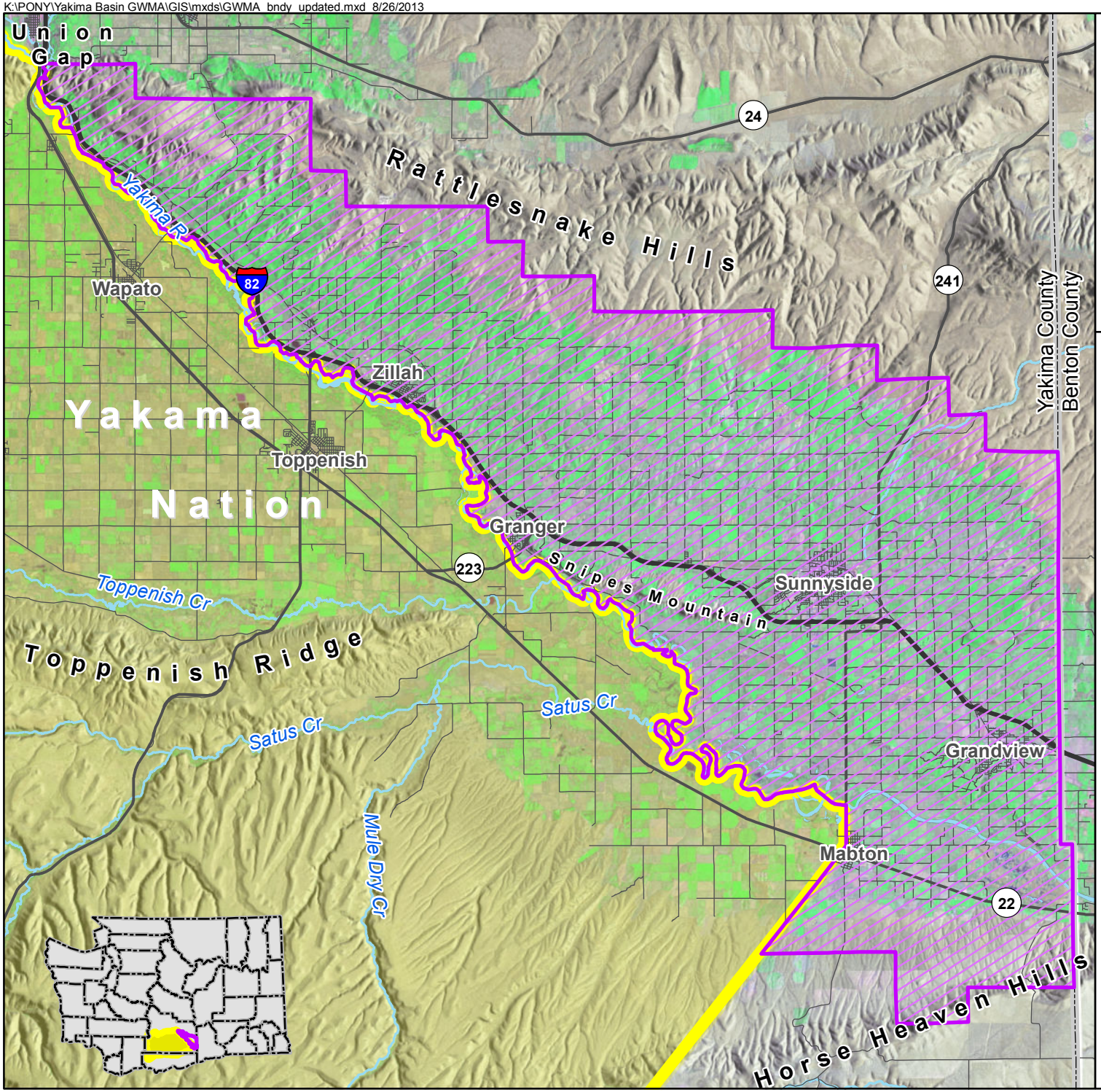

Figure 1

Boundary of the Lower Yakima Valley Groundwater Management Area

PgG

GWMA Boundary

Yakama Nation Boundary (from Yakima County)

N

0 Miles 5

Image derived from Landsat 7 data (1999 - 2002)

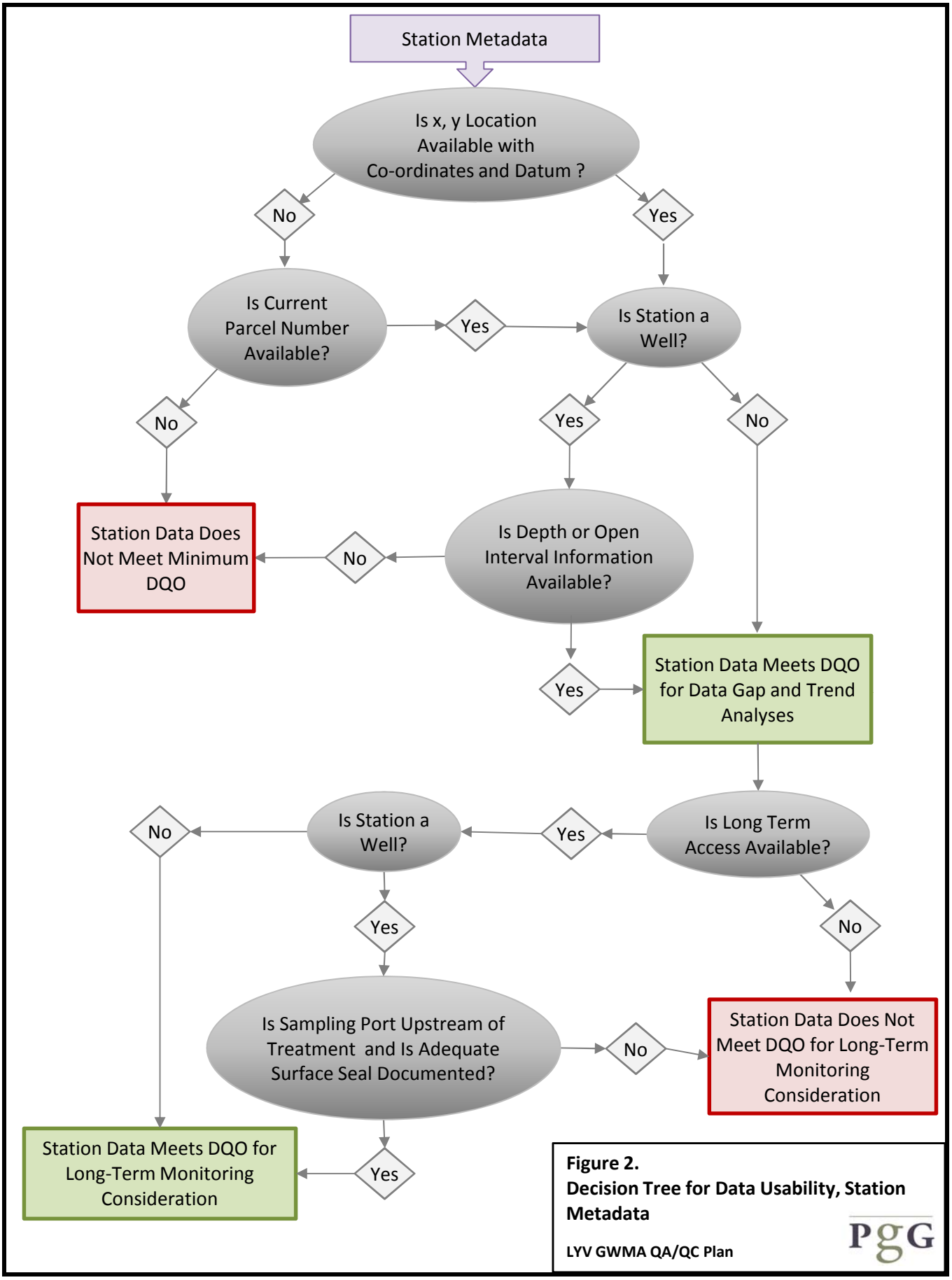

Figure 2.
Decision Tree for Data Usability, Station Metadata

LYV GWMA QA/QC Plan

PgG

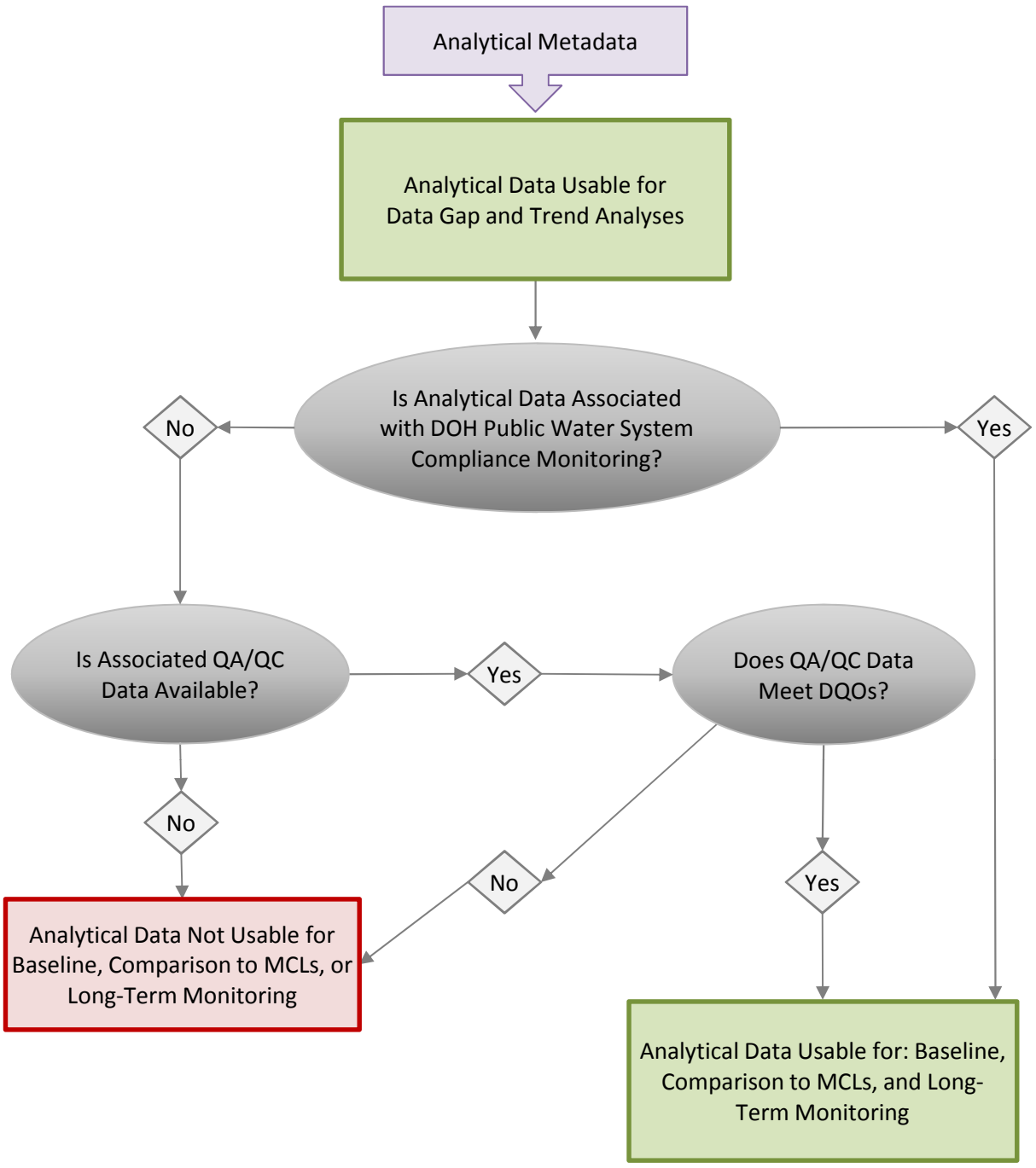

Figure 3.
Decision Tree for Data Usability, Analytical Metadata

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P 206.842.3202 | **F** 206.842.5041

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DEEP SOIL SAMPLING PLAN
LOWER YAKIMA VALLEY
GROUNDWATER MANAGEMENT AREA

March 28, 2014

DEEP SOIL SAMPLING PLAN
LOWER YAKIMA VALLEY
GROUNDWATER MANAGEMENT AREA

Prepared for:

Lower Yakima Valley GWMA
Yakima County, Administrator

Prepared by:

Irrigated Agriculture Working Group

March 28, 2014
2014 03 28 Deep Soil Sampling Plan -VERSION 6 clean.docx

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A. Grower Survey Questionnaire
B. Key Personnel
C. Boring Log
D. Soil Sample Field Form

1.0 INTRODUCTION

The GWMA project is a multi-agency, citizen-based, coordinated effort to reduce groundwater nitrate concentrations in the Lower Yakima Valley (LYV) to below Washington State drinking water standard. This project will identify activities contributing to nitrate groundwater contamination based on scientific data and evaluation.

Nitrate is added to soil by natural processes and human activities. Human activities include growing crops, and managing animal waste, human waste, and waste waters. Nitrate within the plant root zone may be utilized by the plants and if managed properly, leaching to groundwater can be minimized.

Nitrate in soil results primarily from land use at that location over time. Measuring deep soil nitrate may therefore help identify activities that contribute to nitrate groundwater contamination. Looking at nitrate concentrations in soil samples can provide relatively quick feedback on the effectiveness of changes to management practices designed to reduce groundwater contamination.

Initial deep soil sampling should be conducted for the purposes of:

1) Providing baseline data regarding the nitrogen content (nitrate, ammonium, and organic matter) of soils underlying a variety of soil, crop, and irrigation systems that represent a cross-section of agricultural activities.
2) Provide an initial assessment of current nitrogen and water management practices in place today and in the past.
3) Provide information regarding availability of soil nitrogen to crops.
4) Provide the foundation for a technically based education program.
5) Provide information about project design, practical realities, time requirements and costs that can be used in developing subsequent project scopes.

This deep soil sampling may not be sufficient to address future technical questions that may arise during the course of data collection and assessment conducted by current and future consultants tasked by the LYV GWMA Executive Committee (GWAC). Deep soil sampling will be conducted initially for two years to collect baseline information. Deep soil sampling may be repeated in future years to allow analysis of the effects of changing management practices. The timing and budget of future sampling will be coordinated with the pace of change in nitrogen application and irrigation water management practices, as determined by the GWAC.

This deep soil sampling plan will be implemented by South Yakima Conservation District (SYCD) and is summarized below.

1. Grower participation will be solicited by general mailings and outreach by SYCD and other participants of the GWAC.

2. Beginning in 2014, SYCD will distribute a unique identification number (UIN) to be retained by the grower only. The UIN will be translated into a bar code that will be used by the grower to identify their survey, the field and soil samples.

    a. The Deep Soil Sampling Program Questionnaire will include information **specific to an individual field** such as pertinent management information including cropping systems,

nitrogen sources and amounts, historical yields, irrigation practices and application methods (Attachment A).

3. Soil sampling and analysis will begin in Fall 2014:

    a. After crop harvest but prior to nitrogen applications where possible.

    b. Soil samples will be collected at 1-foot increments from 0 to a depth not exceeding 6 feet, or to the depth of refusal as basalt, gravel or caliche that define the limits of a shallower potential root zone.

    c. The 0-1 foot sample will be analyzed for nitrate, ammonium and organic matter content.

    d. Deeper soil samples will be analyzed for nitrate only.

    e. Soil descriptions will be recorded in the field, and the NRCS Soil Series will be identified and documented.

4. Sampling and analysis will be performed by qualified firms contracted to SYCD. Funding to SYCD will be from the LYV GWMA budget.

5. SYCD will use results from soil sampling to identify risk of nitrate leaching posed by the various soil/cropping/irrigation systems.

6. Data will be available on the GWAC Web site and available at SYCD. Data will be identified using and Unique Identification Number (UIN) and kept confidential using bar codes supplied to the grower. Only the participating grower will be able to identify his/her sample(s).

7. The GWAC will retain technical data for analysis.

2.0 DEEP SOIL SAMPLING PROGRAM

2.1 PROJECT ADMINISTRATION

The program will be administered by SYCD under the direction of the GWAC and this plan. Attachment B contains contact information for key project personnel.

SYCD will perform the following tasks:

- Recruit growers for the sampling program with assistance from the GWAC and the Irrigated Agriculture Working Group (IAWG). Effort will be made to get as diversified participation as possible considering crop type and areal distribution.
- Distribute UIN and labels with bar codes for soil samples and grower surveys.
- Contract firms to collect and analyze soil samples.

- Maintain records of sampling and analysis results.
- Record sampling data, analytical results, and quality assurance/quality control (QA/QC) results in a computer database (database design provided by GWMA).
- Provide the county with data to be published on the county web site.
- Report to the GWAC.

2.2 SELECTION OF SAMPLING SITES

The goal in field selection will be to involve as many growers and field conditions as possible for the established budget.

2.2.1 Outreach to Growers

Grower participation will be solicited by general mailings and outreach by SYCD and others participating in the GWAC. Growers will be encouraged to propose fields for sampling by contacting SYCD. In preparation for sampling, outreach should begin during spring/summer 2014.

2.2.2 Sites Identified by Other GWAC Work Groups

Sites other than irrigated agricultural fields may be sampled using the methods of this plan. Such sites may be proposed by the RCIM (residential-commercial-industrial-municipal) or Livestock-CAFO work groups. For application to sites other than agricultural fields, the method should be reviewed and modified if necessary to conform to site conditions. For instance:

- The number of boreholes and the radius within which boreholes are drilled may need to be reduced if a site with a small footprint is investigated.
- The depth of sampling should be coordinated around land cover, and water and waste management specific to the site.
- Analytes should be reviewed.

If the RCIM and Livestock-CAFO work groups propose sites for sampling, they will produce addenda to this plan indicating the sampling sites and necessary modifications to methods. Sites should be proposed prior to SYCD contracting for the work.

2.3 SAMPLING REQUIREMENTS

2.3.1 Expected Variability

The LYV GWAC understands that it would be cost prohibitive to characterize each field to a level of detail necessary to identify all the variability within a field or to accurately quantify field-level leaching estimates. Sampling sites will therefore be selected to measure effects of management practices for the predominant field conditions. The GWAC will evaluate the deep soil sampling program to determine whether the sample requirements and evaluation criteria should be modified during future sampling events.

Generic Variability: Generic conditions exist which create variability in all fields. Examples include field border effects, cultivation patterns, and position relative to an irrigation system. Figures 1 through 12 provide sampling schemes to be used for common field conditions that will be encountered by the program[1]. These figures provide minimum setback distances to avoid field border and cultivation effects. They also suggest sampling locations and transect directions relative to irrigation systems so that known differences in irrigation uniformity can be avoided or incorporated appropriately.

Field Specific Variability: Factors that cause field specific variability include soil type, topography, and management practices. Selecting a sample site with relatively uniform conditions will be the responsibility of the grower. While resources are available to aid the grower, most growers have intimate knowledge of their fields and are best suited to select the locations of average field conditions.

2.3.2 Definitions

Based on the discussion above and for use in this document, the following definitions have been developed.

Sampling Setbacks: Those areas of the field that are automatically determined to be not representative of the average field condition and therefore inappropriate for sampling (Figures 1 – 12). Examples include field borders, first span of a center pivot, and known lap areas.

Sampling Zone: The field area available for sampling after the setbacks described in Figures 1 - 12 are taken into account.

Sampling Site: A sixty-foot diameter circle within the Sampling Zone where samples will be collected from at least four boreholes. The same sampling site will be used year-to-year if possible.

Borehole: A borehole where discrete soil samples are collected to contribute to the composite samples. Boreholes may be advanced by any method capable of collecting discrete samples of sufficient volume over 1-ft intervals – mechanized sampling devices are recommended.

Discrete Sample: A soil sample from a borehole, prior to compositing.

Composited One-foot Sample: The soil sample that will be analyzed to represent concentrations in a given one-foot depth increment within a sampling site. This soil will come from a composite mixture of discrete samples from the same depth from all boreholes.

2.3.3 Sampling Method Requirements

Samplers and laboratories will be contracted by SYCD to perform the field and laboratory work. SYCD will establish terms of the contract including minimum qualifications, and hardware and software to be employed. Samplers shall use GPS-based field location equipment coupled to soil survey maps for working with the grower on site selection and field orientation. The contracts will reference this plan as the basis for sampling and analysis requirements.

[1] Figures 3 and 4 apply to dryland sites which are not currently proposed for sampling. These figures are included for possible future reference.

Samples will be collected within a 60 foot diameter sampling site identified by the grower in conjunction with the sampler. The latitude and longitude at the center of the sampling site will be measured with a global positioning system device (GPS) provided by the sampler. The sampler will provide the coordinates to the grower for future reference. Latitude and longitude coordinates will be based on the datum WGS84 and measured/recorded to a precision of four decimal places (1x10-4 decimal degrees). Example: 46.3874, -120.1408. This level of precision results in the coordinate being rounded to +/- 12 ft East-West and +/- 18 ft North-South. The accuracy of the coordinates will depend on the type of GPS device & the alignment of satellites or the scale of the basemap. Care should be taken to make sure the GPS device is working properly and recording the locations as accurately as possible.

A minimum of four boreholes are required within each sampling site. A mechanized sampling tool (eg: Giddings, AMS, GeoProbe) is recommended that can collect soil from discrete one-foot increments to a depth of 6 feet below ground. The minimum nominal diameter of the standard cores shall be 2-inches; however, below a depth where a sampler is unable to advance a 2-inch core, as small as a 1-inch diameter core may be used. The pattern and location of the boreholes within the sample site will be conducted per the guidelines found in Figures 1 - 12. Portions of the sampling tools that contact soil must be cleaned between sample runs to minimize cross contamination of samples.

The soil from each borehole will be collected at one foot increments and placed temporarily in clean plastic buckets (one for each depth interval) in preparation for composite mixing. Buckets shall be cleaned at least between each sampling site. Each discrete soil sample will be described by the sampler in terms of consistency, moisture content, color, grain size, and other observations such as odor. The sampler will record soil descriptions on Boring Logs (Attachment C). In addition, the sampler will fill out one Soil Sample Field Form (Attachment D) for each site to document the soil sample compositing and lab-submittal process. The Boring Logs, Soil Sample Field Form, and Grower Survey Questionnaire will be returned to the SYCD by the sampler.

Boreholes will be advanced to a maximum depth of 6 feet or until refusal, whichever is shallower. If boreholes terminate at different depths, composite samples will be created by compositing available discrete samples (which may number less than four). During boring and soil collection, care should be taken to avoid mixing the soil from discrete one-foot depth increments with soils from shallower or deeper depths.

After all boreholes have been dug and the soil from each individual depth increment has been placed in the plastic buckets, the soil will be mixed thoroughly in the buckets to form a composite one-foot sample. After compositing, a portion of soil in each quadrant of the bucket will be transferred to a lab-prepared sample container. Tools used to mix and transfer samples must be clean to minimize cross contamination of samples.

Boreholes will be backfilled by the sampler using tamped native soil to prevent creation of a vertical conduit.

2.3.4 Safety and Liability

Because of the proposed sample depths, samplers should use mechanized sampling equipment, which is inherently dangerous. In addition to physical hazards of the equipment itself, there is the potential to intersect power and other utility lines that may lie above or beneath a sampling site.

The sampler must call the utility notification center (information at http://www.callbeforeyoudig.org) and leave sufficient time for their response prior to field work. The grower must identify and record the location of utilities on private land during orientation with SYCD and flag/stake any underground utilities in the field that are within 200 ft of the agreed sample site.

Responsibility for personnel safety will reside with the sampling company.

The GWMA project will repair damage to property of the cooperating grower caused by field sampling except for that caused by the negligence of the sampler. Property damage caused by negligence on the part of the sampler will be repaired by the sampler.

2.3.5 Sampling Schedule

Each sampling site will be sampled for baseline purposes once, unless additional soil sampling is requested based on review of data by GWMA workgroups.

When possible, samples will be collected after crop harvest but prior to any nitrogen amendments. Recent crop, nutrient, and irrigation actions will be recorded by SYCD.

2.3.6 Handling and Custody

A Soil Sample Field Form (Attachment D) will be filled-out by the grower/sampler for each field to be sampled. The UIN will be distributed by the SYCD. The UIN will be used to identify each composited soil sample. Grower identification information will not be included on the Deep Soil Sampling Questionnaire, Soil Sample Field Form, Boring Logs, or sample container labels.

Soil samples will be delivered by contracted samplers to contracted commercial laboratories. For delivery to the lab, samples shall be placed in a cooler with reusable ice substitutes or with ice. If ice is used, sample containers must be placed inside a waterproof bag to prevent contact with melting ice. At no time shall the sampler store samples for more than 48 hours. Samplers may dry samples using methods acceptable to the laboratories and consistent with analytical methods. If the laboratory cannot analyze the sample within 48 hours of sample collection the laboratory must preserve the samples by methods acceptable for the analytical method and standard practice.

The sampler and lab must complete a Chain of Custody form for each batch of samples delivered. The COC must contain the Date, Time, Sampler Name, Bar Code for the UIN, and Sample Depth for each sample submitted. The sampler relinquishing the samples and the laboratory receiving the samples must sign the COC. The "owner" and "client" information on the COC shall be the SYCD, not the grower.

2.4 ANALYTICAL METHODS

The following analytes are required for this program.

- nitrate-nitrogen
- ammonium-nitrogen
- organic matter

The sample from the upper one-foot will be analyzed for all three analytes. Samples below the first foot will be analyzed solely for nitrate-nitrogen. The following subsections specify the laboratory analysis methods.

SYCD will contract with one laboratory to perform the work. Only laboratories that participate in the North American Laboratory Proficiency Testing Program (NAPT) and NAPT's Proficiency Assessment Program (PAP) for the methods listed in this plan will be eligible.

The laboratory shall be instructed to report nitrate concentrations in parts per million (ppm) or milligrams per kilogram (mg/kg) and as pounds per acre (lbs/acre) for each one-foot layer. All reporting values shall be on a dry weight basis. Laboratories shall report assumptions used in conversion from ppm (mg/Kg) to lbs/acre.

The analytical lab report (including QA/QC results) will be submitted to SYCD within three weeks from the date of the analysis. The lab report must indicate the date and time of the analysis for each sample.

2.4.1 Nitrate-Nitrogen

Either of the two analytical methods below are acceptable for measuring nitrate-nitrogen.

Method: Cadmium Reduction

Reporting limit: 1 mg/Kg or lower

Method Reference: Cadmium Reduction Method, S-3.10, Western States Laboratory Proficiency Testing Program: Soil and Plant Analytical Methods, 3rd Edition, 2005, From: Plant, Soil, and Water Reference Methods for the Western Region. 1994, R.G: Gavlak, D.A. Horneck, and R.O. Miller, WREP 125.

Method: Automated Cadmium Reduction (with extraction step added for application to soil samples)

Reporting Limit: 1 mg/Kg or lower

Method Reference: 4500-NO3. F, 1987. Annual Book of ASTM Standards, Vol. 11.01. American Soc. Testing & Materials, Philadelphia, Pa.

2.4.2 Ammonium-Nitrogen

Method: KCL Extraction / Exchangeable ammonium

Reporting Limit: 1 mg/Kg or lower

Method Reference: KCL Extraction / Exchangeable ammonium Method; S-3.50; Western States Laboratory Proficiency Testing Program: Soil and Plant Analytical Methods, 3rd Edition, 2005, From: Plant, Soil, and Water Reference Methods for the Western Region. 1994, R.G: Gavlak, D.A. Horneck, and R.O. Miller, WREP 125.

2.4.3 Organic Matter

Method: Walkley-Black Titration

Reporting Limit: 0.1 percent

Method Reference: Walkley-Black ; S-9.10; Western States Laboratory Proficiency Testing Program: Soil and Plant Analytical Methods, 3rd Edition, 2005, From: Plant, Soil, and Water Reference Methods for the Western Region. 1994, R.G: Gavlak, D.A. Horneck, and R.O. Miller, WREP 125.

2.5 QUALITY CONTROL AND DATA QUALITY OBJECTIVES

Adherence to this plan will maintain quality control for the project. Quality assurance samples shall be analyzed and the results reported to SYCD. The SYCD contract with samplers and laboratories will allow for the GWMA project to discuss results with the samplers and laboratories to determine the cause of problems and arrange for changes in procedure to achieve the data quality objectives.

Laboratories shall perform laboratory blank measurements, calibration measurements, method detection limit determinations, duplicate analyses and performance evaluation samples according to standard laboratory and method-specific procedures. In addition, SYCD will submit performance evaluation samples to the labs. Quality assurance data must be reported with each analytical report submitted to SYCD.

2.5.1 Quality Control Requirements

2.5.1.1 Instrument and Equipment Testing, Inspection, Calibration, and Maintenance

The participating laboratories will follow their standard operating procedures for maintenance and calibration of instruments or systems used for this project. The frequency of calibration will also be consistent with their standard operating procedures.

2.5.1.2 Inspection/Acceptance of Supplies and Consumables

Soil sampling tools shall be supplied by the participating samplers and they will assure the tools are clean and in proper operating condition. Laboratories will inspect and accept supplies per their standard operating procedures. Samplers will obtain sampling containers from the participating laboratories. Samplers shall only accept new (not used) sample containers that are clean.

2.5.1.3 Data to Support Repeat Sampling

To promote consistency and avoid confusion where sites are sampled repeatedly, SYCD and the grower shall refer to the prior Soil Sample Field Form and the latitude and longitude of the sampling site retained by the grower so that the same sites can be revisited. In repeat sampling, growers shall the reuse previous UIN and any remaining bar-code labels (grower/sampler can hand-write the UIN on forms and samples as necessary). Growers shall fill out a new Deep Soil Sampling Questionnaire to reflect field conditions since the last sample round. For data analysis, SYCD shall use the combination of common UIN but different sample dates to match sites that are resampled.

2.5.1.4 Specialized training

Labs and sampling firms are responsible for providing personnel who are qualified to perform the work.

2.5.2 Quality Control Samples and Data Quality Objectives

Requirements to assess accuracy, representativeness, comparability and completeness are summarized below. Data Quality Objectives (DQOs) have been established to help the GWMA project meet its overall objectives. Project DQOs may be revised by GWAC approval in the future.

2.5.2.1 Accuracy

Accuracy is a measure of confidence that describes how close a measurement is to its "true" value. In this program, accuracy will be measured by analysis of performance evaluation (PE) samples provided by a third party and by evaluation of internal lab control samples where such samples are standard to the lab practice.

PE samples (soil with known nitrate concentration) will be obtained by SYCD and submitted blind to prospective laboratories prior to contracting with SYCD. These samples will be obtained from a source used by the North American Laboratory Proficiency Testing program. Two concentrations of PE samples will be used and will represent medium (10-15 mg/kg) and high (>50 mg/kg) soil nitrate values. In addition, SYCD will provide the contracted laboratory blind samples from the medium and high PE samples at least twice during the project time period each year. The RPD between the known value and the reported value from each laboratory will be calculated. A RPD of 20% will be acceptable for this project. If the RPD for individual laboratories regularly falls outside this range, the GMWA project will take corrective action which may include denying the laboratory further participation in the GWMA program.

2.5.2.2 Representativeness

Representativeness is the degree to which data from the project accurately represent a particular characteristic of the environmental matrix which is being tested. Representativeness of samples is ensured by adherence to the field sampling protocols and standard laboratory protocols. The design of the sampling scheme and number of samples should provide a representativeness of the soil matrix being sampled.

2.5.2.3 Comparability

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling, analytical methods and units of reporting with comparable sensitivity helps ensure comparability. The GWMA project is using sampling and analysis methods that are currently being employed by the agricultural industry for nutrient management decisions. The Columbia Basin Deep Soil Sampling Program was conducted using similar procedures.

2.5.2.4 Completeness

Completeness is the percentage of valid results obtained compared to the total number of samples taken for a parameter. A complete or valid result will include full completion of the Deep Soil Sampling Questionnaire, Soil Sample Field Form, Boring Logs, and a laboratory analysis report, all linked through the UIN. Percent completeness may be calculated using the following formula. A DQO of 80% is established for this parameter.

$$\% \, Completeness = \frac{\#\ of\ valid\ results}{\#\ of\ samples\ taken} \text{X } 100$$

2.6 INFORMATION MANAGEMENT

2.6.1 Soil Sampling

Documentation of field and laboratory work for each soil sampling site will consist of submittal of the following documents to SYCD:

- Completed Deep Soil Sampling Questionnaire
- Completed Soil Sample Field Form
- Completed Boring Logs
- A completed Chain of Custody Form
- A copy of the analytical results, including QA/QC results

Forms shall be submitted to the SYCD who will retain the minimum records necessary for technical analysis of the data, documentation to facilitate repeat sampling, and possible audit of financial data.

2.6.2 Computerization of Technical Information

SYCD will enter sample and analytical data into a computer database. The GWMA project will provide the SYCD the database entry form. Computerized data will include technical data necessary for interpretation of the results by the GWMA project. Such data will include sample ID; sampling date; nitrate, ammonium, and OM concentrations; and depth; field information including nitrogen sources and amounts, historical yields, and irrigation practices. The sampling and analytical data will be linked to the soil type, nitrate leaching potential (per NRCS), irrigation type, crop, and other data provided by the grower and recorded by SYCD. SYCD will provide the GWMA the computer database within 90 days of the close of the sampling season (eg: by mid August assuming a mid-May end of sampling season).

SYCD will provide the county with data and copies of the documents listed in section 2.6.1 above identified only by the UIN.

The county will publish data on the LYV GWMA website. Growers will access data from the website or from SYCD.

3.0 TARGETED SAMPLING

Analysis of initial Deep Soil Sampling data collected in 2014 will likely reveal uneven coverage of geographic areas, soil types, crop types, irrigation types, and nitrogen sources. Uneven coverage is expected and may be acceptable; however, extreme bias or uneven coverage could jeopardize fulfillment of GWMA project goals. The GWMA project will analyze distribution of the 2014 data across the field conditions, and identify possible unacceptable bias or gaps in coverage. If unacceptable bias or gaps are present, the GWMA project will reach-out to growers in uncovered areas and

request participation in the deep soil sampling program. Outreach should occur in winter of 2014-15, and sampling to fill data gaps will occur in early 2015.

Targeted sampling may also include sampling of the following sites not accessible through the 2014 program. Note these locations may involve locations that are not irrigated agricultural fields, and would be identified through work of appropriate GWMA subcommittees (eg: livestock-CAFO or residential-commercial-industrial-municipal).

- control sites without intentional nitrogen application
- industrial and commercial sites managing nitrogen fertilizers or wastes
- point sources of possible nitrogen contamination
- private fields in close proximity to wells

FIGURES

Figure 1. Sampling scheme for center pivot irrigation system.

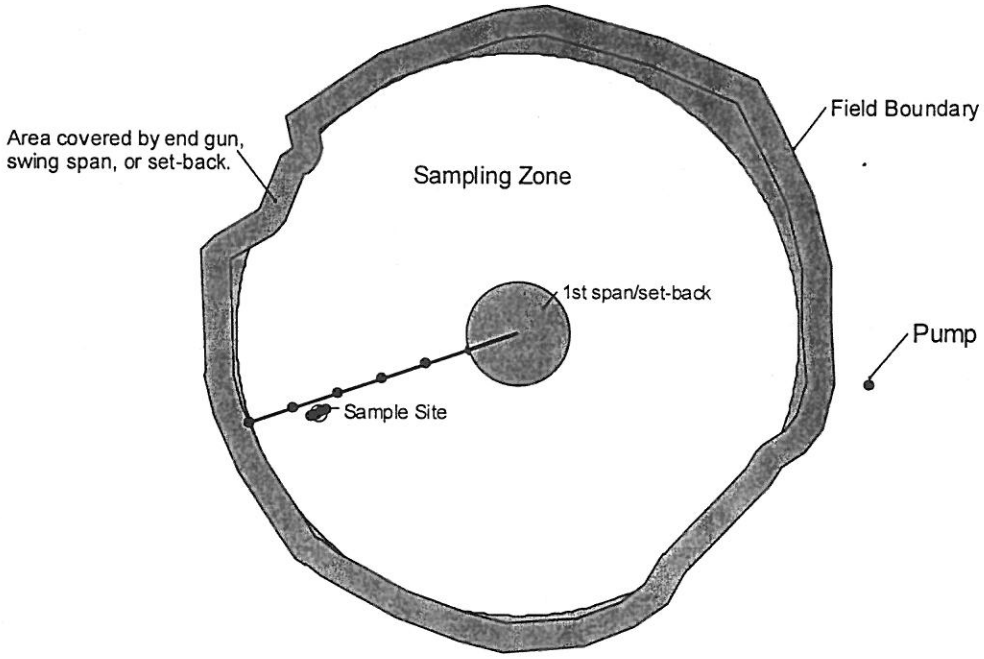


Figure 2. Sample site detail for center pivot irrigation.

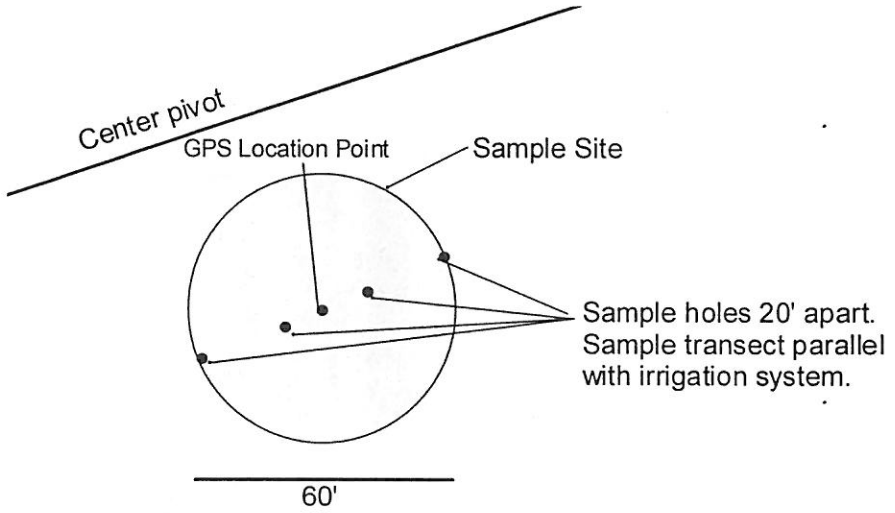


Figure 3. Sampling scheme for dryland fields.

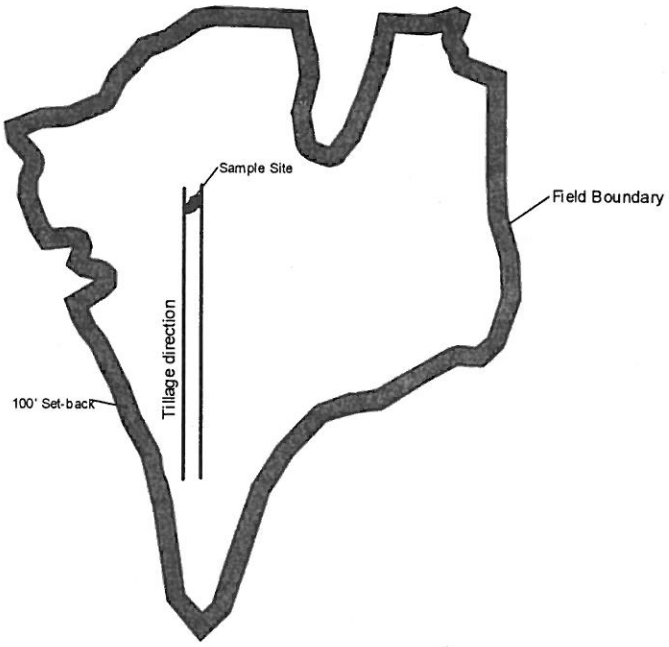


Figure 4. Sample site detail for dryland fields.

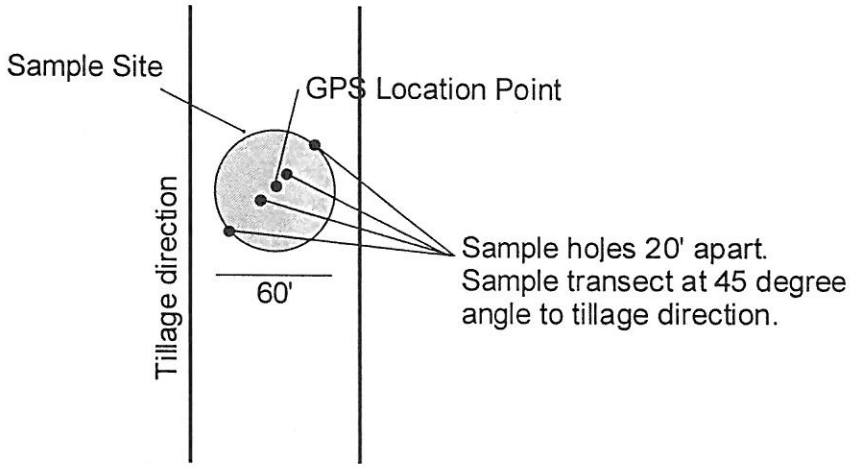


Figure 5. Sampling scheme for handline, wheelline, or solid set (row crop) irrigation systems.

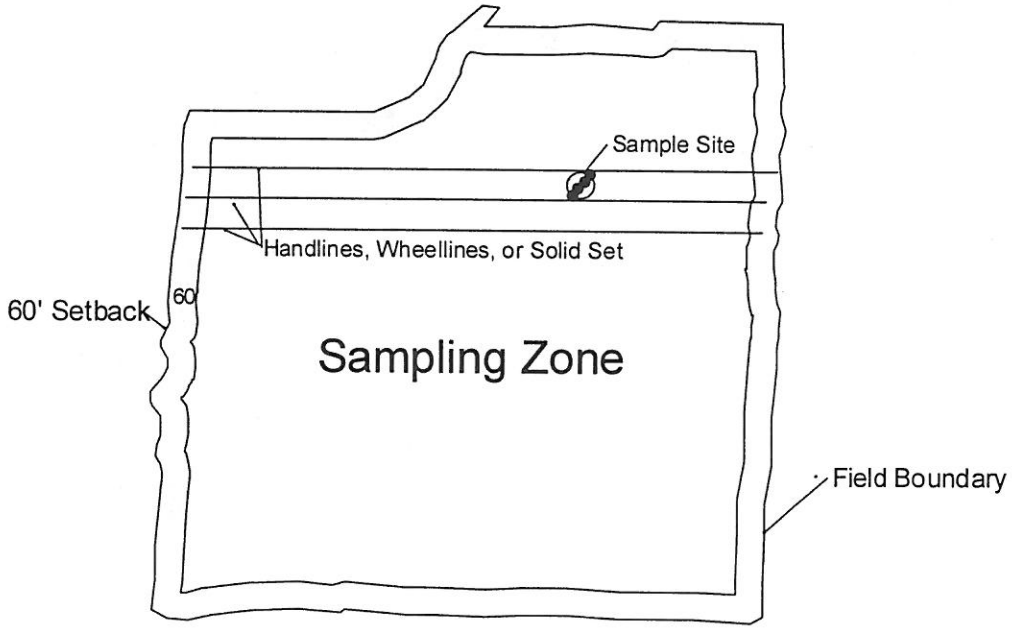


Figure 6. Sample site setail for handline, wheelline, or solid set (row crop) irrigation systems.

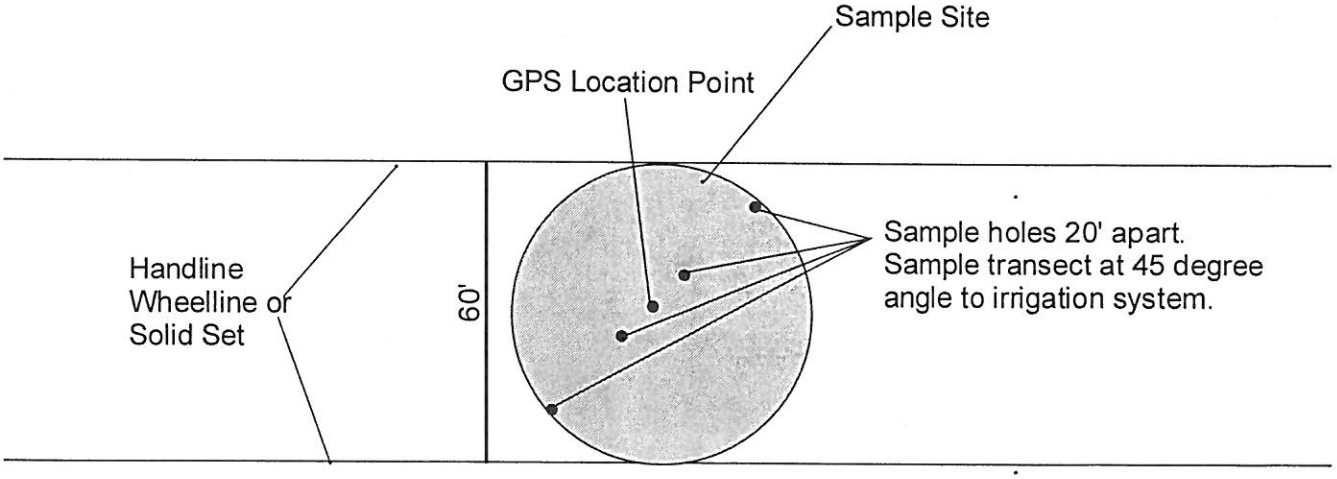


Figure 7. Sampling scheme for rill irrigation systems.

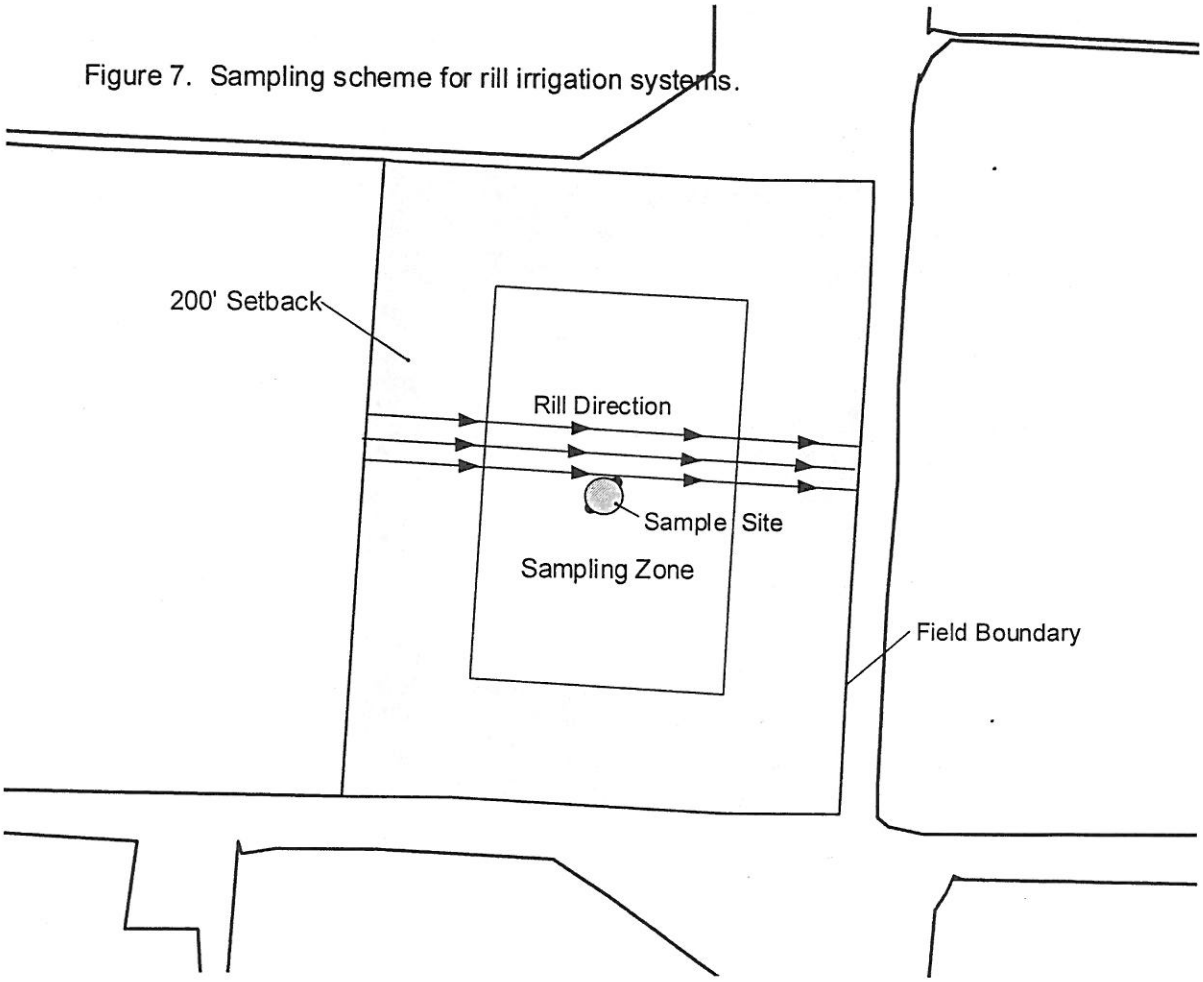


Figure 8. Sample site detail for rill irrigation systems.

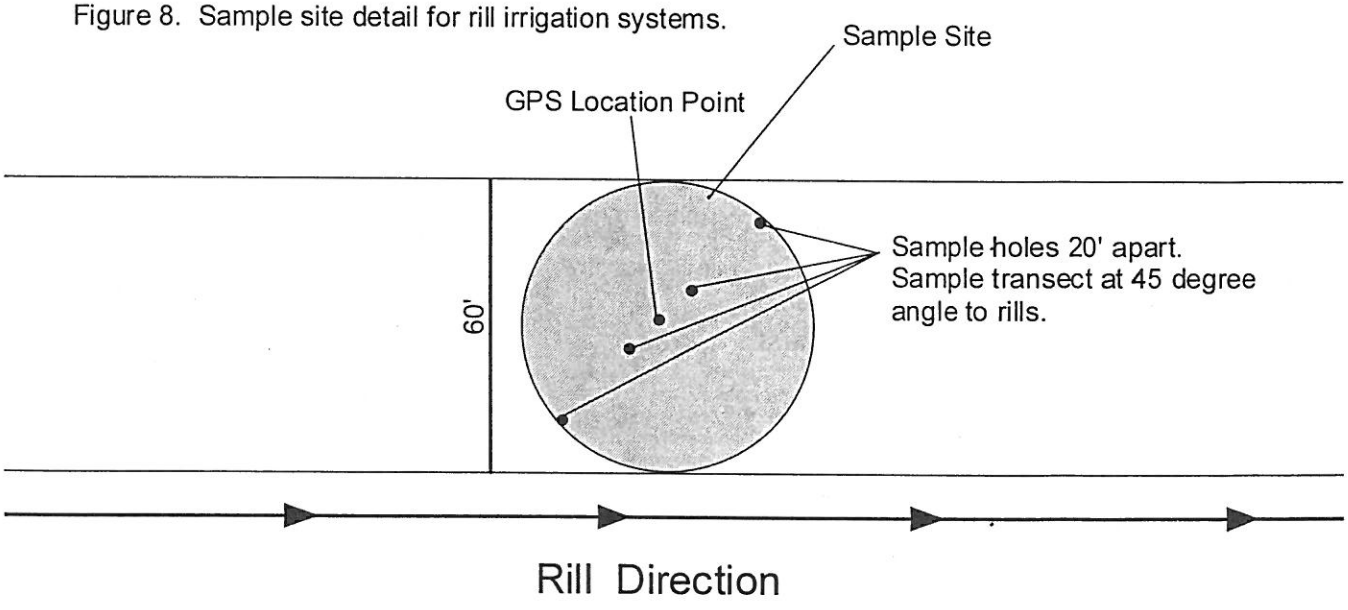


Figure 9. Sampling scheme for solid set or micro-spray (orchards & vineyards) irrigation systems.

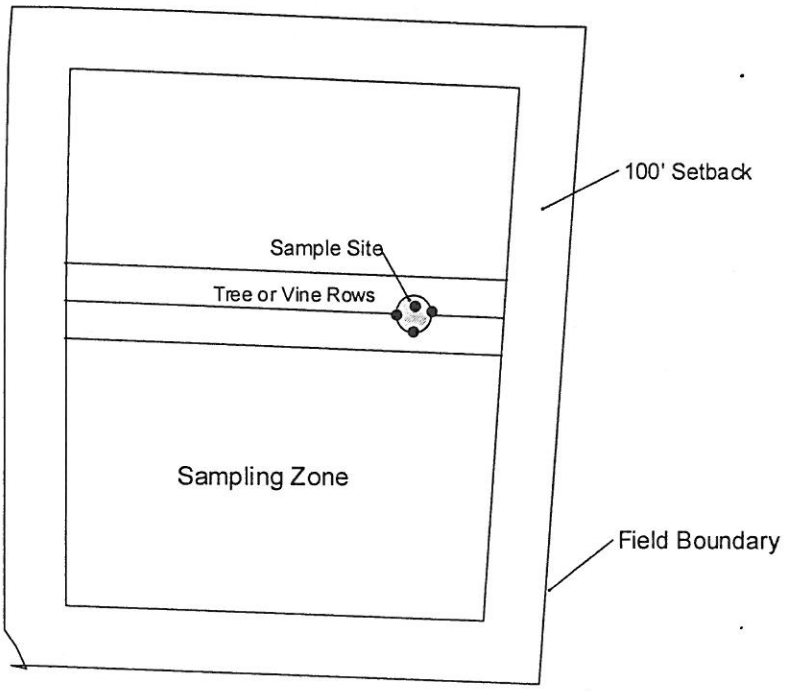


Figure 10. Sample site detail for orchard and vineyards wtih solid-set or drip irrigation systems.

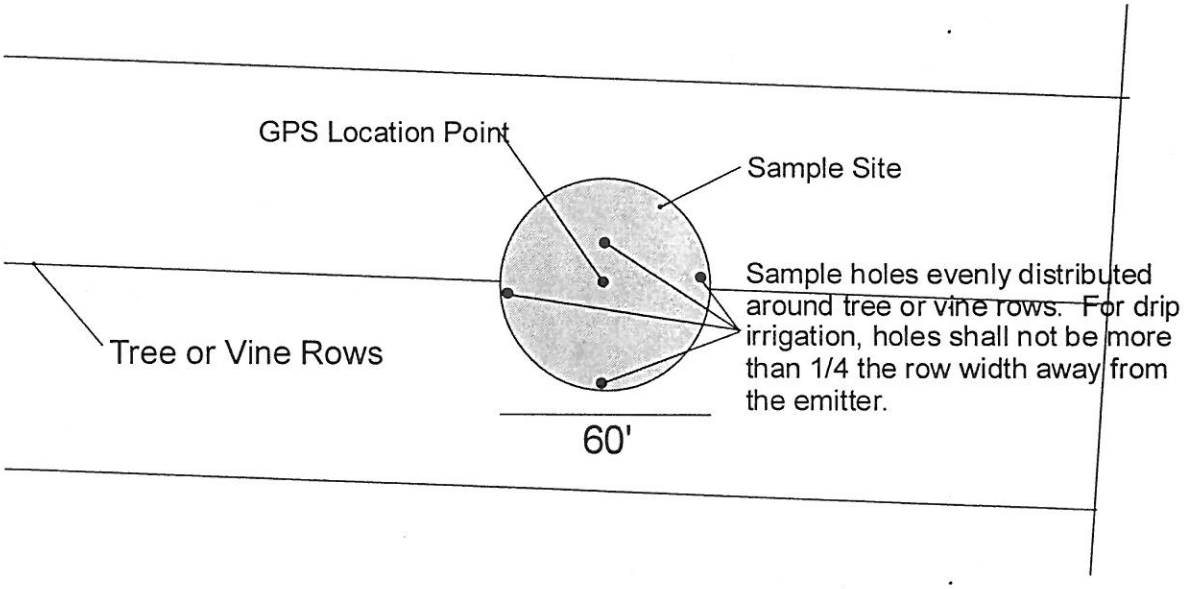


Figure 11. Sampling scheme for linear move irrigation systems.

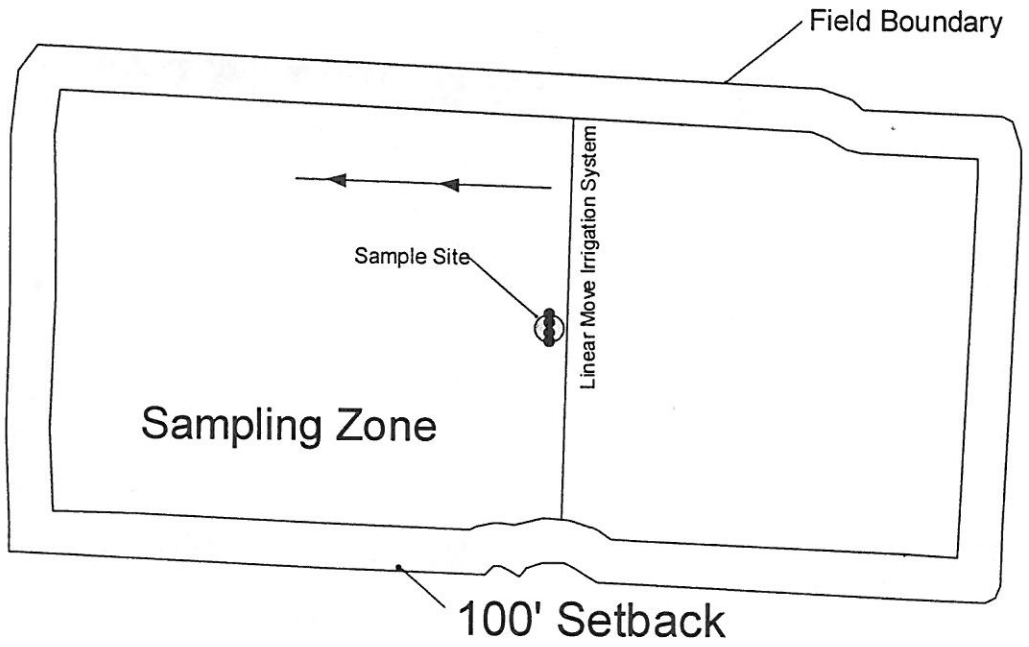
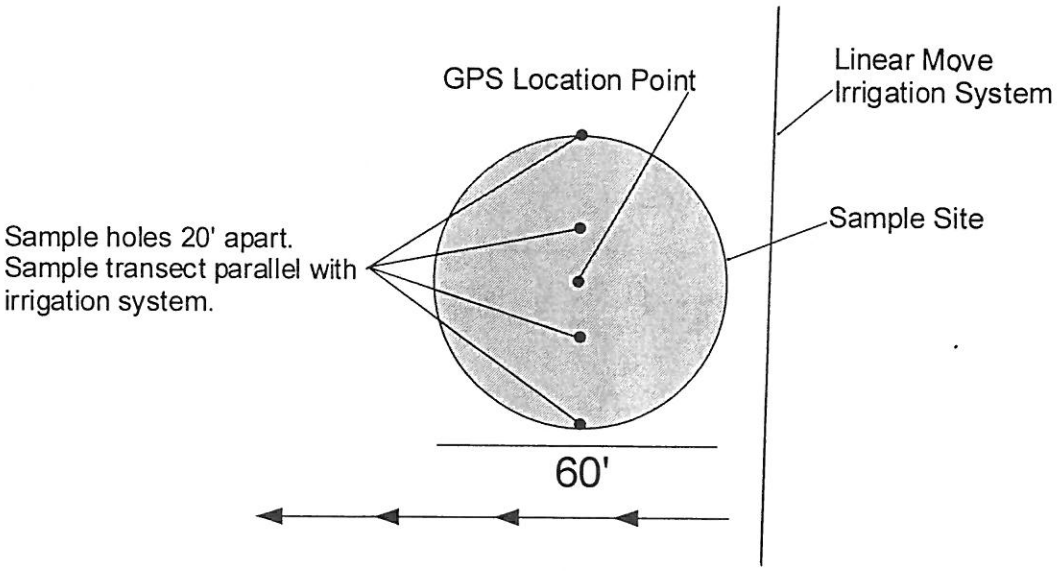


Figure 12. Sample site detail for linear move irrigation systems.



ATTACHMENT A
DEEP SOIL SAMPLING PROGRAM QUESTIONNAIRE

Deep Soil Sampling Program
Questionnaire

General:

As you may know, the aquifer in the Lower Yakima Valley has been shown to have groundwater nitrate concerns. Nitrogen that has migrated below the root zone is useless to crops and can be damaging to water quality. The Lower Yakima Valley Groundwater Advisory Committee (GWAC) designed this grower survey to help everyone better understand current production methods and provide guidance to improve farming practices to assist in improved farming practices. The correlation of the questionnaire with the Deep Soil Sampling Program is an attempt to understand the relationships between the amount and form of nitrogen applied, the application method and timing, the irrigation method, the amount of nitrogen required for plant growth based on cropping patterns, and the quantity of nitrogen that has migrated below the root zone. Participation will be anonymously structured as explained below.

The LOWER YAKIMA VALLEY Groundwater Advisory Committee (GWAC) is encouraging broad producer participation in the Deep Soil Sampling Program – at no cost to the grower. Nitrogen is an expensive input and once it migrates below the root zone it becomes an expensive loss. The results of your soil samples can help guide your input decisions and potentially reduce your nutrient expenses. A grower survey has been designed to better understand current production methods and assist in improved farming practices, where they may be needed to reduce nitrates in groundwater. For those producers who, for whatever reason chose not to participate in the Deep Soil Sampling Program, the GWAC would still encourage participation through completion of the landowner survey to help us understand current production practices. This questionnaire is intended for either growers who participate in the soil sampling project and those growers who choose not to participate.

We are thanking you in advance for agreeing to participate in the Lower Yakima Valley Groundwater Management Area Deep Soil Sampling Program and for completing the questionnaire. As mentioned above, samples will be taken on your property and analyzed at no cost to you, if you participate in the soil sampling program. We are also interested in knowing your agricultural practices such as crops grown, plant nutrients applied, irrigation practices, and soil type. While information gathered in the study will be summarized, your specific data will be confidential. Site specific information asked for on the questionnaire will not be public information. It will be summarized and used in a collective manner to help describe farming operations in the resulting report.

We have developed a procedure to protect your identity and the location of the soil sample locations. This protects your identity in your participation on the questionnaire as well. You are welcome to share that information with the South Yakima Conservation District or anyone else, but are under no obligation to do so.

Please keep the number associated with the attached bar code sheet. The bar code is the same number. It should be filed in a safe location so that you can refer to it to review your results of the soil sampling. With this number, you will be the only person that can identify your soil samples. It is not necessary to include all of the fields on your farm. You can select as many fields to include in the study as you feel comfortable with and may be able to add others later. If you decide not to

include all fields in the study, be sure and convey that information to the person collecting the samples when they arrive.

Place one bar code sticker on the questionnaire and return it in the envelope addressed to the South Yakima Conservation District and mail it. Do not include your return address. When the samples are collected, give the bar codes to the sampler who will attach them to the sample containers.

When all of the samples have been collected, analyzed, and tabulated they will be posted on a website or published in a format suitable for public access. The results from your farm will be identified by the number only you will know.

Participation in the Deep Soil Sampling Program can benefit you economically, as the analytical results will help determine whether or not expensive nitrogen is being applied in excess of what your crop can utilize.

Thanks for your participation.

Note to SYCD: Among other specifications for the samplers, the successful sampler must have an application on a portable device that will pull up the soil information from the NRCS site.

Deep Soil Sampling Program
Questionnaire

WORKSHEET FOR <u>IRRIGATED CROPLAND</u>
Bar Code (Place Bar Code Here) **Date: _____**

Field History
Years Owned/Farmed_____ Soil Type (if know): _____
Currently Soil Testing ___Yes ___No If yes, how often?_____
Number of Acres: _____
Tillage Practices For Crop Cycle

Current Crop (2014)_____Crop condition: _____Poor ____Fair ____Good
Tons/Bushels/Bins/Acre_____ actual or planned (circle one)

Cropping History (Include Double Crossing)

Crop Rotation:

2011 Crop 1_____Tons/Bushels/Bins/Acre _____; Crop 2_____Tons/Bushels/Bins/Acre_____

2012 Crop 1_____Tons/Bushels/Bins/Acre _____; Crop 2_____Tons/Bushels/Bins/Acre_____

2013 Crop 1_____Tons/Bushels/Bins/Acre _____; Crop 2_____Tons/Bushels/Bins/Acre_____

2014 Crop 1_____Tons/Bushels/Bins/Acre _____; Crop 2_____Tons/Bushels/Bins/Acre_____

Current method of scheduling irrigation:
_____ ET; _____ soil moisture sensors; _____ Routine _____ hr. sets; Weather Stations_____

Current Irrigation System: **Years of use on crop? _____**

___Flood Irrigation

___Rill Irrigation

___ Solid Set above canopy - ___Impact Sprinklers, ___ Micro spray ___Rotators

___Solid Set below canopy - ___Impact Sprinklers, ___ Micro spray ___Rotators

___Wheel lines ___Impact Sprinklers ___Rotators

___ Hand lines ___Impact Sprinklers ___Rotators

___ Linear move ___Impact Sprinklers, ___ Micro spray ___Rotators

___ Drip ___ tube,___ tape,___ bury line___ above ground line

___ Pivot ___Impact Sprinklers, ___ Micro spray ___Rotators

Deep Soil Sampling Program
Questionnaire

___ Pod line____Impact Sprinklers ___Rotators

___ Other: _____

Previous Irrigation System: **Years of use on crop? _____**

___Flood Irrigation

___Rill Irrigation

___ Solid Set above canopy - ___Impact Sprinklers, ___ Micro spray ___Rotators

___Solid Set below canopy - ___Impact Sprinklers, ___ Micro spray ___Rotators

___Wheel lines ___Impact Sprinklers ___Rotators

___ Hand lines ___Impact Sprinklers ___Rotators

___ Linear move ___Impact Sprinklers, ___ Micro spray ___Rotators

___ Drip ___ tube,___ tape,___ bury line___ above ground line

___ Pivot ___Impact Sprinklers, ___ Micro spray ___Rotators

___ Pod line____Impact Sprinklers ___Rotators

___ Other: _____

Nitrogen applications

Manure - Liquid

Year	Gallons/Acre applied	#N/1000 gal	How applied	Hours to incorporation	notes
2014					
2013					
2012					
2011					

Manure - Solid

Year	Tons/Acre applied	#N/ton	How applied	Hours to incorporation	notes
2014					
2013					
2012					
2011					

Commercial Fertilizer

Year	Material type?	#N/Acre applied	How applied	Hours to incorporation	notes
2014					
2013					

Deep Soil Sampling Program
Questionnaire

2012					
2011					

Biosolids

Year	Tons/Acre applied	#N/ton	How applied	Hours to incorporation	notes
2014					
2013					
2012					
2011					

Compost

Year	Tons/Acre applied	#N/ton	How applied	Hours to incorporation	notes
2014					
2013					
2012					
2011					

Other

Year	Tons applied	#/ton	How applied	Hours to incorporation	notes
2014					
2013					
2012					
2011					

Please provide additional information if appropriate such as split applications, starter, side dress, etc._____
_____
_____
_____
_____
_

Comments:_____
_____
_____
_____
_____

ATTACHMENT B
KEY PERSONNEL

Attachment B - Key Personnel

Deep Soil Sampling

Lower Yakima Valley Groundwater Management Area

Deep Soil Sampling Program Role	**Person**
Deep Soil Sampling Project Manager	To be determined
SYCD Project Administrator	Laurie Crowe, SYCD, (509) 829-9025
Groundwater Advisory Committee Alternate Chair	Vern Redifer, Yakima County, (509) 574-2300
Irrigated Agriculture Committee Chair	Jim Trull, SVID, (509) 837-8611
Livestock / Confined Animal Feeding Operation Committee Chair	Charlie McKinney, Dept. Ecology, 509-457-7107
Data Committee Chair	Kirk Cook, WSDA, (360) 902-1936
Education and Public Outreach Committee Chair	Lisa Freund, Yakima County, (509) 574-2300

ATTACHMENT C
BORING LOG

Soil Boring Log

Return this form, filled out, to South Yakima Conservation District
PO Box 1766 (or 200 Chenye Rd), Zillah, WA 98953
Fax: (509) 829-9027

Bar Code (Place Bar Code Here)

Boring Number: _____

Boring Date: _____ Boring Logged by: _____

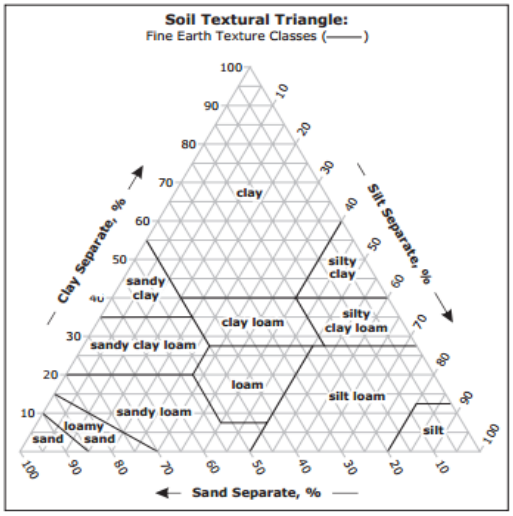
Boring and Sampling Device (example: AMS 9100 Ag Probe with 2-inch tube sampler) _____

_____

NRCS Soil Series (soil type) _____

Describe each soil sample.

Depth in ft	Munsel color	Consistence	Moisture	Texture	Other
0-1					
1-2					
2-3					
3-4					
4-5					
5-6					
6-7					
7-8					



TEXTURE MODIFIERS - Conventions for using "Rock Fragment Texture Modifiers" and for using textural adjectives that convey the "% volume" ranges for **Rock Fragments - Size and Quantity**.

Fragment Content % by Volume	Rock Fragment Modifier Usage
< 15	No texture adjective is used (noun only; e.g., *loam*).
15 to < 35	Use adjective for appropriate size; e.g., gravelly.
35 to < 60	Use "**very**" with the appropriate size adjective; e.g., *very gravelly*.
60 to < 90	Use "**extremely**" with the appropriate size adjective; e.g., *extremely gravelly*.

Moisture options:
D=dry
M=moist
Dp=damp
W=wet

Consistance options:
L=loose, S=soft, SH=slightly hard, HA=hard, EH=extremely hard, FR=friable, FI=firm; VFI=very firm; C=cemented.
See Field Book for Describing and Sampling Soils, NRCS, August 2011.

ATTACHMENT D
SOIL SAMPLE FIELD FORM

Soil Sample Field Form

Return this form, filled out, to South Yakima Conservation District
PO Box 1766 (or 200 Chenye Rd), Zillah, WA 98953
Fax: (509) 829-9027

Bar Code (Place Bar Code Here)

Sample Collection Date: _____ Sampled by: _____

Check depths sampled in each borehole, and samples submitted to lab:

Depth in ft	Borehole 1	Borehole 2	Borehole 3	Borehole 4	Composite Submitted
0-1					
1-2					
2-3					
3-4					
4-5					
5-6					
6-7					
7-8					

Sampling Site Sketch:
Draw sampling site and borings in relation to irrigation system and other features.
Provide GPS coordinates to owner (to 0.0001 decimal degree precision).

North

PACIFIC groundwater GROUP

INTERIM FINAL GROUNDWATER MONITORING PLAN
LOWER YAKIMA VALLEY GWMA
INITIAL CHARACTERIZATION

August 15, 2014

INTERIM FINAL GROUNDWATER MONITORING PLAN
LOWER YAKIMA VALLEY GWMA
INITIAL CHARACTERIZATION

Prepared for:

Lower Yakima Valley Groundwater Advisory Committee
and
Yakima County
128 N. Second Street
Yakima, Washington 98901

Prepared by:

Pacific Groundwater Group
2377 Eastlake Avenue East, Suite 200
Seattle, Washington 98102
206.329.0141
www.pgwg.com

August 15, 2014
JE1308
GWMAMonPlan_v7

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Table 2: Ecology Accredited Labs for GWMA Parameters of Concern

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Figure 1: Lower Yakima Valley Groundwater Management Area Groundwater Monitoring Study Area

APPENDICES

Appendix A: Example Field Sampling and Instrument Calibration Forms

Appendix B: Groundwater Monitoring Quality Assurance/Quality Control Plan, Lower Yakima Valley GWMA Initial Characterization

MONITORING PLAN APPROVALS

This Groundwater Monitoring Plan, developed (insert final date), 2014 for the Lower Yakima Valley Groundwater Management Area, has been reviewed and approved by the undersigned. Copies of the completed and signed Groundwater Monitoring Plan shall be distributed to the undersigned and all field personnel.

Lower Yakima Valley Groundwater Advisory Committee	Date
Project Manager	Date
QC Coordinator	Date
Field Manager	Date

This work was performed under HDR contract #CON0082545 and partially fulfills scope Item 2c. The Groundwater Monitoring Plan was prepared in accordance with hydrogeologic practices generally accepted at this time in this area, for the exclusive use of the Lower Yakima Valley Groundwater Advisory Committee and HDR, for specific application to the Initial Characterization. No other warranty, express or implied, is made.

1.0 PROJECT BACKGROUND

The Lower Yakima Valley (LYV) Groundwater Management Area (GWMA) was formed in 2011 in response to elevated nitrate concentrations in groundwater in the LYV. The GWMA project is a multi-agency, citizen-based, coordinated effort to reduce groundwater nitrate concentrations in the LYV to below Washington State drinking water standards. To achieve this goal, activities contributing to elevated groundwater nitrate concentrations must be identified based on scientific data and evaluation, and strategies for implementing best management practices must be developed. The GWMA extends from Union Gap southeast to the Yakima County boundary, minus the Yakama Reservation (Figure 1).

The LYV Groundwater Advisory Committee (GWAC) through Yakima County Public Services, selected HDR Engineering (HDR) and Pacific Groundwater Group (PGG) to perform two Scopes of Work under HDR contract #CON0082545. The first scope, led by HDR, is a study to identify applicable local, state, and federal regulatory requirements that control and manage nitrate in groundwater, identify Best management Practices (BMPs), and evaluate the effectiveness of these BMPs. The second scope, led by PGG, focuses on development of this Groundwater Monitoring Plan to establish a network of wells and field procedures to evaluate current and future nitrate concentrations in groundwater.

This interim final Groundwater Monitoring Plan addresses:

- Sampling Procedures
- Sampling Schedule (*developed following identification of the sampling network*)
- Sampling Network (*sampling network has not been established as of the date of issue for the interim final Groundwater Monitoring Plan*)
- Quality Assurance/Quality Control
- Reporting (*frequency developed following identification of the sampling network and schedule*)

While this Monitoring Plan is intended to be comprehensive, revisions and/or amendments may be required as the project evolves.

1.1 OBJECTIVES

The objectives of this Groundwater Monitoring Plan are to establish procedures for the collection and analysis of representative groundwater samples for nitrate and nitrate-related analytes. In accordance with objectives established in the Potential Groundwater Monitoring Stations Report (PGG, December 2014), the data should be used to:

- Evaluate BMP effectiveness
- Evaluate groundwater trends
- Identify nitrate hotspots

- Calculate basin-wide average nitrate concentrations

The GWAC will use analytical results from these samples to make administrative decisions and policy recommendations; therefore, the data inputs must be reliable and defensible. Following the sampling protocols and methods described in this Monitoring Plan will facilitate collection of samples that accurately represent the groundwater and minimize sampling artifacts.

1.2 PROJECT DESCRIPTION/SCOPE OF WORK

This project is designed for the GWAC to collect representative nitrate and nitrate-related groundwater data to assess current and future conditions and to meet the objectives summarized in Section 1.1.

The study boundaries for the groundwater monitoring program are the GWMA boundaries minus the area covered by the consent order between the United States Environmental Protection Agency and several dairies ("dairy cluster", Figure 1).

The sampling program described in this Groundwater Monitoring Plan involves collecting groundwater samples from a network of wells for analyses of nitrate, nitrite, ammonia, and the sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen). The network is assumed to include wells that already have pumps (private, public, and irrigation supply wells), and monitoring wells that require use of sampling pumps.

Groundwater samples will be analyzed by labs accredited by the Washington State Department of Ecology (Ecology). To avoid data entry errors, PGG recommends that preference be given to labs that can provide electronic data deliverables (EDDs) to the GWAC for direct upload to a database. Data will be managed in the project database and evaluated for trends, effectiveness of BMPs, hotspots, etc.

1.3 PROJECT SCHEDULE

Once the Groundwater Monitoring Plan is approved, field personnel will be identified, associated training will be completed, and equipment purchases or rental arrangements (field instruments, etc.) will be made. Following completion of these tasks, the initial sampling event under this Monitoring Plan will be performed at the next occurring interval established by the sampling schedule (Section 3.5).

Reports summarizing monitoring data will be prepared and submitted to the GWAC (Section 5).

2.0 PARAMETERS OF CONCERN AND ANALYTICAL LABS

Based on previous investigations and the purpose for establishing the GWMA, the parameters of concern for this study are:

- Nitrate
- Nitrite
- Ammonia-nitrogen
- Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen)

Recommended and alternative analytical methods and holding times (from sample collection to analysis) are summarized in Table 1. The analytical method list in Table 1 was derived from Ecology's *Methods and Analytes Table* on their environmental lab accreditation website. The recommended analytical methods in Table 1 meet the PQL requirements, are common analytical methods, and have frequently been used by PGG in characterization studies. Alternative analytical methods are listed so that multiple labs (which may use acceptable but different methods of analysis from the recommended methods) could be contracted to analyze the parameters of concern. If there are discrepancies regarding preservation or holding time between Table 1 and the analytical method, the analytical method shall be considered correct.

Samples will be analyzed by a Washington State accredited chemical laboratory. A list of labs accredited for the GWMA parameters of concern is presented in Table 2, which was derived from Ecology's Lab Search website. Lab-prepared sample bottles should be acquired from the selected analytical lab prior to mobilizing to the field. Since nitrate and nitrite will be analyzed individually, rather than combined as nitrate+nitrite, the sample bottles will not have a sulfuric acid preservative. When sulfuric acid preservative is added to a sample, only nitrate+nitrite concentrations can be measured and not individual concentrations of nitrate or nitrite.

Considerations for selecting a lab from Table 2 should include price, logistics in delivering or shipping samples to the lab within 45 hours of collection, and EDD availability.

3.0 SAMPLING PROTOCOLS

Before mobilizing to the field, consult data collected during the Field Verification survey for information regarding well access. Note and meet any access notice requested by the well owner or operator. It is also important that a member of the sampling team can communicate effectively with well owners who are Spanish speakers.

Samples may be collected from either pre-existing, privately-owned supply wells, or project-specific monitoring wells. Sampling methods for both well types are given below.

3.1 WATER QUALITY METER CALIBRATION

Water quality instruments will be used to measure pH, electrical conductivity, temperature, and dissolved oxygen in the field during sampling. Flow through cells and multi-parameter meters are preferred; however, it may not be practical to use flow through cells at domestic and irrigation wells because unknown fittings may be required. In those cases, single-use CHEMetrics CHEMets may be used to measure dissolved oxygen.

Water quality instruments will be calibrated at the beginning (prior to sampling) and middle of each sampling day for pH and electrical conductivity following manufacturer's instructions. Readings will also be taken at the end of the day to evaluate drift.

Rented multi-parameter meters should be calibrated for dissolved oxygen by the rental company prior to delivery to the sampling team. Purchased multi-parameter meters should be calibrated for dissolved oxygen in the office prior to the sampling event. At the beginning (prior to sampling), middle, and end of each sampling day, partially fill the manufacturer supplied calibration cup or sensor storage container with enough tap water to submerge the dissolved oxygen sensor. Cap the cup/container and shake it up to aerate the water. Install the dissolved oxygen probe and record the reading, it should be about 10-12 mg/L if the probe is well calibrated. If not, all dissolved oxygen readings should be J-flagged in the field notes. The relative values will be useful to monitor stabilization; however, the absolute values will not be accurate. Alternatively, CHEMets may be used, which do not require calibration.

Calibration data will be recorded in the field notes. An example Field Instrument Calibration Form is presented in Appendix A.

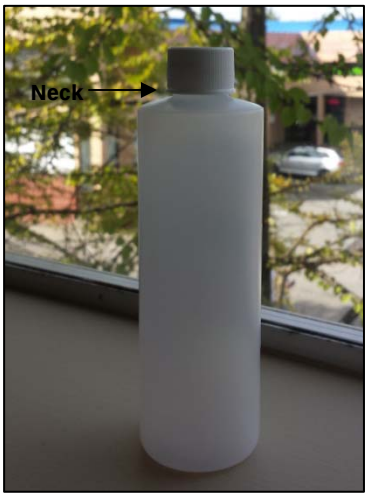
3.2 WATER SUPPLY WELL SAMPLES FROM SPIGOTS

The following tasks will be performed at each domestic, irrigation, and water supply well to be sampled. An example Groundwater Monitoring – Supply Well Sampling Field Form is presented in Appendix A. Field forms or notebooks should be weather-resistant (e.g. Rite in the Rain paper).

1. Confirm that water quality instruments have been calibrated according to the schedule presented in Section 3.0.
2. Record date, time, Ecology well ID, well owner and number where applicable (e.g. City of Sunnyside Well #10), appearance and condition of the wellhead, and weather conditions.
3. Groundwater samples should be collected from a sampling port on the well or the nearest tap to the wellhead and upstream of any tank or treatment device. Any tank or treatment device upstream of the sampling location should be noted on the field form. The well owner should observe and approve of modifications and operations.
4. Inspect the sampling port to assess if it is possible to connect a flow through cell with available fittings. If so, open the spigot and allow water to run for approximately 1 minute to flush out any particulates. If sampling in a well house, this water may be collected in buckets. Close the spigot and connect the flow through cell outfitted with a calibrated multi-parameter meter. If it is not possible to connect a flow through cell with available fittings, record in field notes what additional fittings would be required for future sampling events.
5. Start purging the well by opening the spigot. Record the time purging began in the field notes. Purge water should be routed to the ground or a floor drain. A length of polyethylene (PE) tubing (typically 1/2 by 3/8 inch diameter) and female threaded metal clamp hose may be used if necessary to route water outside well houses to ground surface. The pump should be running when samples are collected, even

though a pressure tank could cause the sampling port to flow even when the pump is off.

6. Record the make/model of water quality instrument(s) in the field notes. During purging, monitor the following field parameters at regular intervals (2 to 5 minutes): temperature, pH, specific conductivity, and dissolved oxygen. Record the time and measurements in the field sheets. Also note on field sheets any observed color or odor in purge water.
7. Continue purging until field parameters have stabilized according to:
   - pH: ± 0.1 standard units
   - Specific conductance: ±10.0 umhos/com for values less than 1,000 umhos/cm, or ±20 umhos/cm for values greater than 1,000 umhos/cm
   - Dissolved oxygen if using a probe (multi-parameter meter): ±0.05 mg/L for values less than 1 mg/L, or ±0.2 mg/L for values greater than 1 mg/L
   - Dissolved oxygen if using CHEMets: ±0.1 mg/L for values less than 1 mg/L, or ±1 mg/L for values greater than 1 mg/L
   - Temperature: ±0.1 degree C
8. After field parameters have stabilized, disconnect the flow through cell and any tubing or hose used to route purge water to the ground. If the sampling port is located inside a well house, a 5-gallon bucket may be required to capture discharge water during sampling if a floor drain is not nearby.
9. Record unique well ID, sample date and time, and sampler's initials on each sample container, in the field notes, and on the Chain-of-Custody. Samples will be labeled in accordance with criteria described in Section 3.3. Bottles should not be filled until they are labeled.
10. Collect samples of water directly from the sampling port into laboratory-supplied containers for parameters listed in Table 1. The pump should be running when samples are collected. Do not use intermediate containers or vessels. Hands and clothing shall be clean when handling sampling equipment. Wear clean, disposable, latex gloves when filling bottles for analyses and change gloves between sampling locations. If it is necessary to set the bottle cap down during sampling, place it cap side up on a clean sheet of plastic or clean plastic storage bag (e.g. sandwich bag). Collect samples in the following manner:
    - Nitrate and nitrite: fill laboratory provided bottle to the top
    - Ammonia and Total Kjedahl Nitrogen (TKN): fill laboratory provided bottle to the neck of the bottle, but *do not overfill*. Bottles for these analyses are provided by the lab containing preservative that should not be washed out by dumping or overfilling.



11. Collect QA/QC samples according to Appendix B in the manner described in Step 7.
12. Turn off sampling port.
13. Place sample bottles in a clean plastic bag and place the bag in a clean, insulated container (ice chest or cooler) containing frozen gel ice or wet ice to maintain sample temperatures at approximately 6 degrees Celsius, but not at or below, freezing. Double bag ice to prevent leakage during shipping. Use sufficient cooling materials to maintain sample temperature near 6 degrees Celsius during the entire time of transport to the lab.
14. Restore any objects at the wellhead that may have been disturbed during sampling. Obtain owner approval that conditions are satisfactory prior to departure. In winter, special procedures for start-up and shut-down will likely be required to protect equipment.
15. Maintain custody of samples from time of sampling to receipt at the laboratory. "Custody" means that samples remain:
    - In direct possession of a person who is recorded on the Chain-of-Custody form, or
    - Locked in secure vehicles or offices

Complete the Chain-of-Custody forms and any other pertinent sampling/shipping documentation to accompany the samples.

Ship or deliver samples to the selected Washington State accredited chemical laboratory, accompanied by Chain-of-Custody forms and any other pertinent shipping/sampling documentation. One set of Chain-of-Custody forms will be used per laboratory shipment.

In order to meet holding times, samples must be received by the lab less than 45 hours from the time they were collected.

3.3 MONITORING WELL SAMPLING

The following tasks will be performed at each water-table monitoring well to be sampled. An example Monitoring Well Sampling Field Form is presented in Appendix A.

1. Record date, time, unique well ID, appearance and condition of the wellhead, and weather conditions.
2. Measure and record static water level to the nearest 0.01 foot using a decontaminated electric well sounder. Well sounders shall be decontaminated by rinsing the length of the sounder that will be submerged in the well with distilled water prior to each use. Water level measuring points (top of PVC well casing) will be permanently marked on each well.
3. Install sampling pump.
    - If the depth to water is less than 25 feet, a peristaltic pump may be used to collect the sample. Wearing clean, disposable gloves, lower new, clean, ¼ inch diameter

PE tubing or dedicated[1] ¼ inch diameter PE tubing into the well until the bottom of the tubing is below the water surface and within the well screen. Attach the top of the tubing to approximately 6 to 9 inches of silicone tubing and mount the silicone tubing in the peristaltic pump head. Attach approximately 2 feet of ¼ inch diameter PE tubing to the other end of the silicone tubing – this will be the sampling point. Confirm the pump rotation is set to lift water from the well.

- If the depth to water is greater than 25 feet, a portable or dedicated submersible pump should be used to collect the sample. Confirm with the distributor, manufacturer, or rental company that the pump has adequate lift for the anticipated depths to water. Wearing clean, disposable gloves, attach new, clean, PE tubing or dedicated PE tubing to the top of the pump motor and secure with a zip tie, hose clamp, or similar. Lower the pump until the intake is below the water surface and within the well screen. At the wellhead or ground surface, secure the electrical line of the pump so it does not slip during sampling. Attach the pump to the control box (if applicable), and power source.

4. If using a flow through cell, install the multi-parameter meter in the flow through cell and connect the pump discharge line to the inlet on the bottom of the cell. Connect a discharge line from outlet of the flow through cell of sufficient length to reach the discharge bucket.
5. Remove gloves and start the pump. Low-flow purge techniques will be used, with flow rates being less than 1.0 liters/minute (0.25 gallons per minute) to minimize drawdown and disturbance of sediment. Calculate flow rates using a stop-watch and calibrated vessel (e.g. kitchen measuring cup), adjust flow rates as necessary using the peristaltic pump speed dial, submersible pump control box speed dial, or a decontaminated PVC valve installed in the submersible pump discharge line. Discharge water into a 5-gallon bucket or similar that can be used to estimate purge volume. Filled buckets may be discharged to ground near the wellhead.
6. Record the make/model of water quality instrument(s) in the field notes. During purging, monitor the following field parameters at regular intervals (e.g. 2 to 5 minutes or every 0.5 gallons): temperature, pH, specific conductivity, dissolved oxygen, depth to water, estimated purge volume, and purge rate. Record the time and measurements in the field sheets. Also note on field sheets any purge water color or odor.
7. Continue purging until field parameters have stabilized according to:
    - pH: ± 0.1 standard units
    - Specific conductance: ±10.0 umhos/com for values less than 1,000 umhos/cm, or ±20 umhos/cm for values greater than 1,000 umhos/cm
    - Dissolved oxygen if using a probe (multi-parameter meter): ±0.05 mg/L for values less than 1 mg/L, or ±0.2 mg/L for values greater than 1 mg/L. If using CHEMets: ±0.1 mg/L for values less than 1 mg/L, or ±1 mg/L for values greater than 1 mg/L
    - Temperature: ±0.1 degree C

[1] "dedicated" devices are those permanently installed (left in the wells between sampling rounds).

8. Record unique well ID, sample date and time, and sampler's initials on each sample container, in the field notes, and on the Chain-of-Custody. Samples will be labeled in accordance with criteria described in Section 3.3. Bottles should not be filled until they are labeled.
9. Hands and clothing shall be clean when handing sampling equipment. Wear clean, disposable, latex gloves when filling bottles for analyses and change gloves between sampling locations. Wearing gloves, disconnect the pump discharge line from the flow through cell. Collect samples of water directly from the discharge line into laboratory-supplied containers for parameters listed in Table 1. Do not use intermediate containers or vessels. If it is necessary to set bottle caps down during sampling, place the caps side up on a clean sheet of plastic or clean plastic storage bag (e.g. sandwich bag). Collect samples in the following manner:
    - Nitrate and nitrite: fill laboratory provided bottle to the top
    - Ammonia and Total Kjedahl Nitrogen (TKN): fill laboratory provided bottle almost to the neck, but do not overfill (see photo in Section 3.1). Bottles for these analyses are provided by the lab containing preservative that should not be washed out by dumping or overfilling.
10. Collect QA/QC samples according to Appendix B in the manner described in Step 9.
11. Turn off the pump.
12. Bag sample bottles in a clean plastic bag and place the bag in a clean, insulated container (ice chest or cooler) containing frozen gel ice or wet ice to maintain sample temperatures at approximately 6 degrees Celsius, but not at or below, freezing. Double bag ice to prevent leakage during shipping. Use sufficient cooling materials to maintain sample temperature near 6 degrees Celsius during the entire time of transport to the lab.
13. Remove non-dedicated equipment (e.g. submersible pump) from the well[2]. Dedicated peristaltic or submersible pump tubing may be stored in the well between sampling events provided the tubing is at least the length of the well casing (i.e. can be reached by hand if bottom of tubing rests on bottom of well). Alternately, dedicated pump tubing may be stored in labeled, clean, plastic bags. Secure, and lock the monitoring well.
14. Decontaminate non-dedicated submersible pumps, in-line flow valves, and water level sounders according to the following methods. Peristaltic pumps do not come in direct contact with purge or sampling water and therefore do not require decontamination:
    - Fill a clean bucket with sufficient distilled water to submerge the pump motor and intake and pour in approximately 1 ¼ ounces (or 2.5 tablespoons) per gallon of water of Liquinox™ or similar liquid detergent.

[2] For certain types of submersible pumps (e.g. Grundfos RediFlo 2™), it is often easiest and most effective to decontaminate the electrical line as the pump is being removed from the well, especially with a two-person sampling team. Soak heavy paper towel in a distilled water and Liquinox™ (or similar) solution (See Step 14) and grasp the electrical line in the paper towel with the hand closest to the well. Soak another heavy paper towel in distilled water and grasp the electrical line in the paper towel with the hand farthest away from the wellhead. Have the second team member pull up the pump. Re-soak or replace paper towels as necessary.

- One at a time, scrub the outside of the pump motor, pump electrical line (if not decontaminated during removal), in-line flow valve, and water level sounder (full length placed in the well) in the detergent solution using a clean nylon brush. Pour the detergent solution through the in-line flow valve.
- With the pump intake submerged, turn the pump on to run detergent solution through the pump.
- Rinse the outside of the pump motor, pump electrical line (if not decontaminated during removal), in-line flow valve, and water level sounder thoroughly with distilled water.
- Fill a second clean bucket with sufficient distilled water to submerge the pump motor and intake. Turn the pump on to rinse distilled water through the pump.
- Place decontaminated field equipment in clean bags or tote boxes for transport between stations.

15. Maintain custody of samples from time of sampling to receipt at the laboratory. "Custody" means that samples remain:
    - In direct possession of a person who is recorded on the Chain-of-Custody form, or
    - Locked in secure vehicles or offices

Complete the appropriate Chain-of-Custody forms and any other pertinent sampling/shipping documentation to accompany the samples.

Ship or deliver samples to the selected Washington State accredited chemical laboratory, accompanied by Chain-of-Custody forms and any other pertinent shipping/sampling documentation. One set of Chain-of-Custody forms will be used per laboratory shipment.

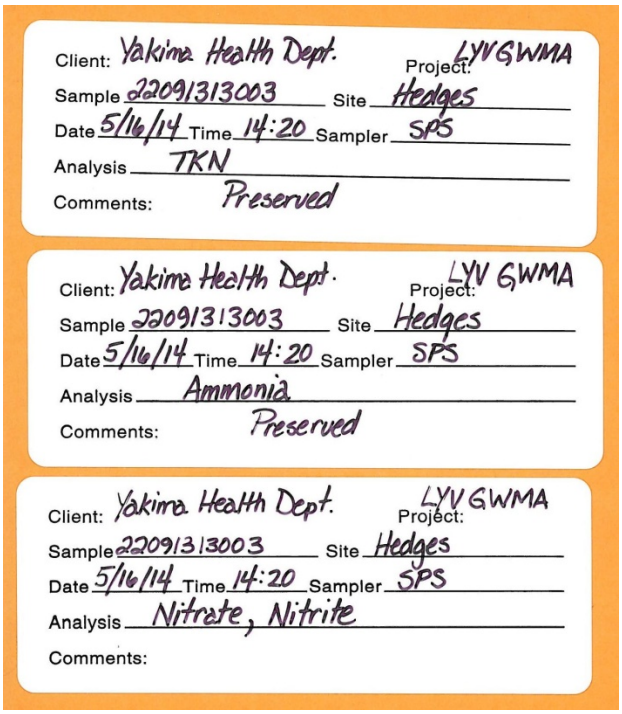
In order to meet holding times, samples must be received by the lab less than 45 hours from the time they were collected.

3.4 SAMPLE LABELING SYSTEM

Sample bottles will be provided and preserved by the analytical lab(s) chosen for the project. All containers will be clearly labeled in the field with indelible ink, **prior to filling**. Each sample container will be identified with the following information:

- Project (e.g. "LYV GWMA")
- Client/Entity analytical invoice will be submitted to (e.g. "Yakima County Health Department")

- Well ID (or QA/QC nomenclature)
- Well Owner name or Water System name and well name (e.g. “Hedges” or “Sunnyside Well 10”)
- Initials of sampler (e.g. “SPS”)
- Date and time of sample collection using the 24 hour time system (e.g. “5/16/14 14:20”)
- Comments regarding bottle preservation, field filtering



Example labels for one sample (3 bottles) are shown to the right. Note that these labels are presented as examples for the type of information to be included only. The actual lab(s) used for the GWMA Groundwater Monitoring program may group analyses into bottles differently than presented.

3.5 SAMPLING SCHEDULE

Sampling schedule should be established following identification of the Groundwater Monitoring well network.

As described in the *Potential Groundwater Stations* report (PGG, 2013), results of approximately 1,000 nitrate and nitrate-related samples are estimated to be required to meet the objective of measuring basin-wide averages at a level of confidence that supports use of the data for future GWMA purposes. Therefore, the sampling frequency is dependent on the number of wells in the Groundwater Monitoring well network.

3.6 WELL NETWORK

The monitoring well network should be established following completion of the Field Verification survey currently being performed by the Yakima County Health Department.

The final Groundwater Monitoring Plan will identify network wells in a table, present the well locations in a figure(s), and provide background of how the network was established.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

The Quality Assurance/Quality Control program is presented in Appendix B and identifies data quality objectives, quality control checks, and data validation and usability.

5.0 REPORTING AND DATA MANAGEMENT

Reporting frequency should be established following identification of the Groundwater Monitoring well network and sampling schedule.

Reports will be prepared to summarize data, update trend and other statistical analysis as appropriate, estimate basin-wide average concentrations as appropriate, identify data gaps or redundancies in the network, and present recommendations for adjustments to the monitoring program.

Water quality data associated with this Groundwater Monitoring Plan will be uploaded to Ecology's Environmental Information Management (EIM) System.

6.0 REFERENCES

Pacific Groundwater Group, 2013. Potential Groundwater Monitoring Stations Yakima Groundwater Management Area. Consultant's report prepared for HDR, Inc., Yakima County, and Lower Yakima Valley Groundwater Advisory Committee. December 3, 2013.

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Washington State Department of Ecology, n.d. Methods and Analytes table. http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html. Web. September 4, 2013.

Table 1. Water Quality Parameters of Concern, Analytical Methods, and Project MCLs

Table 1a. Lab Analyzed Parameters

Parameter	Recommended Analytical Method	Alternative Analytical Methods	Preservative	Holding Time	Bottle Type	GWMA Project MCLs [2]	PQL Goal [3]
Ammonia-N	EPA 350.1	EPA 349.0 / USGS 1-3520-85 / SM4500-NH3 C, D, E, F, G, H, or I / ASTM D1426-08 or -98A / ASTM D 6919-03	H2SO4	28 days	Lab Provided	Not Established	0.3 mg/L or lower
Nitrate	EPA 353.2[1]	EPA 300.0 / SM 4110 B / SM 4500-NO3 B, D, E, F, H, or I		48 hours	Lab Provided	10 mg/L	1 mg/L or lower
Nitrite	EPA 353.2[1]	EPA 300.0 / SM 4500-NO2 B / SM 4110 B / SM 4500-NO3 F or I		48 hours	Lab Provided	1 mg/L	0.1 mg/L or lower
Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen, TKN)	SM 4500-Norg D	EPA 351.1 / EPA 351.2 / SM 4500-Norg B or C / ASTM D1426-93B	H2SO4	28 days	Lab Provided	Not Established	1 mg/L or lower

[1] Method may be used to determine nitrate+nitrite, nitrite, or nitrate. Nitrate and nitrite (individually) are parameters of concern for this study, while nitrate+nitrite is not. No preservative is used when individually measuring nitrate or nitrite concentrations, and therefore the holding time is 48 hours. If H2SO4 preservative is used the holding time is extended to 28 days, but only nitrate+nitrite concentrations can be measured and not individual nitrate or nitrite concentrations.

[2] As presented in Groundwater Monitoring Quality Assurance/Quality Control Plan Lower Yakima Valley GWMA Initial Characterization.

[3] Practical Quantitation Limits/Lab Reporting Limits for these methods are determined by individual labs. Practical Quantitation Limits/Lab Reporting Limits must be 10-percent of Project MCLs or lower for nitrate and nitrite. PQL Goals for Ammonia and TKN based on the maximum PQL among 6 accredited labs located in Eastern Washington based on June 27, 2014 survey

Analytical Methods consistent with Ecology's Methods and Analytes Table at: http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html

Discrepancies between Preservation/Holding Time between this table and the Analytical Methods should be resolved in favor of the Analytical Method

Table 1b. Field Parameters

Parameter	Meter	Stabilization Criteria
pH	Water Quality Meter	±0.1 standard units
Specific Conductance	Water Quality Meter	±10 umhos/cm for values <1,000 umhos/cm; ±20 umhos/cm for values >1,000 umhos/cm
Temerature	Water Quality Meter	±0.1 degrees Celsius
Dissolved Oxygen	Water Quality Meter or CHEMets™	Water Quality Meter: ±0.05 mg/L for values <1mg/L; ±0.2 mg/L for values > 1mg/L CHEMets™: ±0.1 mg/L for values < 1 mg/L; ±1 mg/L for values > 1 mg/L

Table 2. Ecology Accredited Labs for GWMA Parameters of Concern*

Analytical Lab Name	City	State	Phone	Accreditation No.	Accredited GWMA Parameters of Concern			
					Ammonia	Nitrate	Nitrite	TKN
AAA Laboratory	Cheney	WA	(509) 235-9390	C576-13	X	X	X	X
ALS Environmental - Kelso	Kelso	WA	(360) 577-7222	C544-13a	X	X	X	X
AmTest Laboratories	Kirkland	WA	(425) 885-1664	C554-13	X	X	X	X
Analytical Resources, Incorporated	Tukwila	WA	(206) 695-6205	C558-13b	X	X	X	X
Anatek Labs, Inc. - Spokane	Spokane	WA	(509) 838-3999	C585-13	X	X	X	X
Aquatic Research, Inc.	Seattle	WA	(206) 632-2715	C550-13	X	X	X	X
Archer Analytical	Richland	WA	(509) 375-6147	C872-13	X	X	X	X
Avocet Environmental Testing	Bellingham	WA	(360) 734-9033	C602-13	X	X	X	X
Benton-Franklin Health District Lab	Kennewick	WA	(509) 460-4206	H408-13	X	X	X	X
Cascade Analytical, Inc. - Wenatchee	Wenatchee	WA	(509) 662-1888	C564-13	X	X	X	X
Centric Analytical Labs, LLC	Port Orchard	WA	(509) 844-6597	C1003-13a	X	X	X	X
Dragon Analytical Laboratory, Inc	Olympia	WA	(360) 866-0543	C890-13	X	X	X	X
Edge Analytical, Incorporated	Burlington	WA	(800) 755-9295	C567-14a	X	X	X	X
Everett Environmental Laboratory	Everett	WA	(425) 257-8230	M667-13	X	X	X	X
Mukang Labs, Inc.	Pasco	WA	(509) 544-2159	C914-13	X	X	X	X
Soiltest Farm Consultants, Inc. Laboratory	Moses Lake	WA	(509) 765-1622	C605-13	X	X	X	X
Spectra Analytical, Inc.	Tacoma	WA	(253) 272-4850	C575-13a	X	X	X	X
Tshimakain Creek Laboratories	Spokane	WA	(509) 928-3577	T975-13	X	X	X	X
Twiss Analytical Laboratories, Inc.	Poulsbo	WA	(360) 779-5141	C594-13	X	X	X	X
Valley Environmental Laboratory	Yakima	WA	(509) 575-3999	C862-13	X	X	X	X
Water Management Laboratories, Inc.	Tacoma	WA	(253) 531-3121	C546-13	X	X	X	X
Weyerhaeuser Analysis & Testing	Federal Way	WA	(253) 924-4294	C551-13	X	X	X	X
Anatek Labs, Inc. - Moscow	Moscow	ID	(208) 883-2839	C595-13a	X	X	X	X
APPL, Incorporated	Clovis	CA	(559) 275-2175	C790-13	X	X	X	X
BSK Associates	Fresno	CA	(559) 497-2888 Ext.125	C997-13b	X	X	X	X
CH2M Hill Applied Sciences Laboratory - Corvallis	Corvallis	OR	(541) 768-3111	C556-13	X	X	X	X
Environmental Science Corporation	Mt. Juliet	TN	(615) 758-5858	C847-13	X	X	X	X
Eurofins Lancaster Laboratories, Inc.	Lancaster	PA	(717) 556-7327	C457-13	X	X	X	X
GEL Laboratories, LLC	Charleston	SC	(843) 556-8171	C780-13	X	X	X	X
Pace Analytical Services, Inc. - Billings	Billings	MT	(612) 607-1700	C993-13	X	X	X	X
Pyxis Laboratories LLC	Portland	OR	(503) 254-1794	C924-13	X	X	X	X
Specialty Analytical	Clackamas	OR	(503) 612-9007	C804-13	X	X	X	X
SVL Analytical, Incorporated	Kellogg	ID	(208) 784-1258	C573-13	X	X	X	X
TestAmerica Denver	Arvada	CO	303-736-0116	C583-13	X	X	X	X
TestAmerica Nashville	Nashville	TN	(615) 301-5759	C789-13	X	X	X	X

*As downloaded from Ecology's Lab Search Website February 10, 2014. https://fortress.wa.gov/ecy/laboratorysearch/Default.aspx

K:\PONY\Yakima Basin GWMA\GIS\mxds\GWMA_bndy_updated.mxd 2/14/2014

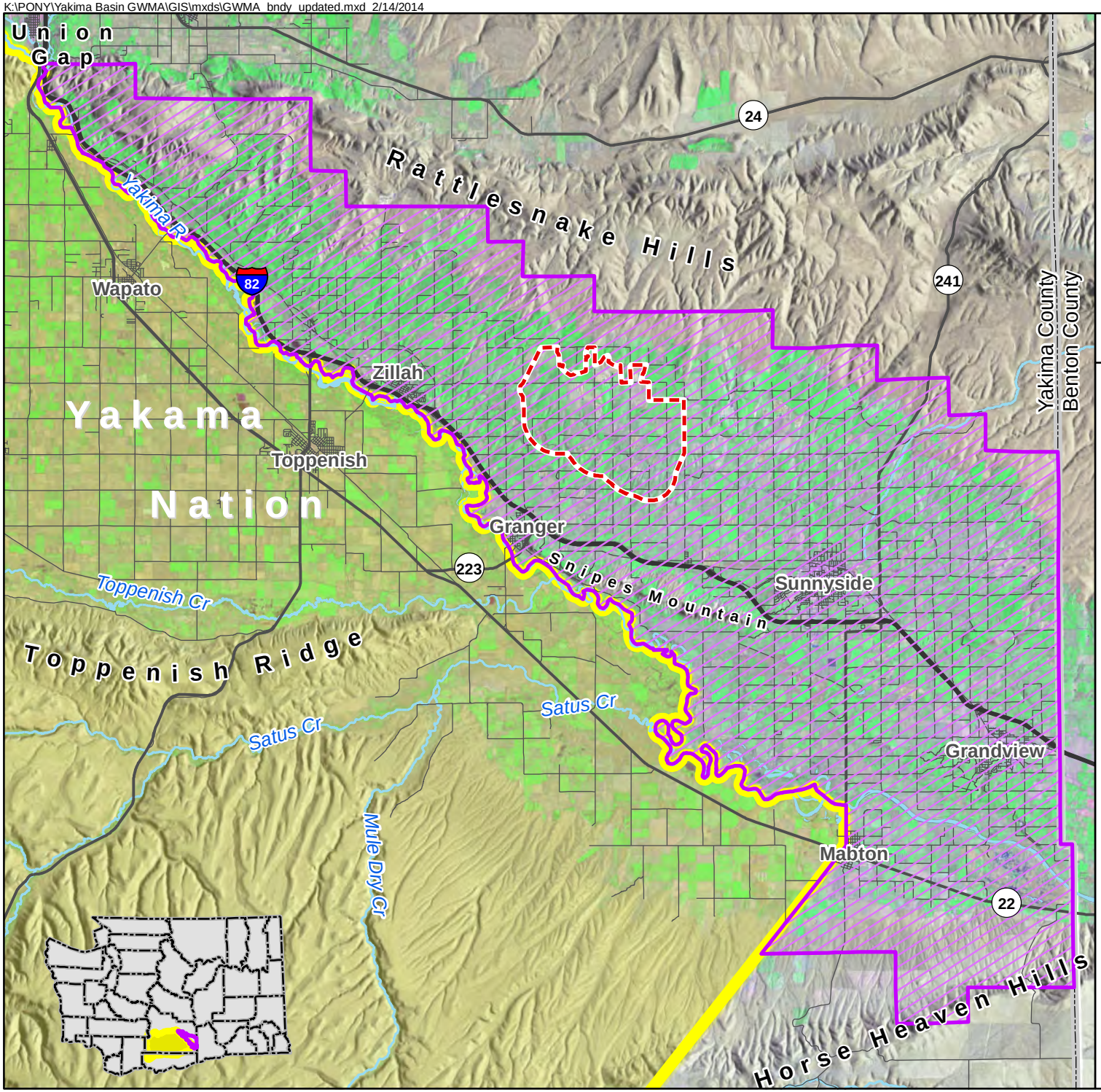

Figure 1

Lower Yakima Valley Groundwater Management Area Groundwater Monitoring Study Area

DRAFT

PgG

GWMA Boundary

EPA Dairy Cluster Buffer Boundary

Yakama Nation Boundary (from Yakima County)

N

0 Miles 5

Image derived from Landsat 7 data (1999 - 2002)

APPENDIX A
EXAMPLE FIELD SAMPLING AND INSTRUMENT CALIBRATION FORMS

Lower Yakima Valley Groundwater Management Area

Supply Well Sampling Field Form

Date: _____ Weather: _____

Sampler: _____

Well ID:	Well Owner/System Name and Well Name:

Wellhead Condition: _____

_____

Sampling Point Description: _____

_____

Time Spigot Turned On: _____

Water Quality Meter(s): _____

Time	**Temp** Circle:C/F	**pH**	**Ec** umhos/cm	**Diss. Ox** mg/L	**Comments** (odor, color, bubbles, etc.)

Sample Date/Time: _____

Analytical Lab: _____

Number of Unpreserved Bottles Collected (Nitrate, Nitrite): _____

Number of Preserved Bottles Collected (Ammonia, TKN): _____

Lower Yakima Valley Groundwater Management Area

Monitoring Well Sampling Field Form

Date: _____ Weather: _____

Sampler: _____

Well ID:	Wellhead Condition:

Well Diameter (circle): 2 inch (gal/ft factor = 0.17) 4 inch (gal/ft factor = 0.65)

Total Well Depth (TD) in feet below measuring point (ft bmp): _____

Depth to Water (DTW) ft bmp: _____

Height of Water (h) [calculate by TD-DTW] ft: _____

One Casing Volume [calculate by h x gal/ft factor from Well Diameter] gal: _____

Purge Volume [calculate by One Casing Volume x 3] gal: _____

Pumping Method (circle): Peristaltic / Submersible (specify type): _____

Water Quality Meter(s): _____

Time	**Volume** gallons	**Temp** Circle:C/F	**Ec** umhos/cm	**pH**	**Diss. Ox** mg/L	**DTW** ft bmp	**Rate** mL/min	**Comment**
Table continued on page 2 (circle): Yes / No								

Sample Date/Time: _____

Analytical Lab: _____

Number of Unpreserved Bottles Collected (Nitrate, Nitrite): _____

Number of Preserved Bottles Collected (Ammonia, TKN): _____

Monitoring Well Sampling Field Form Continued...

Well ID:	Wellhead Condition:

Time	**Volume** gallons	**Temp** Circle:C/F	**Ec** uS/cm	**pH**	**Diss. Ox** mg/L	**DTW** ft bmp	**Rate** mL/min	**Comment**

Lower Yakima Valley Groundwater Management Area

Field Instrument Calibration Form

Date: _____

Start of Day

Time: _____ Field Staff: _____

	Standard	Reading	Adjusted To
pH	4.00		
pH	7.00		
Ec (umhos/cm)	1413		
Diss Ox	Aerated Water		NA (see text)

Mid Day

Time: _____ Field Staff: _____

	Standard	Reading	Adjusted To
pH	4.00		
pH	7.00		
Ec (umhos/cm)	1413		
Diss Ox	Aerated Water		NA (see text)

End of Day

Time: _____ Field Staff: _____

	Standard	Reading
pH	4.00	
pH	7.00	
Ec (umhos/cm)	1413	
Diss Ox	Aerated Water	

APPENDIX B
GROUNDWATER MONITORING QUALITY ASSURANCE/QUALITY CONTROL PLAN
LOWER YAKIMA VALLEY GWMA INITIAL CHARACTERIZATION

GROUNDWATER MONITORING
QUALITY ASSURANCE/QUALITY CONTROL PLAN
LOWER YAKIMA VALLEY GWMA
INITIAL CHARACTERIZATION

September 16, 2013
Revised August 15, 2014

GROUNDWATER MONITORING QUALITY ASSURANCE/QUALITY CONTROL PLAN LOWER YAKIMA VALLEY GWMA INITIAL CHARACTERIZATION

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QA/QC APPROVALS

This Groundwater Monitoring QA/QC Plan, developed September 16, 2013 for the Lower Yakima Valley Groundwater Management Area, has been reviewed and approved by the undersigned. Copies of the completed and signed QA/QC Plan shall be distributed to the undersigned and all field personnel.

Lower Yakima Valley Groundwater Management Committee	Date
Project Manager	Date
Analytical Lab Project Manager	Date
QC Coordinator	Date
Field Manager	Date

This Groundwater Monitoring Quality Assurance/Quality Control Plan has been prepared as an appendix to the forthcoming Groundwater Monitoring Plan, which has an anticipated publication date of March 2014. References to the Groundwater Monitoring Plan within this appendix should be understood as information that will be available in the future.

Project Background, Project Objectives, Scope of Work, and Sampling Protocols will be detailed in the Groundwater Monitoring Plan and are not included herein.

This work was performed under HDR contract #CON0082545 and partially fulfills scope Item 1a. The QA/QC Plan was prepared in accordance with hydrogeologic practices generally accepted at this time in this area, for the exclusive use of the Lower Yakima Valley Groundwater Advisory Committee and HDR, for specific application to the Initial Characterization. No other warranty, express or implied, is made.

1.0 INTRODUCTION

This Quality Assurance/Quality Control (QA/QC) Plan has been developed as an appendix to the Groundwater Monitoring Plan for the Lower Yakima Valley Groundwater Management Area (GWMA) Initial Characterization. The QA/QC Plan has been prepared in general accord with U.S. Environmental Protection Agency (EPA) (EPA, 2002) and Washington State Department of Ecology (Ecology) (Ecology, 2004) guidelines and specifications. This document addresses:

- Data Quality Objectives for stations (groundwater quality sampling stations) and analytical data
- Quality Control Checks for field and laboratory
- Analytical methods
- Data Validation and Usability

While this QA/QC Plan is intended to be comprehensive, revisions and/or amendments may be required as the project evolves. Descriptions of the project background, project objectives, scope of work, and field protocols are provided in the Groundwater Monitoring Plan.

1.1 OBJECTIVE

The Initial Characterization will be developed from existing water quality data collected during previous investigations, and future water quality data that will be collected as described in the Groundwater Monitoring Plan. The Initial Characterization will be used by the Groundwater Advisory Committee (GWAC) to make administrative decisions and policy recommendations; therefore, the data inputs must be reliable and defensible. This QA/QC Plan defines the quality of data necessary for various uses within the Initial Characterization.

"Core data" as used in this project is the information that Pacific Groundwater Group recommended for inclusion in the project database related to groundwater quality samples (PGG, 2013). These data include analytical and field test results for parameters of concern (Section 1.2), station location, and well construction information.

QA/QC data for the project consists of information that documents the accuracy and precision of the analytical results. Each analytical batch should have associated QA/QC data, which may include results of method blanks, laboratory replicates, and field duplicates. QA/QC data, where available, will also be uploaded to the project database for the parameters of concern.

Data Quality Objectives (DQO) for the project are described in Section 2.0 of this QA/QC Plan. Station DQOs will be used to evaluate lateral and vertical distribution of the sampling network and to evaluate potential bias that could be introduced from treatment or wells with poor surface seals. Analytical DQOs will be used to evaluate representativeness, precision, and potential bias from sampling or lab artifacts. Stations

and analytical sets that do not meet DQOs may be qualified or considered unacceptable for some or all project needs.

1.2 PARAMETERS OF CONCERN AND PROJECT MCLS

As described in the Groundwater Monitoring Plan, the GWMA was formed in response to elevated nitrate concentrations in groundwater in Lower Yakima Valley. The boundaries of the GWMA are presented in Figure 1. The concentrations of nitrate detected in groundwater indicate impact by human activity and may pose significant risk to human health in localized areas. The GWMA was formed with the stated purpose of reducing nitrate concentrations in groundwater to below drinking water standards.

Based on previous investigations and the GWMA's purpose, the parameters of concern for this study are:

- Nitrate
- Nitrite
- Ammonia-nitrogen
- Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen)

These parameters are a subset of inorganic parameters that are referred to as conventionals. Recommended and alternative analytical methods and holding times (from sample collection to analysis) are summarized in Table 1. The analytical method list in Table 1 was derived from Ecology's *Methods and Analytes Table* on their environmental lab accreditation website (Ecology, n.d.). The recommended analytical methods meet the PQL requirements, are common analytical methods, and have frequently been used by PGG in characterization studies. Alternative analytical methods are listed so that multiple labs (which may use acceptable but different methods of analysis from the recommended methods) could be contracted to analyze the parameters of concern. If there are discrepancies regarding preservation or holding time between Table 1 and the analytical method, the analytical method shall be considered correct. Since nitrate and nitrite are being analyzed individually, rather than combined as nitrate+nitrite, the sample bottles will not have a sulfuric acid preservative. When sulfuric acid preservative is added to a sample, only nitrate+nitrite concentrations can be measured and not individual concentrations of nitrate or nitrite.

Method detection limits (MDLs) are the minimum concentration of an analyte that can be identified, measured, and reported with 99 percent confidence that the analyte concentration is greater than zero. Analytical methods may specify MDLs or may describe procedures for establishing MDLs. Practical Quantitation Limits (PQLs) or lab Reporting Limits are the minimum concentration of an analyte that can be reliably achieved during routine laboratory operating conditions within specified limits of precision and accuracy. PQLs and Reporting Limits are greater than MDLs and are statistically determined by individual labs. Because the analytical labs for this project have not been identified, PQLs and lab Reporting Limits cannot be specified in this QA/QC Plan. PQLs and lab Reporting Limits must be 10-percent or less of the GWMA Project Maximum Contaminant Levels (MCLs) defined below for nitrate and nitrite. Because MCLs are not established for ammonia and TKN, PQL Goals are presented for

these parameters in Table 1 based on a June 27, 2014 survey of six accredited labs in eastern Washington.

Water quality standards or criteria established by regulatory agencies will be used to evaluate analytical results for the parameters of concern listed above. Standards applicable to the GWMA groundwater studies are EPA MCLs, Washington State Public Water Supply MCLs (WAC 246-290-310), and Washington State Groundwater Quality Criteria (WAC 173-200-050). Established standards for the GWMA parameters of concern are generally consistent between these regulations (Table 2). GWMA Project MCLs are based on the most stringent relevant regulatory water quality standards and are summarized in Table 2.

Water quality standards have not been established for ammonia-nitrogen or the sum of organic nitrogen + ammonia + ammonium under the regulations cited above; however, these analytical results may be useful for trend evaluation and for understanding nitrogen speciation.

2.0 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative criteria established to limit uncertainty in analytical results. They are established to create analytical data sets that will support the study objectives. It is important to meet DQOs in order to produce analytical results that are considered defensible and reliable.

2.1 STATION DATA QUALITY OBJECTIVES

"Station Metadata" for this project refers to physical and access details about sampling stations, including the station location, owner and/or tenant name and contact information, well construction, and sampling point. Station DQOs will be used to:

- Understand the lateral distribution of the stations
- Understand what aquifer system (e.g. shallow or deep) the stations represent
- Understand potential bias in samples from surface contamination
- Understand potential bias in samples from treatment
- Identify stations for long-term monitoring consideration

A decision tree for evaluating Station Metadata against DQOs is presented in Figure 2. The DQOs may be used to evaluate those stations acceptable for Data Gap and Trend Analyses, and those acceptable for Long-Term Monitoring.

Data Gap and Trend Analyses DQOs. Station location and indications of completion depth and surface seals for wells are the DQOs for a station to be considered for Data Gap and Trend Analyses. Locations must be available by either coordinates in a known datum (preferred) or by a current parcel number. Station location information may be refined during field work. For wells, documented depth information must be available either for the open interval (preferred) or for the total depth of the well. Well depth

should be documented on a well log, video log, maintenance log, pump installation records, or similar means of documentation. An owner's recollection of total depth will not be considered valid documentation. An adequate surface seal should be documented in a well log. If no well log is available, field tests may be used to confirm the presence of seal material; however, field tests cannot confirm that the depth of the surface seal is adequate. Therefore, professional judgment shall be used to decide whether a well with a positive field test for the presence of a surface seal be advanced through the decision tree. A primary factor to consider is how critical the station is relative to other available stations in the area. Special consideration may be given to wells that do not meet the surface seal criterion in areas with limited stations; however, comparison of analytical results relative to project MCLs would not be valid.

Long-Term Monitoring Consideration DQOs. To be considered for Long-Term Monitoring, stations must meet the Data Gap and Trend Analyses DQOs plus long-term access to the station must be available. For well stations, the sampling port should be upstream of treatment. Long-term access and information about available sampling ports may be collected during field work. Special consideration may be given to wells that do not meet the sampling port relative to treatment criterion in areas with limited stations; however, comparison of analytical results relative to project MCLs would not be valid.

2.2 ANALYTICAL DATA QUALITY OBJECTIVES

QA/QC data associated with water quality samples can be used to assess the accuracy and precision of the analytical results. This QA/QC Plan stipulates the QA/QC data required for water quality samples, and the DQOs to evaluate the QA/QC data against. However, it is likely that some water quality data from previous investigations will not have available QA/QC data.

The availability and acceptability of QA/QC data will affect how sample results may be used in the GWMA Initial Characterization. A decision tree to assess usability of the analytical metadata is presented in Figure 3. If station location and depth information is available (Section 2.1), all existing analytical data will be considered in the evaluation of Data Gaps and Trends, regardless of whether associated QA/QC data are available. Water quality results with available QA/QC data that meet DQOs described in this section and water quality results associated with the Washington State Department of Health (DOH) compliance monitoring of public water systems will be considered in the evaluation of Data Gaps and Trends, and in addition will be used to establish Baseline Water Quality, evaluate Compliance with project MCLs, and establish Long-Term Monitoring Data. While QA/QC data associated with DOH compliance monitoring are not available, the data will be considered acceptable for the additional evaluations because the analytical labs are required to be accredited by Ecology; and samples are required to be collected and transported according to EPA or DOH approved methods (WAC 246-290-300 and WAC 246-291-300).

DQOs for analytical data are typically expressed in terms of accuracy, precision, representativeness, completeness, and comparability. Definitions of these terms follow.

Accuracy. Accuracy is how close an analytical result is to the true concentration in the sample. For conventional parameters, accuracy is analytically evaluated with spike samples.

A spike QA sample is prepared by adding a known concentration of an indicator parameter to an environmental sample. The indicator parameter should be the same or similar (for isotopically labeled compounds) as the target analyte. The spike should increase the concentration in the environmental sample by a predictable amount.

The analytical lab shall calculate and report the percent recovery (%R) of the target analyte in the spiked sample by:

$$\%R = \left(\frac{SSR - SR}{SA}\right) \times 100$$

Where:

SSR = measured value of analyte concentration in sample after addition of spike

SR = measured value of analyte concentration in sample before addition of spike

SA = value of spike added

The GWMA QA Reviewer (QA Reviewer) shall evaluate accuracy by comparing the %R to acceptable limits statistically determined by the laboratory (Section 4).

Precision. Precision measures the reproducibility of results and can be evaluated through field duplicate (collocated samples collected in the field that are analyzed independently) and lab replicate (aliquots prepared in the lab of the same sample that are analyzed independently).

Field duplicates will be collected on at least a 10 percent frequency (1 duplicate per 10 samples collected). At least one field duplicate shall be collected each event (Section 3.1). Lab replicates may be analyzed according to an individual lab's Standard Operating Procedure (SOP). Lab replicates are prepared in the lab by taking an aliquot of an environmental sample and treating that aliquot throughout the analytical method as though it were another sample.

Relative Percent Differences (RPD) values between field duplicates shall be calculated by the QA Reviewer and RPD values between lab replicates shall be calculated and reported by the lab. RPDs are calculated by:

$$RPD = \frac{|(D1 - D2)|}{\frac{D1 + D2}{2}} \times 100$$

Where:

D1 = measured concentration of duplicate or replicate 1

D2 = measured concentration of duplicate or replicate 2

The QA Reviewer shall evaluate precision by comparing the RPD to acceptable limits (Section 4). For this study, the acceptable RPD limits for field duplicates shall be 20 percent or ± the lab reporting limit if the concentration of either the sample or duplicate is less than 5 x the lab reporting limit. The acceptable RPD limits for lab replicates shall be statistically established by the analytical lab.

Representativeness and Comparability. Representative samples accurately represent the environmental matrix being tested. Comparable samples are collected during different sampling events, but at the same station. For this study, representativeness and comparability shall be achieved by following the field sampling protocols and methods described in the Groundwater Monitoring Plan, using the same analytical methods, and to the degree possible, the same analytical lab.

As described in the Groundwater Monitoring Plan, the majority of water samples collected for this study will be collected directly into laboratory-provided bottles without the use of non-dedicated or non-disposable sampling devices such as bailers, portable pumps, dippers, or grab samplers. When non-dedicated or non-disposable sampling devices are used, representativeness and comparability will be evaluated using rinsate or decontamination blanks (Section 3.1). These blanks will be collected following decontamination of the sampling device, on at least a 10 percent frequency (1 blank per 10 samples collected with a non-dedicated or non-disposable sampling device) and a minimum of 1 blank will be collected per event where non-dedicated sampling devices are used.

Completeness. Completeness is the percentage of valid results obtained from a given sampling event. For this study, completeness is anticipated to be equal or better than 85 percent.

3.0 QUALITY CONTROL CHECKS

Quality control checks will be performed by project field staff and by the analytical lab as described below.

3.1 FIELD QUALITY CONTROL

Field quality control checks are summarized in Table 3.

Field Duplicates will be collected at a rate of at least 10 percent as described in Section 2.0. After collection of the original sample, a duplicate shall be collected by filling another set of laboratory-provided bottles using the same sampling procedure. Field duplicates shall be analyzed for each parameter of interest. Field duplicates will be labeled with a unique sample ID and collection date/time. Field sample forms shall document the stations where field duplicates were collected, the duplicate ID, and duplicate sample time.

Rinsate or decontamination blanks will be collected at a rate of at least 10 percent of samples collected per sampling team with non-disposable or non-dedicated equipment. After the non-dedicated equipment is decontaminated following procedures described in

the Groundwater Monitoring Plan, a rinsate or decontamination blank shall be collected by transferring commercially available distilled water from the sampling equipment to a set of laboratory-prepared bottles, or by pouring distilled water over the equipment and collecting the water that that rinses off in a set of laboratory-prepared bottles. The rinsate or decontamination blank shall be labeled with a unique sample ID and collection date/time. Field sample forms shall document the stations where field blanks were collected, the blank ID, and blank sample date/time.

Matrix Spike and Matrix Spike Duplicates (MS/MSD) will be analyzed per batch of samples. MS/MSDs prepared from samples collected for the GWMA project are preferred over MS/MSDs prepared from samples collected for another project that may be part of the same analytical batch. This may require additional volume to be collected in the field. The Field Sampling Manager or Lead should confer with the analytical lab about additional volume requirements when placing the bottle order. Sample bottles for MS/MSD analysis will be labeled with the station ID followed by "-MS/MSD" and field forms will document where the MS/MSD are collected.

3.2 LABORATORY QUALITY CONTROL

Analytical services for this study will be provided by labs accredited by Ecology for drinking water or non-potable water analyses of the parameters of concern (there are currently no drinking water accredited labs for analyses of ammonia or TKN, there are non-potable water accredited labs for these parameters). Prior to mobilization to the field, the lab will provide proof of Ecology accreditation for analytical methods and matrices related to this QA/QC Plan. Labs routinely perform performance checks and each analytical method requires specific QA/QC protocols that must be complied with by the lab. No additional audits will be performed on the analytical labs for this study.

The analytical lab will follow their written QA/QC Plan and Standard Operating Procedures (SOP) to assure data quality. Lab QC samples will be analyzed in accordance with the lab QA/QC Plan, SOP, and analytical method and may include the following:

- Method blanks are used to assess contamination that may be introduced in the lab during sample preparation. Method blanks are prepared, extracted, digested, and analyzed in the same manner as field samples. Analytical results will be included in lab reports.
- Laboratory control samples (LCS) are used to evaluate the performance of the total analytical system, including all preparation and analysis steps. They contain known concentrations of the analytes of interest and the percent recovery reflects the accuracy of the analysis. Analytical results will be included in lab reports.

Lab QA/QC also typically includes instrument-related calibration blanks and performance checks. Instrument-related QA/QC results will not be included in lab reports, but will be made available on request if other QA/QC results are considered unacceptable.

4.0 DATA VALIDATION AND USEABILITY

Data validation will be performed by the lab in accordance with their QA/QC plan and SOP prior to the release of the analytical results. The lab shall document their data validation in a case narrative, identifying any QA/QC recoveries that were outside the lab's acceptance criteria, and potentially flagging or reanalyzing unacceptable results.

The QC Reviewer will review field notes for compliance with sampling protocols described in the Groundwater Monitoring Plan and will validate the analytical data in accordance with the QA/QC requirements specified in this QA/QC Plan and the analytical methods. The analytical reports shall be checked for completeness that the data requested has been delivered. They shall also be checked for compliance of the analytical QA/QC results with acceptance limits. Data validation will also include review of the method blanks, holding times, and lab reporting limits.

DQOs or acceptance limits for Percent Recoveries (%R) of spike samples, including matrix spikes, shall be established statistically by the lab and provided in the lab reports. In the event that statistical acceptance limits are not available, the following limits from the Quality Assurance Project Plans for the Yakima Basin Nitrate Study Phase 3 (U.S. EPA, 2010b) and Lower Yakima Valley Dairy Investigation (SAIC, 2012) shall be applied:

- Accuracy (percent recovery of spikes including laboratory control samples and matrix spikes): 80-120 percent
- Precision (lab replicate and matrix spike duplicate): ± 20 percent

For this study, the acceptable RPD limits for field duplicates shall be 20 percent or ± the lab reporting limit if the concentration of either the sample or duplicate is less than 5 x the lab reporting limit.

Data associated with QA/QC results that fall outside acceptance limits may be qualified or rejected. The EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (EPA 2010a) generally do not extend to conventional parameters; however, the guidelines may be referred to for qualification guidance. Findings and conclusions of the Data Validation will be summarized in a narrative by the QC Reviewer.

As presented in Figure 3 and described in Section 2.2, all existing analytical data will be considered in the evaluation of Data Gaps and Trends, regardless of whether associated QA/QC data are available or whether associated QA/QC data meet Analytical DQOs (acceptance limits) described in this Plan. Analytical results with QA/QC data that meet DQOs and analytical data associated with DOH compliance monitoring of public water systems will be considered to meet project needs to be valid for: Data Gaps and Trend analyses, establishing Background Water Quality, evaluating Compliance with project MCLs, and establishing Long-Term Monitoring Data.

5.0 REFERENCES

Pacific Groundwater Group, 2013. Core Data Recommendations. Consultant's technical memorandum prepared for Yakima County and HDR. July 29, 2013.

SAIC. 2012. Quality Assurance Project Plan Lower Yakima Valley Dairy Investigation Yakima County, Washington. Consultant's plan prepared for U.S. Environmental Protection Agency, Region 10. December 2012.

U.S. Environmental Protection Agency, 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5. EPA/240/R-02/009. December 2002.

U.S. Environmental Protection Agency, 2010a. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review. January, 2010.

U.S. Environmental Protection Agency, 2010b. Quality Assurance Project Plan For Yakima Basin Nitrate Study Phase 3 – Comprehensive Analytical Source Tracer April 2010 Sampling Event Yakima County. U.S. EPA Region 10. April 8, 2010.

Washington State Department of Ecology, 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030. Revision of Publication No. 01-03-003. July 2004.

Washington State Department of Ecology, n.d. Methods and Analytes Table. http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html. Web. September 4, 2013.

Table 1. Water Quality Parameters of Concern and Analytical Methods

Parameter	Recommended Analytical Method	Alternative Analytical Methods	Preservative	Holding Time	Bottle Type	PQL/Lab Reporting Limit Goals [2]
Ammonia-N	EPA 350.1	EPA 349.0 / USGS 1-3520-85 / SM4500-NH3 C, D, E, F, G, H, or I / ASTM D1426-08 or -98A / ASTM D 6919-03	H2SO4	28 days	Lab Provided	PQL Goal 0.3 mg/L or lower
Nitrate	EPA 353.2[1]	EPA 300.0 / SM 4110 B-00 / SM 4500-NO3 B, D, E, F, H, or I		48 hours	Lab Provided	PQL must be 10-percent or less of GWMA MCLs (Table 2), or 1 mg/L
Nitrite	EPA 353.2[1]	EPA 300.0 / SM 4500-NO2 B / SM 4110 B / SM 4500-NO3 F or I		48 hours	Lab Provided	PQL must be 10-percent or less of GWMA MCLs (Table 2), or 0.1 mg/L
Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen, TKN)	SM 4500-Norg D	EPA 351.1 / EPA 351.2 / SM 4500-Norg B or C / ASTM D1426-93B	H2SO4	28 days	Lab Provided	PQL Goal 1 mg/L or lower

[1] Method may be used to determine nitrate+nitrite, nitrite, or nitrate. Nitrate and nitrite (individually) are parameters of concern for this study, while nitrate+nitrite is not. No preservative is used whe individually measuring nitrate or nitrite concentrations, and therefore the holding time is 48 hours. If H2SO4 preservative is used the holding time is extended to 28 days, but only nitrate+nitrite concentrations can be measured and not individual nitrate or nitrite concentrations.

[2] Practical Quantitation Limits/Lab Reporting Limits for these methods are determined by individual labs and therefore are not specified in this QA/QC Plan. Practical Quantitation Limits/Lab Reporting Limits must be 10-percent of Project MCLs or lower for nitrate and nitrite. PQL Goals for ammonia and TKN are based on a June 27, 2014 survey of six accredited labs located in eastern Washington.

Analytical Methods consistent with Ecology's Methods and Analytes Table at: http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html

Discrepancies between Preservation/Holding Time between this table and the Analytical Methods should be resolved in favor of the Analytical Method

Table 2. Relevant Regulatory Water Quality Standards and GWMA Project MCLs

Parameter	Relevant Regulatory Water Quality Standards			**GWMA Project MCLs**
	EPA MCLs	WA Public Water Supply MCLs	WA Groundwater Quality Criteria	
Ammonia-N	Not Established	Not Established	Not Established	**Not Established**
Nitrate (as N)	10 mg/L	10 mg/L	10 mg/L	**10 mg/L**
Nitrite (as N)	1 mg/L	1 mg/L	Not Established	**1 mg/L**
Sum of organic nitrogen + ammonia + ammonium (Total Kjeldahl Nitrogen (TKN))	Not Established	Not Established	Not Established	**Not Established**

EPA MCLs established by Safe Drinking Water Act (SDWA)

WA Public Water Supply MCLs established by WAC 246-290-310

WA Groundwater Quality Criteria established by WAC 173-200-040

Practical Quantitation Limits/Lab Reporting Limits for these methods are determined by individual labs and are therefore not specified in this QA/QC Plan. Practical Quantitation Limits/Lab Reporting Limits must be 10-percent of Project MCLs or lower.

Table 3. Field Quality Control Summary

Type of Quality Control Check	Minimum Frequency	Bottle ID	Process
Field Duplicates	1 per 10 samples collected	Station ID + 200	After collection of the original sample, fill a second set of laboratory-provided bottles using the same sampling procedure. Label the duplicate uniquely and analyze for all sampling event parameters.
Rinsate/ Decontamination Blank	1 per 10 samples per team collected with non-disposable or non-dedicated equipment	Station ID + 100	Decontaminate the non-dedicated/non-disposable equipment following procedures described in the Work Plan. Transfer commercially available distilled water from the sampling equipment to a set of laboratory-prepared bottles, or pour DI water over the equipment and collect the water that rinses off in a set of lab-prepared bottles. Label the blank uniquely and analyze for all sampling event parameters.
MS/MSD	1 per event	Station ID + "-MS/MSD"	After collection of the original sample, fill a second and third set of laboratory-provided bottles using the same sampling procedure. Label the bottles with the addition of "-MS/MSD" and analyze for all sampling event parameters.

K:\PONY\Yakima Basin GWMA\GIS\mxds\GWMA_bndy_updated.mxd 2/14/2014

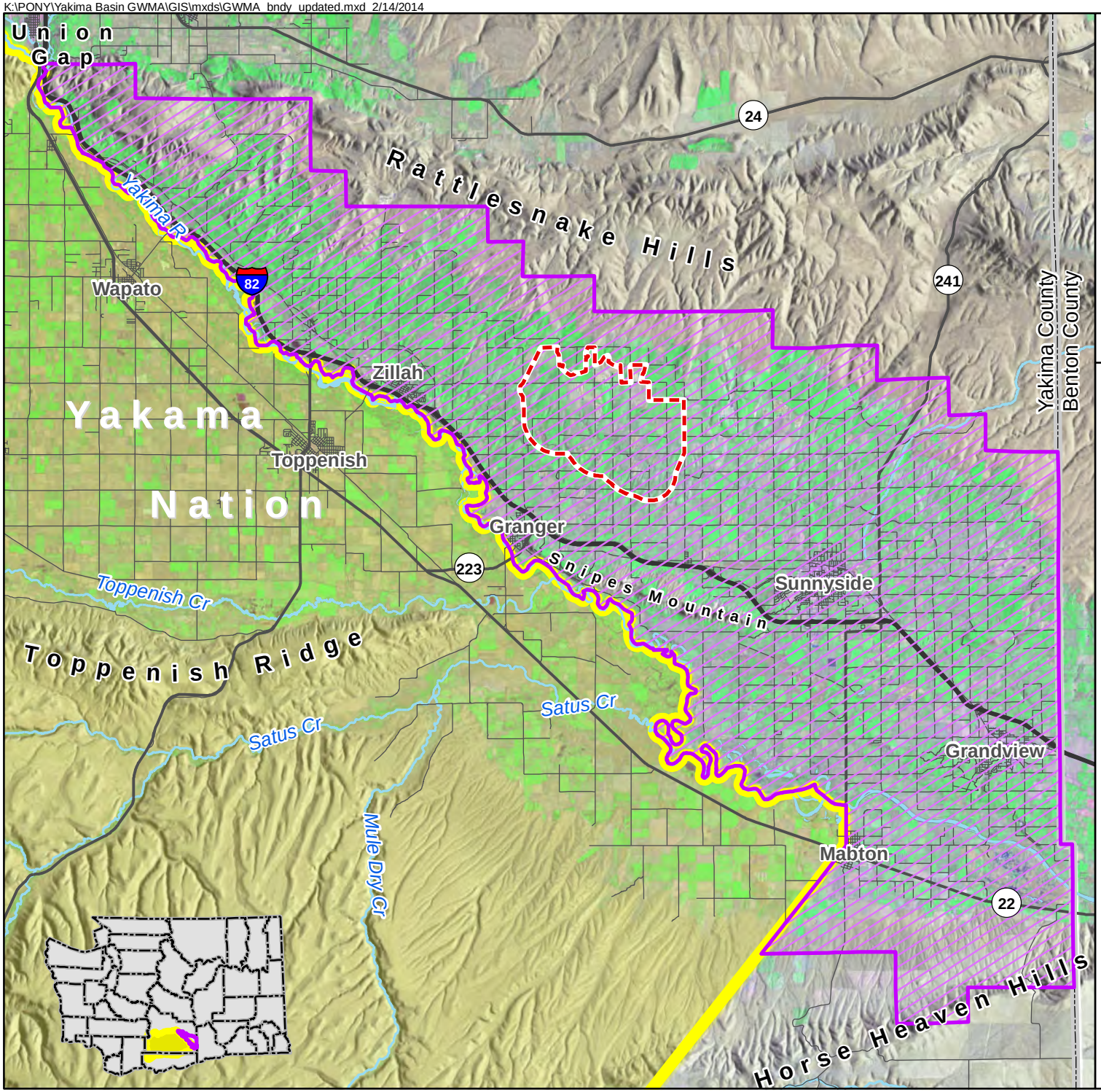

Figure 1

Lower Yakima Valley Groundwater Management Area Groundwater Monitoring Study Area

DRAFT

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GWMA Boundary

EPA Dairy Cluster Buffer Boundary

Yakama Nation Boundary (from Yakima County)

N

0 Miles 5

Image derived from Landsat 7 data (1999 - 2002)

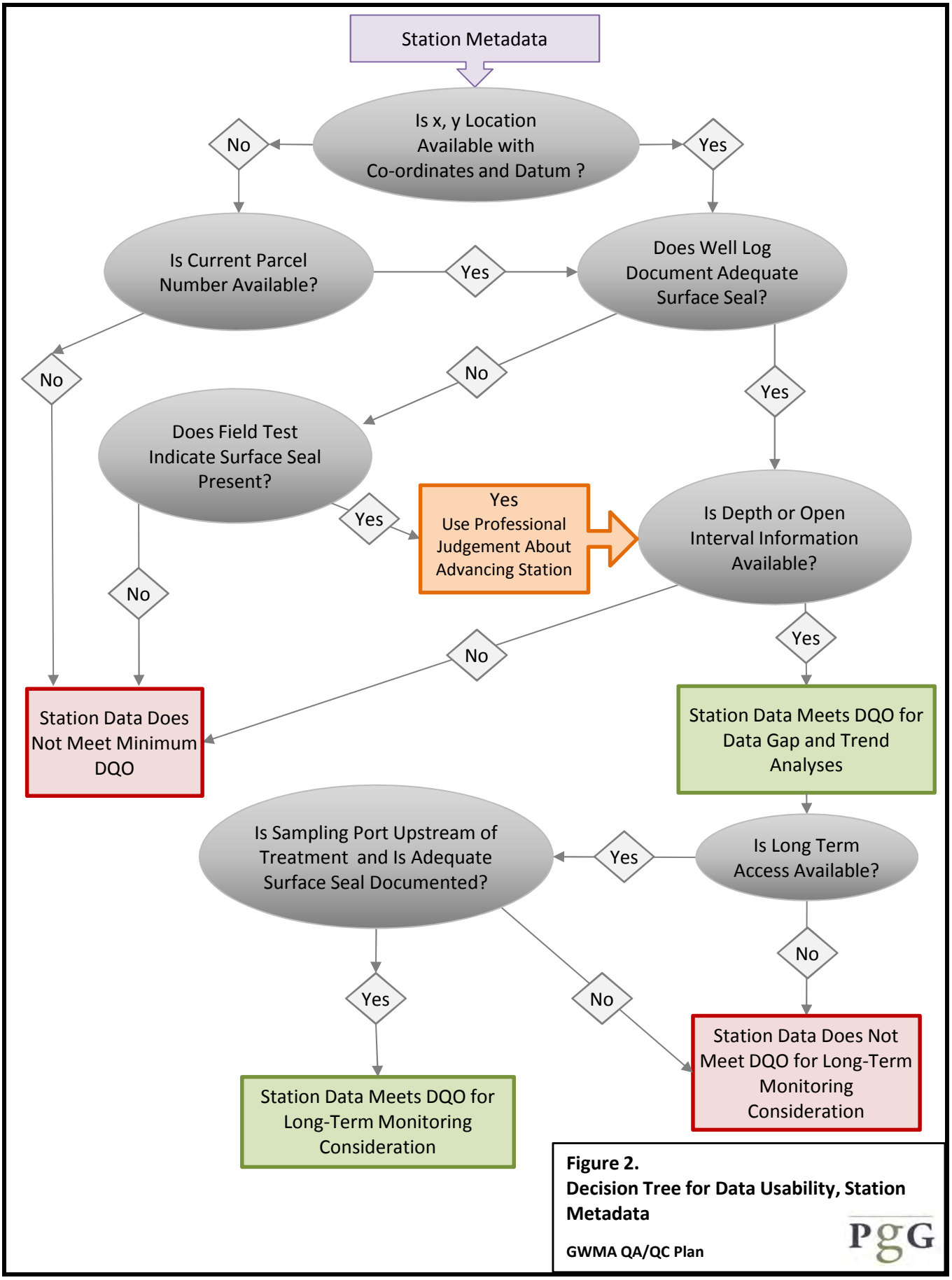

Figure 2.
Decision Tree for Data Usability, Station Metadata

GWMA QA/QC Plan

PgG

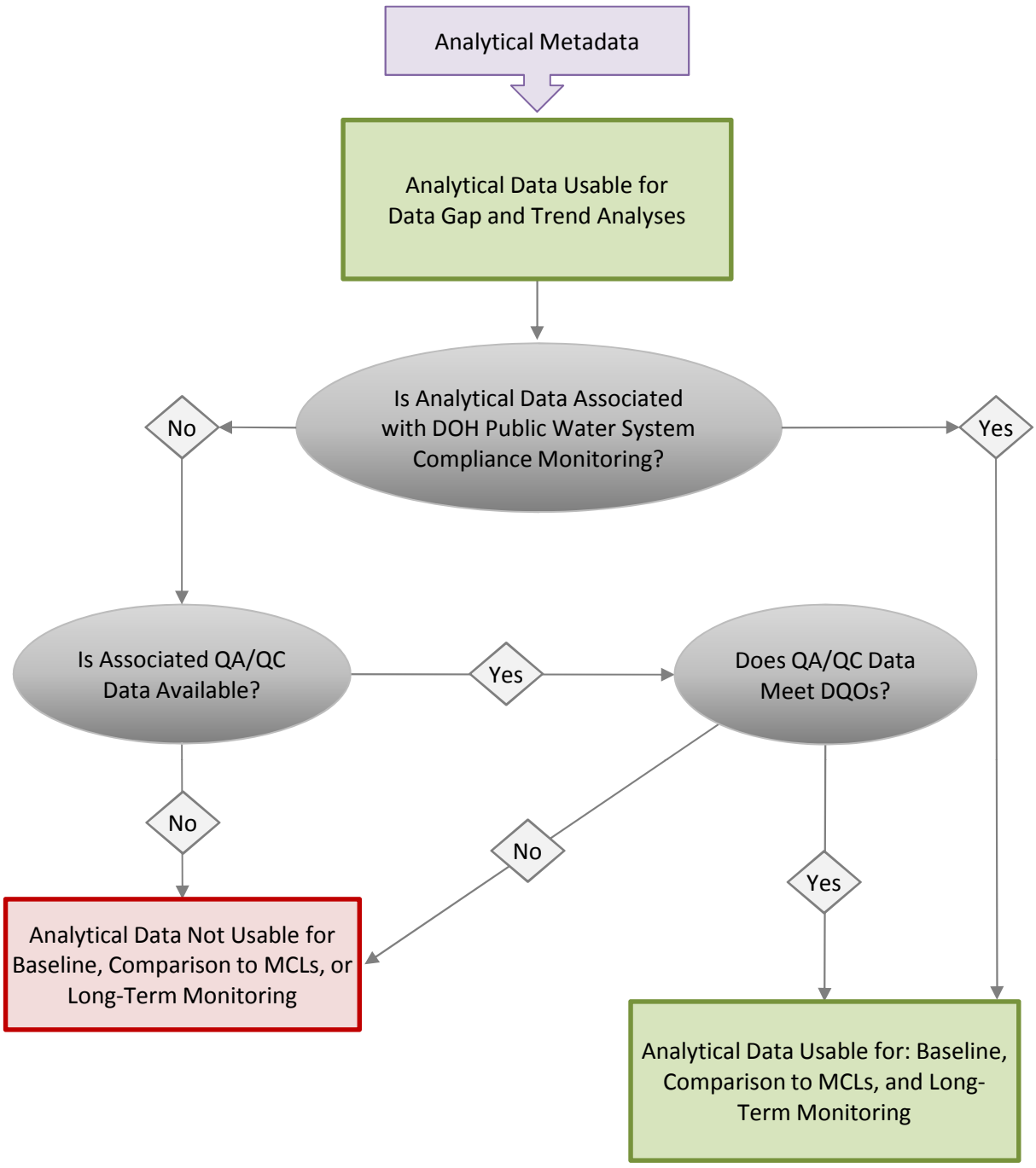

Figure 3.
Decision Tree for Data Usability, Analytical Metadata

P 206.329.0141 | **F** 206.329.6968

2377 Eastlake Avenue East | Seattle, WA 98102

P 206.842.3202 | **F** 206.842.5041

8150 West Port Madison NE | Bainbridge, WA 98110

P 360.570.8244 | **F** 360.570.0064

1627 Linwood Avenue SW | Tumwater, WA 98512

www.pgwg.com

PgG

LOWER YAKIMA VALLEY GROUNDWATER ADVISORY COMMITTEE

Groundwater Management Area (GWMA)

Comprehensive Nitrogen Loading Assessment for the Lower Yakima Valley Groundwater Management Area – Scope of Work and Budget

Version 1.2a

December 3, 2014

Comprehensive Nitrogen Loading Assessment for the Lower Yakima Valley Groundwater Management Area – Scope of Work

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Project Management

WSDA Lead:

Kirk V. Cook, LG, LHG

Mr, Cook has over 35 years of experience with the US Geological Survey, the Washington State Departments of Health and Ecology, and current oversees the Washington Department of Agriculture's Natural Resource Assessment Section comprised of 10 research staff with expertise in environmental toxicology, pesticide use, hydrogeology, water resource management, GIS application science, environmental engineering, water quality and water resource modeling, endangered species protection, and agricultural science. Combined experience and education of section staff exceeds 80 years.

1.0 Purpose

The goal of the Lower Yakima Groundwater Management Area is to reduce nitrate contaminations in groundwater below state drinking water standards. Within the boundaries of the Lower Yakima Groundwater Management Area exists areas where the state drinking water standard for nitrate (10mg/L) has been exceeded for years. This area has supported a variety of agricultural practices for over 100 years. Many of these practices have required the use of nitrogen fertilizers and nutrients (both organic and inorganic) or where nutrient rich effluent haves been allowed to enter the soil column via permitted or otherwise sanctioned activities. These applications are suspected to have contributed to the elevated levels of nitrate in groundwater currently used as drinking water supplies. In order to determine to what extent the application of nitrogen has contributed to the elevated nitrate levels in groundwater, it is necessary to evaluate current land use management practices suspected of contributing to groundwater loading of organic and inorganic nitrogen. This is necessary to determine the activities contributing and to what degree that contribution may be impacting groundwater quality.

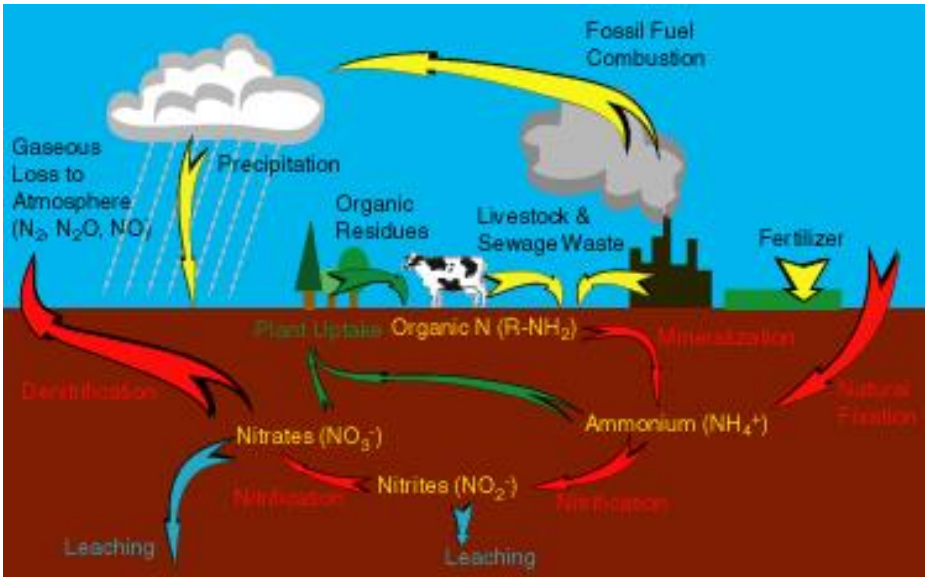

Figure One: Factors to be considered during the assessment of nitrogen loading and relationship to groundwater quality

The Nitrogen Loading Assessment is a mass-balance model. These models are the simplest models employed by researchers. These models have value in that they are able to predict mass flux in a generalized sense and do assist in estimating loading rates from various land uses and estimating input rates and concentrations for transport modeling. The limitation on these types of models is that they cannot be used to predict solute concentration at any single point in time or space. The Nitrogen Loading

Assessment will provide the information necessary to evaluate the nitrate contribution from various sectors within the boundaries of the GWMA and will provide information loading estimates to crop management / livestock management, and activities associated with residential, commercial, industrial and municipal activities. These estimates are necessary to evaluate the spatial loading of vulnerable groundwater within the Groundwater Management Area boundaries (which can result in elevated nitrate levels in drinking water), the effectiveness of current management practices in limiting that loading, and if necessary, provide a basis for implementation of new or expanded practices that may be required to achieve the goals of the GWMA.

Establishing a relationship between nitrogen loading to land surface and underlying water quality requires an understanding of, the factors influencing the degree to which that nitrogen is used by crops, lost to the atmosphere, or modified as it passes through the soil column. This assessment will utilize a combination of peer reviewed scientifically derived estimates applicable to the Yakima Valley in combination with specific land use management data collected through the Deep Soil Sampling project and supplemented by targeted data collection activities conducted by WSDA, Yakima County, the Washington Departments of Ecology and Health.

2.0 Overall Concept

The Nitrogen Loading Assessment is a cooperative project between Yakima County and The WA Department of Agriculture. The goal of the Assessment will be to develop a mass balance for nitrogen usage within the GWMA. In achieving this goal, assessments of specific activities conducting both permitted and non-permitted nitrogen application will be developed and will provide data on which to base both land use recommendations within the Groundwater Management Area Plan and educational materials for use by residents within the GWMA. The results will provide focus on those modifications in land management or facility operations that have the greatest potential to reduce or eliminate excess nitrogen loading to the land surface which ultimately result in excessive nitrate leaching to underground sources of drinking water.

The assessment, in addition to accessing the degree to which current land management activities may be impacting groundwater quality, will provide data (in conjunction with the Deep Soil Sampling Project) regarding the extent to which current groundwater quality is being impacted by historic nitrogen management techniques.

The assessment of nitrogen loading and loss will be divided into two sub-activities. One for irrigated and livestock agriculture, the other for residential, commercial, industrial municipal activities. WSDA will have primary responsibility for the assessment of irrigated and livestock activities, Yakima County will focus on assessment of residential, commercial, industrial, and municipal activities. These two areas of interest will be addressed in the application of the following overriding equation:

NLGW = RL + BL + IACF + IAOF + CAFOPP +AL

Where

• NLGW = nitrogen load to groundwater, which assumes that all nitrogen present below the root zone will become nitrate and either be denitrified or leach to groundwater.

• RL = nitrogen loading to groundwater from residential sources including septic tanks, lawn fertilization, and onsite septic systems

.

• BL = nitrogen loading to groundwater from sites with municipal biosolids, and municipal and industrial wastewater (under State Waste Discharge Permits, or NPDES permits)

• IACF = nitrogen loading to groundwater from irrigated agriculture land use where chemical fertilizers are applied and further discussed below

• IAOF = nitrogen loading to groundwater from irrigated agriculture land use where organic fertilizers (e.g., manure) are applied

• CAFOPP = nitrogen loading to groundwater from livestock pond and pen sources this will include such activities as lagoon operations, composting activities, feeding and milking areas

• AL = nitrogen loading to groundwater from atmospheric deposition. Local values from national atmospheric monitoring data sets will be used and applied evenly across the GWMA.

Note: Where appropriate denitrification will be factored into the overall sector contribution for the equation above. As specified in Sections 4 thru 6 below, denitrification will (when appropriate) will be applied to the original nitrate load as calculated or estimated in the respective source category.

3.0 Development of Comprehensive Nitrogen Source Database

In order to adequately evaluate the effects of nitrogen application for the majority of land uses within the GWMA boundaries, it will be necessary to develop a database or GIS linkage capable of housing application and management data from a wide variety of source specific information collected using differing methodologies. Some database fields will be similar for all sources, whereas other data fields will be source-specific, and it will be designed so that it will be expandable and able to include additional fields. Data collected for the major sectors identified by the GWAC will be clearly identifiable within the data so that analysis can be conducted on a sector by sector basis if desired. Most data fields will be identified during the initial creation of the database or GIS linkage, though some will likely be added as management practices change or updated information becomes available. WSDA and Yakima County have taken steps toward the development of a GIS linkage structure. This structure will be submitted for review to the County, and the Data, RCIM, IA, and Livestock/CAFO working groups prior to entering source data into it. This review will apply to the final draft report and will exclude any trial or developmental runs of the database). The database will include numeric fields to support calculations, as well as fields necessary for display within the GIS environment. Three main tasks are associated with this activity; data evaluation prior to database development in order to develop necessary fields and evaluate the utility of a single database or two separate databases linked to operate as one, development of database structure, and database population.

Task 3.1 Evaluate current and planned data sources to determine necessary database fields[1]

Estimated Budget 100 hours @ 26.00/hr $ 2600.00

Task 3.2 Develop comprehensive database for all nitrogen sources covered by RCIM, Irrigated Agriculture, and Livestock Agriculture. Database will be developed using Access from which a geodatabase will be created for use within the ESRI environment.

Estimated Budget 100 hours @ 35.00/hr $ 3500.00

Task 3.3 Population of database with data collected as a result of grower surveys, estimates for various land uses associated with residential, commercial, industrial, and municipal sources, and data collected from on-site livestock operations.

[1] Data quality will be guided by a developed QA/QC plan, some of which currently exists within documents produced by PGG for environmental data collection.

Estimated Budget	*80 hours @ 26.00/hr*	*$ 2080.00*
Total Budget for Task 3.0		***$ 8180.00***

4.0 Residential, Commercial, Industrial, and Municipal Assessment

Yakima County will be the lead for assessing the overall nitrogen loading that occurs as a result of activities associated with RCIM activities. This will include assessment of septic systems, state waste discharge permits (Ecology), underground injection well contribution, and hobby farm activities. WSDA will provide technical assistance to Yakima County regarding application of various methodologies applied to the parcels to estimate N loading. WSDA will also assist the County by facilitating the involvement of technical experts currently working for cooperating state and federal agencies, or consultants.

Residential and Municipal Septic Systems and other Residential Sources

Parcel data from Yakima County will be used by the County to identify parcels where residential septic systems are present. Septic loads from each parcel will be calculated assuming an average sized household in Yakima County (based on census data), consultation with Yakima County, WA Department of Ecology and the Washington State Department of Health. In estimating daily septage volumes and nitrogen loads per person, WSDA will utilize a septic system leaching model developed by the Environmental Assessment Program at the Department of Ecology. Model developers will assist WSDA in its application. These data sources and assessment methodology will be referenced in the final report. Prior to employing these sources/references, project leader(s) will consult the Monitoring and Data Work Group for review and comment.

If a large on-site septic system (LOSS) is designed to enhance denitrification and that design is identifiable in WDOH or Ecology records, the enhanced denitrification rate will be considered.

In addition to septic loads, other residential nitrogen sources such as fertilization of lawns and gardens will be examined. Information on fertilization practices and the percent of homeowners who actively fertilize will be pursued and the data most representative of LYV (given geography, environment, and socio-economic factors) will be used for this project. If local data are unavailable, regionally recommended fertilization practices and data will be reviewed to estimate nitrogen loading due to lawn fertilization. These data currently exist in peer reviewed documents published by the University of California-Davis, and other research institutions. Existing data sources (GIS coverage's, aerial photographs, and previous reports) will be reviewed to assess the most feasible way to quantify local lawn areas. City parks and golf courses with their associated fertilization rates will be included in this analysis.

Currently Regulated RCIM Activities

Sites for which there exists a State Waste Discharge Permit (discharging to the ground) will be identified based on Department of Ecology online records. These permits include mandated limits for nitrogen discharge to underlying groundwater. Additionally the locations of municipal Underground Injection Control (UIC) devices will be obtained from the online Ecology UIC database and local municipalities to identify features that may act as conduits allowing surface water (and potentially contaminants within it) to more easily enter groundwater. All sites will be entered into the database but sites used for groundwater calculations will be limited to those with potential to impact groundwater based on consultation with the Department of Ecology. Location and source data will be entered into the nitrogen source database so that nitrogen loading rates can be estimated. Facilities that are potential nitrogen sources and are not regulated under NPDES/State Waste Discharge Permits (such as large onsite septic systems, biosolid application areas, or com-posting facilities) will also be reviewed, with relevant data obtained from Ecology the Washington State Department of Health, and Yakima County for inclusion in the nitrogen source database.

Other potential sources of nitrogen from residential land use include pet waste and hobby farms/livestock nutrients. Regional or literature values will be used to estimate nitrogen loads associated with pet and hobby-farm livestock nutrient management. Prior to use of any regional or literature values, the Monitoring and Data Work Group will be consulted.

Assessment of RCIM nitrogen loads will require a minimum of field work and data collection, therefore the budget does not reflect an allocation for field data collection.

Task 4.1 Analysis of septic system N loading using existing parcel data and database

Estimated Budget 90 hours @ 30.00/hr $ 2700.00

Task 4.2 Identify and analyze N loading from permitted land application sites. This task will be coordinated with the Washington State Department of Ecology.

Estimated Budget 30 hours @ 30.00/hr $ 900.00

Task 4.3 Develop N loading estimates from municipal Underground Injection Control devices. This will include analysis of stormwater management structures, but will not include an assessment of potentially existing UIC's

nor will there be an attempt to identify UIC not currently noted in Ecology's UIC database.

Estimated Budget 60 hours @ 30.00/hr $ 1800.00

Task 4.4 Develop N loading estimates from hobby farm operations. This task will require coordination with WSDA and CD's within the GWMA. Typical N loading for pasture parcels will be developed by WSDA and CD's and applied to existing parcel database. Loading estimates due to application for lawn and garden uses will be captured in this Task.

Estimated Budget 60 hours @ 30.00/hr $ 1800.00

Task 4.5 Assemble data analysis for RCIM elements and produce estimated N loading in both database and GIS formats.

Estimated Budget 60 hours @ 30.00/hr $ 1800.00

Total Budget for Task 4.0 ***$ 9000.00***

5.0 Irrigated Agriculture Source Quantification

Data for the irrigated agriculture nitrogen loading assessment will be collected using three different methods:

1) County specific crop use, irrigation method, and fertilizer databases

2) Information gathered from a voluntary grower questionnaire that will report site-specific information regarding nitrogen application and removal over several growing cycles and

3) Information collected through a series of group interviews/surveys with local crop consultants and agronomists.

Because collection of the deep soil survey data set may take up to two years as part of the GWMA's Deep Soil Sampling program, WSDA has developed a GIS layer based on recommended fertilizer application from published crop-specific growing manuals. This will be used as an initial baseline and modified as additional information collected from grower surveys (from DSS project) and group interviews becomes available[2]. As the representative set of grower surveys increase in numbers they will be compiled and calculations will be updated using that additional site specific data.

Nitrogen application and removal rates will be evaluated to estimate nitrogen excess or deficiency for groups of crop, soil, fertilization, irrigation, and removal combinations. This evaluation will be conducted by a group of qualified agronomists selected by WSDA for their expertise in nitrogen behavior and local expertise. Fields contained within the operational boundries of livestock operations and upon which manure is applied will be evaluated using the same process as outlined below for irrigated agriculture fields using manure, chemical fertilizer, or combination of chemical fertilizer and manure. Excess nitrogen determined through the evaluation will be assumed to be available for leaching to groundwater. The 2013 WSDA field-specific crop distribution map will then be used as a platform to allocate nitrogen loading across the GWMA based on crop acreage and growing areas. This process will identify a long-term nitrogen balance consistent with current (and recent historical) practices which is not dependent on irrigation or weather (these factors mostly affect timing of nitrate percolation which is not addressed in this analysis).

Use of Grower Survey Data

[2] WSDA has developed a contingency explained in Section 9 that can be used to supplement data collection in the event that the number of grower surveys completed are insufficient to provide a statically valid population on which to conduct the analysis.

WSDA will use data collected from voluntary grower surveys that will provide detailed information regarding nitrogen application and loss over several growing cycles. WSDA will conduct an assessment as to the statistical validity of the surveys as compared to the total number of crop specific parcels. Coordination with the National Agricultural Statistics Service (NASS) will be sought to determine at which level statistical validity will occur, This will be completed prior to assessment of the N loading for irrigated crop lands.

Survey data from a representative sample of the major crops grown in the GWMA boundaries will be analyzed and a typical application/loss determination made for each major crop or livestock activity. Using the 2013 WSDA crop distribution map those typical results would be allocated across the GWMA based on acreage for each crop and/or activity and determination made as to excess or deficient of nitrogen available for leaching to groundwater across the GWMA or in smaller sub-areas as deemed necessary. Based on these results targeted Best Management Practices and educational products can be selected or developed to address those areas, crops, or activities that are determined to contribute to nitrate loading to shallow groundwater.

WSDA, is aware that a sufficient number of surveys may not be received to allow for extrapolation of typical use of nitrogen for each major crop within the boundaries of the GWMA. To address this potential "issue", WSDA will conduct a series of group interviews for growers, consultants, and agronomists to collect data regarding nitrogen timing, application amount, irrigation, etc. This process will mimic that used in the collection of pesticide use data that WSDA has implemented since 2002 with good results. This data combined with that received from grower surveys should provide for an adequate population to conduct the necessary analysis. Depending upon the number of these "meetings" that are considered necessary; the budget estimate may vary by $1000.00 to $2,000.00 this activity.

General

The following equation will be used to estimate nitrate loading to groundwater from irrigated agricultural fields:

Nitrogen load to ground water = (Nitrogen input - Nitrogen removed by cropping)*(1- denitrification fraction)

For crops that fix nitrogen (legumes such as alfalfa and peas), either a fixation term will be included in the nitrogen input term or a calculation using a leached concentration and recharge volume will be used to calculate loading (as performed in other studies), depending on data availability.

Use of the above equation requires the following assumptions and limitations:

• All nitrogen not consumed by the crop and removed will become nitrate

• Excess nitrate is denitrified in the vadose zone or leaches to groundwater

• Input and results are not variable over time and can be approximated with average annual values

• Removal of nitrogen from a field via runoff or tile drainage is negligible

Task 5.1 Develop spreadsheet of grower survey results including estimates of N application, irrigation amounts and timing, biomass removal, crop type, etc.

Estimated Budget 50 hours @ 55.00/hr $ 2750.00

Task 5.2 Conduct statistical analyses of survey populations, and analyze spreadsheet data as to major influences.

Estimated Budget 30 hours @ 55.00/hr $ 1655.00

Task 5.3 Develop crop specific and basin wide NO3 loss estimation, this includes analysis of all survey and published data, working with agronomists to determine crop uptake and N removal from "non-fertilizer" activities. An estimation of total nitrogen budget for each major crop will be develop and rolled into a basin wide estimation following the equation contained in Section 2.0 of this scope.

Estimated Budget 280 hours @ 55.00/hr $ 15400.00

Total Budget for Task 5.0 ***$ 19805.00***

Revised Budget to Include Grower Meetings ***$21805.00***

6.0 Livestock Sources Quantification

Evaluation of N loading from livestock sources will be confined to those areas under the jurisdiction of WSDA (Dairy) or under permit by Ecology as a Confined Animal Feeding Operation[3]. Movement of manure off these designated facilities on to cropland will be captured under the assessment for irrigated agriculture. Nitrogen sources from livestock are divided into two categories, and will focus on dairy and CAFO operational lands:

• Lagoons, feeding and milking pens on unpaved surfaces, composting facilities, manure storage areas, liquid (stormwater) storage areas

• Other possible sources (ditches and pipelines between lagoons and solids separators, and silage leachate)

Agricultural areas where manure is spread to grow a crop will be covered under the irrigated agriculture chapter

Existing data from WSDA and Ecology will be evaluated and may include number of animals per facility, lagoon size, manure storage system, and animal yard size. Required data for this analysis is the current number of head per facility.

Additional data that will be obtained through a literature review or data collection include:

• Manure produced per dairy cow and per beef cow and manure nitrogen content

• A range of lagoon seepage and nitrogen leaching rates

• Ammonia volatilization rates from stored and applied manure

• Typical nitrogen loads generated in unpaved animal yards

• Typical manure management practices for animal yards

• Amount of solids/compost or other nitrogen-containing material that is exported from the GWMA

One meeting is planned with the Livestock/CAFO working group to review and receive feedback regarding “typical” management practices and implemented BMPs within the LYV. Potential nitrogen sources and sinks on local CAFOs will also be discussed as an exercise to identify potentially overlooked nitrogen sources or sinks.

[3] Data collected as a result of US EPA’s consent order with four dairies will be considered as appropriate and where QA/QC requirements meet federal data collection protocols

Published data and work group feedback will be compiled and analyzed to define typical management practices for livestock facilities. Nitrogen mass balances will be calculated based on the number of cows per facility and type of facility (dairy vs beef), typical manure management and storage practices, calculated lagoon/pond leaching rates, expected loading rates from pens, manure removed from the facility for land application or other uses, denitrification, and other quantifiable nitrogen sources/sinks. Nitrogen mass balance results will be allocated across the GWMA at dairy and CAFO facilities. The following equation will be used as a basis for calculating a livestock N loading mass balance:

(Number of cows x Manure generated per cow x Nitrogen content of manure) = Nitrogen leached from storage ponds + Nitrogen leached from unpaved animal yards + Nitrogen removed for local land application + Nitrogen exported from the GWMA as compost or in other forms + Nitrogen lost to volatilization + Nitrogen lost to denitrification

The use of this equation assumes that:

- Input and results are not variable over time and can be approximated with average annual values
- On an average annual basis, all manure and nutrients generated on a livestock operation will be removed, leached, or volatilized (i.e. long-term storage of manure does not occur)
- All major nitrogen sources/sinks for a given livestock are identified in the equation

Data collected within the area referred to as the "dairy cluster" will be evaluated for use in the N evaluation provided that acceptable QA/QC requirements are met (data collected using federal data collection protocols will be considered acceptable).

Task 6.1 Conduct literature review to assemble peer reviewed data on lagoon leakage rates, regional nitrogen content of manure from dairy and beef cattle, required manure handling activities on facility sites. Coordinate with EPA regarding "lagoon" data collected from "Dairy Cluster".

Estimated Budget 30 hours @ 26.00/hr $ 780.00

Task 6.2 Conduct evaluation of manure generation using latest livestock population data, evaluate 3rd party application, develop lagoon leakage rates, evaluate soil testing results and evaluate manure export activities.

Estimated Budget 90 hours @ 45.00/hr $ 4050.00

Task 6.3 Develop N loading estimate for designated dairy and CAFO properties

Estimated Budget *35 hours @ 45.00/hr* *$ 1575.00*

Total Estimated Budget Task 6.0 ***$ 6405.00***

7.0 Comparison of Nitrogen Loading Assessment to Other Related Estimates

Quality Assurance/Quality Control evaluations are proposed to check assumptions and parameters used in the Nitrogen Loading Assessment. These activities include:

- Compare livestock mass balance results with grower survey results to verify assumptions used related to manure application. If the total nitrogen applied across the GWMA as organic fertilizer based on grower survey data differs significantly from the mass expected based on the number of livestock in the GWMA and other identified organic nitrogen sinks, input parameters for the nitrogen loading assessment will be reevaluated. This activity will be addressed through periodic revisions to the document as is warranted as new information become available.

- Conduct an assessment on synthetic fertilizer use using the mass applied to fields (based on grower surveys and WSU rates) compared to nitrogen fertilizer mass sold by fertilizer distributors (assuming data are available). This will provide a check on amounts claimed on grower surveys.

    - Use of current and historical groundwater quality data may be used to assist in defining areas where the results of the mass balance appear to be at odds with groundwater data. Care will be exercised not to confuse water quality that may be the result of historic application from land management activities currently being conducted.

- Upon completion of the Deep Soil Sampling analysis, compare and contrast Nitrogen Loading Assessment with DSS findings. Existing shallow groundwater nitrate data may also be used for this purpose. *The installation of shallow groundwater wells for N loading verification is not considered part of this project. If deemed necessary, this activity should be included in any future groundwater monitoring projects.*

Task 7.1 Conduct evaluation of synthetic fertilizer use (grower survey vs. synthetic fertilizer sold). This task is dependent upon willingness of fertilizer outlets and crop consultants to supply WSDA with data.

Estimated Budget *40 hours @ 45.00/hr* *$ 1800.00*

Task 7.2 Evaluate DSS results with N Assessment results and determine relative gaps in assessment.

Estimated Budget 80 hours @ 55.00/hr $ 4400.00

Total Estimated Budget Task 7.0 ***$ 6200.00***

8.0 Communication and Reporting

A GWMA-wide nitrogen balance will be calculated using the database(s) at the parcel/field scale. The total load from a parcel/field will be the sum of loads from all sources considered. The data will then be mapped at a scale necessary for the GWAC to base GWMA plan recommendations.. A draft report will then be submitted to the Data, IA, RCIM, and Livesock/CAFO work groups for review. It is assumed that up to four conference calls will occur for comments, feedback, and clarification for working group members. The chairs of the working groups will compile, summarize, and resolve conflicting written comments and generate a set of comments for Yakima County/WSDA to complete a GWAC-review draft. Yakima County/WSDA will address working group comments, then produce a GWAC-draft report. A final report will be generated after addressing GWAC comments.

Task 8.1 Develop draft report on nitrogen loading and loss for the Lower Yakima Valley Groundwater Management Area. This will include sub-assessments of the three major areas of concern: RCIM, Irrigated Agriculture, and Livestock/CAFO operations. This report will be submitted to the GWAC for comment. This will be a cooperative effort between WSDA and Yakima County

Estimated Budget 120 hours @ 45.00/hr $ 5400.00

Task 8.2 Review comments from GWAC, and workgroups. This item includes up to four single or joint meetings with workgroups to consider comments, and will conclude with the presentation of a final report on N loading in the Lower Yakima Valley. This will be a cooperative effort between WSDA and Yakima County

Estimated Budget 50 hours @ 45.00/hr $ 2250.00

Total Estimated Budget Task 8.0 ***$ 7650.00***

Total Project Budget Estimate ***$ 56660.00 - $58660.00***

This budget is for the combined work from Yakima County and WSDA and represents and estimated split of $ 13,000.00 for Yakima County specific activities and $ 45,000.00 due WSDA.

It should be noted that the budget submitted does not reflect the true cost of the project but rather approximately 70% of the cost. Because of the critical nature of the project and the need to establish a N loading baseline, WSDA and Yakima County will contribute significant staff resources not funded by GWMA monies to ensure the timely completion of the project.

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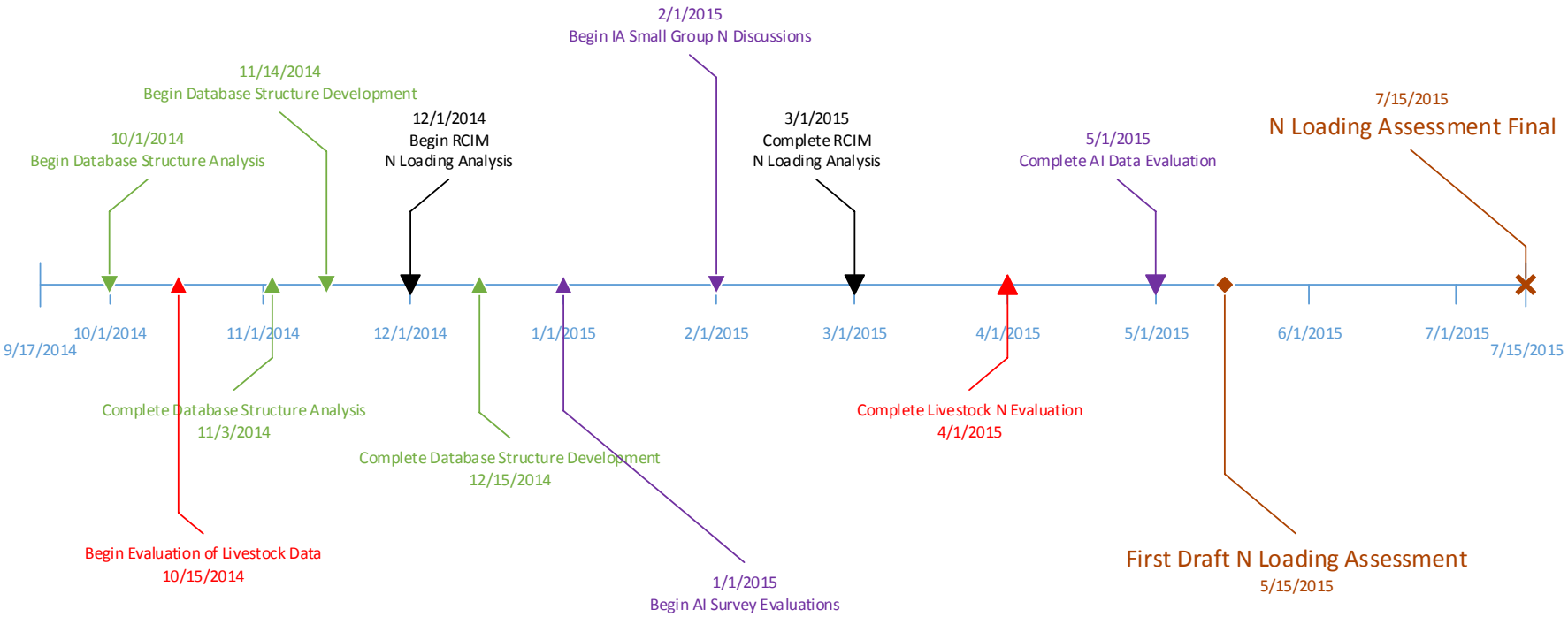
Nitrogen Loading Assessment – Yakima Groundwater Management Area

Project Timeline – Major Milestones



~~DRAFT~~ LOWER YAKIMA VALLEY GWMA PROPOSED AMBIENT GROUNDWATER MONITORING NETWORK

June 8, 2016

~~DRAFT~~ LOWER YAKIMA VALLEY GWMA PROPOSED AMBIENT GROUNDWATER MONITORING NETWORK

Prepared for:

Lower Yakima Valley Groundwater Advisory Committee
and
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June 8, 2016
JE1512
GWMA Ambient Monitoring Network Report v5~~*GWMA Ambient Monitoring Network Report v4*~~

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Appendix A: Local Maps of Preliminary Drill Sites

SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.

Charles Ellingson	**Glenn Mutti-Driscoll**[JGMD1]
Principal Hydrogeologist	Hydrogeologist
Washington State Hydrogeologist No. 631	Washington State Hydrogeologist No. 2832

1.0 INTRODUCTION

The Groundwater Advisory Committee (GWAC) for the Lower Yakima Valley Groundwater Management Area (GWMA) requested the design of a purpose-built groundwater monitoring system to establish a baseline of groundwater quality conditions near the water table in the GWMA. The water table is being targeted since little data from this zone exists, and because concentration changes associated with land use change will occur there first. The design considerations ~~stipulated by the GWAC for the proposed monitoring network~~ were:

- Target the water table or shallow aquifer
- Establish reasonable well density
- Consider the availability of alternative sampling locations
- Consider the general pattern of land use but avoid locations likely to be anomalous as a result of local man-made or natural conditions
    - Include a scale of prioritization indicating which of the specific wells should be given the highest priority for early installation

The network designed using those guidelines will be appropriate for ~~calculating basin wide average conditions at the water table, and for~~ tracking concentration changes at the water table over time. It may also allow mapping of the variation in concentration at the water table. The confidence associated with calculated averages and variation will be sensitive to the number of wells installed, which is not yet determined. ~~This network alone will not address all the goals of the GWMA. For instance, protection of public health is best addressed by sampling of municipal and domestic supply wells; and analysis of nitrate loads from small sites is best addressed by sampling small-scale networks designed around the specifics of such sites.~~

The following report presents the method used to generate a groundwater monitoring network composed of wells, and the results of that work – preliminary drill sites. A comparison of preliminary drill sites to general land use in the GWMA is presented, as well as a discussion on how a monitoring network at irrigation drains can be used to augment groundwater monitoring at wells. Interim work products were presented to the GWMA Data Committee in the form of two technical memoranda (PGG, 2016a; PGG, 2016b) which were discussed on April 13 and May 11, 2016. This final report includes information in the prior memos, and presents network installation cost estimates and timelines.

This work was performed, and this report prepared, in accordance with hydrogeologic practices generally accepted at this time in this area. The resulting report is for the exclusive use of the Lower Yakima Valley Groundwater Advisory Committee and Yakima County for specific application to the Lower Yakima Valley. This is in lieu of other warranties, express or implied.

2.0 GENERAL WELL LOCATION METHODOLOGY

To be responsive to the designmonitoring network considerationscriteria, a method was developed that distributed and ranked monitoring points using only the geographic shape of the GWMA. These points were subsequently adjusted to facilitate permanent access and avoid potentially anomalous areas, consistent with GWAC design considerations. The following subsections provide details on this method.

2.1 INITIAL RANDOM MONITORING POINT POOL

Initial Random Monitoring Points were generated using the Geographical Information System program ArcMap, which was used to first randomly distribute 1000 points across and within the GWMA (excluding the EPA monitored dairy-cluster area). The ArcMap Create Random Points (ESRI, 2016) tool used was to generate this distribution. These interior points created a pool from which *General Well Locations* were selected. General Further information on random sampling can be found in Gilbert (1987) and EPA (2009).

2.2 GENERAL WELL LOCATION SELECTION AND RANKING

Ranked GGeneral Well Locations were selected from the pool of Initial Random Monitoring Points and ranked. The resulting ranked set of General Well Locations was based on the following process:

- The first location selected is the point furthest from the GWMA boundary; this location approximates the centroid of the GWMA.
- The second General Well Location is the point that is farthest from the combination of the boundary and the first General Well Location. This is the middle of the largest un-sampled area.
    - Each subsequent General Well Location is the point closest to the center of the largest un-sampled area. This evenly distributes general well locations throughout the GWMA and ranks them by the size of the un-sampled area.

Figure 1 presents the first 30 General Well Locations as selected and prioritized by the method presented above. Additional locations could be identified using this process in the future. Following the selection of ranked General Well Locations, Preliminary Drill Sites (discussed below) were selected by identifying nearby public land where potential anomalous groundwater nitrate concentrations were not expected.

2.3 PRELIMINARY DRILL SITE SELECTION

Preliminary Drill Sites are refined from the General Well Locations by evaluating surrounding land use. Public lands, canals, agricultural drains, dairies, parcels with septic systems, and known existing monitoring wells were mapped to help select preliminary drill sites. Additionally, road signage and roadside images were reviewed to identify relatively safe sites. The preliminary drill sites were not inspected by visitation. The following bullets describe how each factor was considered.

- Groundwater flow directions and irrigation features (canals, joint drains, lateral canals, and drainage ditches) were mapped to assess up-gradient and down-gradient locations for identifying Preliminary Drill Sites.
- Preliminary Drill Sites were moved from the center of the General Well Location to the nearest public land, subject to the additional criteria below. We recommend that final drill sites be selected near the Preliminary Drill Sites based on field inspection and utility clearances.
- Irrigation canals and joint drains (which have multiple drainage ditches flowing into them) can lose water to the ground and may influence groundwater quality in their vicinity. Preliminary Drill Sites were not located within approximately one-quarter mile from irrigation canals and joint drains.[1] Data from the Columbia Basin GWMA support using a setback from irrigation features (Columbia Basin GWMA, 2008).
- Lateral canals and drainage ditches are smaller features which also may lose water and locally affect groundwater quality. Preliminary Drill Sites were not located within approximately 200 feet from these features.
- Preliminary Drill Sites were not located within one-quarter mile downgradient from other known land uses that may result in anomalous groundwater nitrate concentrations. In application, only one site was moved on this basis: Preliminary Drill Site 7 was moved away from the Port of Sunnyside sprayfield. In addition, although Preliminary Drill Site 23 was not near a dairy or sprayfield, the closest public land with sufficient canal offset was within the EPA dairy-cluster area; therefore the drill site was moved further away to be outside of the cluster.
- Existing publically-owned water table monitoring wells were mapped based on information in the Ecology well log database to assess the availability of pre-existing wells. The accuracy of the monitoring well map coverage is likely imperfect. Use of existing wells is subject to field verification, water table completion, and agreement with the (public) well owner. In practice, no existing monitoring wells were mapped within ¼ mile of the General Well Locations,[2] and therefore ~~no~~ existing wells are not proposed for monitoring in lieu of the purpose built wells proposed within this plan.~~.~~
- Street-view imagery from Google Street View is available for much of the Lower Yakima Valley, and was reviewed for each Preliminary Drill Site (where available) to identify intersections with stop signs, locations with suitable road shoulders, and the presence of overhead lines or other utilities that could interfere with drilling. Mapped irrigation features were also reviewed to assess if they are subsurface pipes and therefore not expected to leak significantly.

3.0 PRELIMINARY DRILL SITES

Preliminary Drill Sites are shown in Figure 2, with more detailed maps of each site in Appendix A, Figures A1 to A30. Site descriptions are presented in Table 1, and include a general summary of the Preliminary Drill Site and the rationale used when moving away from the General Well Location to the Preliminary Drill Site.

[1] PGG initially considered providing setbacks from canals only.
[2] Monitoring wells logs near General Well Locations 7 and 22 were reviewed based on their proximity to the Preliminary Drill Sites, but these monitoring wells were either decommissioned or mis-located.

Depth to water estimates were used to develop well drilling cost estimates. Depth to water estimates come from mapped regional water table elevations (Vaccaro and others, 2009), with linear interpolation applied to estimate elevations between mapped contours; depth to water was then calculated by subtracting this elevation from surficial elevations based on USGS 1:24,000 topographic maps. We have assumed that all wells will be screened over 20 vertical feet extending down from the water table at the time of drilling; however, these well depths are estimates, and actual depths are expected to differ. A comparison of water levels measured at 10 EPA monitoring wells in the dairy cluster to USGS estimates found half of the wells were within 15 feet of the USGS estimate, while the other half had ~~s~~ estimates between 33 feet too high and 126 feet too low. Areas with the greatest discrepancies generally appear to be in higher elevation areas near the edge of the valley and in the vicinity of the Roza Canal. Therefore, in some instances (at sites 15 and 25), professional judgement was used in estimating depths to water based on observed EPA-well water levels.

3.1 PRELIMINARY DRILL SITE LOCATIONS IN RELATION TO SHALLOW BASALT

Shallow geology within the GWMA is primarily alluvial and semi-consolidated basin fill sediments; however, shallow basalt occurs in some areas, which could influence the optimal drilling method. Also, some basalt is of such low permeability that it will not yield sufficient water to a monitoring well.

To evaluate this issue, ~~Expected~~ Preliminary Drill Site well depths were compared to estimated top of basalt elevations ~~to assess if any well screens are likely to be installed in basalt~~. Regional USGS data were~~as~~ used to approximate the top of basalt elevation and the water table elevation (Vaccaro and others, 2009). As discussed in Section 3.0, subsurface elevations based on the USGS~~'s~~ regional characterization may differ from observed actual~~local~~ elevations. In areas where basalt elevations are expected near or above the water table, local well logs from Ecology's well log viewer were reviewed to evaluate basalt and groundwater depths. Areas identified where basalt will likely be encountered above the water table are ~~include~~:

- Preliminary Drill Site 14: it is very likely that basalt will be encountered before the water table at this location.
- Preliminary Drill Site 18: it is likely that basalt will be encountered before the water table at this location.
- Preliminary Drill Sites 9 and 24: it is possible that basalt may be above the water table at these locations, or that saturated sediments will be encountered but will not be 20 feet thick (which is the assumed screen length).
- Preliminary Drill Site 4: basalt may be observed at this location, but it is likely that 20 feet of saturated sediments are present.

Though there is uncertainty in what the constructed depths of the wells will be and the geologic materials that they will encounter, we assume that wells will not be moved in response to expected shallow geology - thus~~be drilled at the Preliminary Drill Sites to~~ re-

taining ~~provide~~ a basin-wide water table monitoring network that is not limited to basin fill areas.

In instances where basalt is encountered during drilling, the following decision ~~making matrix~~process is proposed:

- If ~~dense~~ basalt of any character~~with low permeability~~ is encountered but at least 15 ft of saturated sediments with ~~a~~ high permeability (silty sand or coarser) are present, a well should be completed within ~~only~~ the sediments only~~screened~~.
- If ~~high permeability basalt (fractured or vesicular) exists above the water table and~~ water-bearing basalt is encountered at the water table, the saturated basalt should be screened.
- If dense basalt with low permeability is encountered at the water table and will have insufficient yield to support a well, the borehole should be abandoned (decommissioned) and the next well in the ranked priority ~~order~~ should be drilled.

~~4.0~~ Detailed ~~It is likely that some~~ well construction and completion decisions will ~~also~~ need to be made in the field in response to the field data~~due to the uncertainties associated with drilling~~. In general, saturated materials with low permeability~~ies~~ (for basalt and sediments) will be avoided for screened sections because they compromise well performance and sample representativeness~~since groundwater samples collected from such materials may not be representative of concentrations and trends occurring in the broader valley-wide shallow aquifer system~~.

- ~~[CE2]~~

~~5.0~~4.0 COMPARISON OF PRELIMINARY DRILL SITES TO GENERAL LAND USE

Figures 2 and 3 map preliminary drill sites relative to land use. Figure 2 shows that Preliminary Drill Sites 1 through 9 (the highest priority sites) are all in the lower (southeast) part of the GWMA, that nearly all the drill sites are located close to agricultural land uses, and that several are also near residential, cultural/recreation lands, and undeveloped land. Site 12 appears to be the only site surrounded by non-agricultural uses (it is in Grandview). Sites 1, 5, and 20 (all near Sunnyside) also have significant residential and commercial land uses nearby.

Whereas Figure 2 lumps all agricultural land uses, Figure 3 differentiates various irrigated agricultural land categories according to a method developed for the GWMA's Deep Soil Sampling work (PGG, 2014b), and presented in Table 2. The method defines categories of fields that have three parameters in common:

- NRCS nitrate leaching potential (primarily represents soil type)
- Crop rooting depth (represents crop types)
- Irrigation type (represents potential for over-irrigation)

Figure 3 maps only the ten largest categories according to acreage (they make up 96 percent of the total irrigated acreage)[3]. White areas on the map are a land use other than irrigated agriculture (see Figure 2). The categories mapped on Figure 3 are defined below in order of decreasing acreage.

~~6.0~~5.0 GROUNDWATER MONITORING WITH DRAINS

Given the relatively high installation cost of purpose-built monitoring wells, supplemental groundwater monitoring using the existing irrigation drain[4] network (ie drainage ditches and wasteways) in the GWMA was considered. Given that drains have no additional installation costs, pumps or passive samplers are not necessary for sampling, and they can be sampled in minutes (relative to approximately an hour for sampling a monitoring well with a pump), groundwater monitoring data from drains is much less expensive than data from wells.

While data produced from a drain monitoring network will differ from a monitoring well network (as further discussed below), both well and drain monitoring programs can be pursued in parallel.

~~6.1~~ 5.1 CONCEPTUAL DRAIN MONITORING APPROACH

Nitrate concentrations in Yakima Valley drains ~~temporally~~ vary in response to the~~based on~~ irrigation ~~s~~season. Irrigation in the Yakima Valley typically occurs from April through October, with water from the Yakima River diverted through canals and ultimately applied to fields. During this ~~time~~ period, unused irrigation water, irrigation runoff, and water intercepted by subsurface tile drains is conveyed to drains, and ultimately discharges to the Yakima River. Most of the water present in the drains during this period is water diverted from the Yakima River. Since nitrate and nitrogen concentrations in Yakima River water are low, nitrate concentrations in the drain line water are also relatively low during irrigation months.

During the non-irrigation season (roughly November through March), water diversion from the Yakima River ceases, and water present in the drains is predominantly groundwater that continues to enter those features. Multiple studies in the Yakima Valley (Ebbert and others, 2003; Zuroske, 2009) and from the irrigated part of the Central Columbia Plateau (Williamson and others, 1998) have found elevated nitrate concentrations in drains during the non-irrigation season due to the un-diluted discharge of higher concentration groundwater. Example data plots from existing reports showing this trend are presented in Figure 4. Figure 4a plots drain-water nitrate concentrations and streamflow, and shows that nitrate concentrations are high when flow is low. Figure 4b is a set of bar graphs plotting median monthly nitrate concentration and flow values for the Granger Drain and Sulphur Creek Wasteway; a comparison of the two bar graphs indicates that

[3] A category with "unknown" irrigation type was excluded.

[4] The drain network as referred to in this report includes the drainage ditches and wasteways conveying water from and between fields. Tile drains are not included in our term "drainage network" or "drains" since they are maintained on a field-scale by landowners and are not mapped basin-wide. All return-flow features interconnecting fields are henceforth referred to as "drains" in this report.

higher nitrate concentrations occur in non-irrigation months when groundwater discharge is not diluted.

Apart from differences in cost, groundwater data collected from drains will differ from data collected from wells in several ways, and in some cases may pose benefits or limitations relative to data collected from wells. These differences include:

- Groundwater collected from drains will be an aggregate of groundwater discharged to the drains over potentially large areas that may not be well known. The shallow aquifer capture area for a given drain may be affected by numerous spatially distributed land uses. Groundwater sampled from monitoring wells, on the other hand, is captured from a relatively small area of the shallow aquifer and will be effected by land use directly upgradient of the well.
- For groundwater to discharge to a drain, the water table must intersect the bottom of the drainage feature, groundwater must flow toward the drain, and there must be hydraulic continuity between the drain and aquifer. Therefore water-tight pipelines or areas with paved drainage ditches will receive limited groundwater discharge. In areas of the GWMA with higher elevations that are relatively far from the Yakima River, groundwater will not discharge to drains because the water table is lower in elevation than the drain bottom. Thus the entire GWMA cannot be monitored by sampling drains, and the available drain sampling stations cannot be randomly located.
- Upstream/downstream sampling and/or studies where multiple sampling locations are present along a discharge path can easily be performed using drains. These data could be used to evaluate nitrate contributions from different drain segments.
- Given that nitrate concentrations in drains are only representative of groundwater concentrations during non-irrigation months, drain data cannot be used to evaluate seasonality of groundwater nitrate concentrations. Monitoring well data are necessary to evaluate seasonal groundwater nitrate concentrations in the GWMA.

Because of these differences, we recommend maintaining and evaluating drain monitoring data separately from well data, and therefore have not altered proposed well monitoring locations based on the presence/absence of proposed drain monitoring locations discussed below.

~~6.2~~ 5.2 PROPOSED DRAIN SAMPLE STATIONS

A total of 25 drain sampling stations are identified on Figure 5 and Table 3 based on the distribution of drains, the occurrence of shallow groundwater, and the presence of historical nitrate sampling data. Sampling stations, as discussed below, were not randomly selected and generally are proposed near the Yakima River at drain mouths or upstream at relatively large joint drain junctions. Digital drain coverages for the Sunnyside Valley and Roza[5] irrigation districts where reviewed; however, we were unable to review drain coverages in some of the smaller irrigation districts (Union Gap, Buena, Home, Grandview, and Zillah) present in the GWMA, and therefore additional sampling loca-

[5] Roza Irrigation District wasteways were reviewed, while all other drains in the Roza District are managed by land owners and could not be reviewed at a valley-wide scale.

tions in some of these irrigation districts could be added based on local knowledge or if mapped coverages become available.

Data from Ecology's Environmental Information Management (EIM) database for the Lower Yakima Valley were downloaded to identify historical drain sampling locations. Where possible, proposed sampling locations were located adjacent to historical sampling sites with the intent of combining data sets. In total, 19 out of the 25 proposed sampling locations have historical data. Coordination with the Roza-Sunnyside Board of Joint Control (RSBOJC) and USGS is recommended to obtain any additional monitoring data (historical or current) that are not available in the EIM database.

As shown in Figure 5 and Table 3, most drains have one sample location proposed, though some larger drains with numerous tributaries (Granger Drain and Sulphur Creek Wasteway) have multiple sampling locations proposed. Both the Granger Drain and Sulphur Creek Wasteway have large drainage areas, and it is likely that nitrate concentration changes will be more detectable at the smaller scale/more localized drain monitoring stations.

We recommend that each drain site initially be sampled to establish its seasonal signature of flow and nitrate concentration. That could be accomplished with a minimum of six samples collected bimonthly over a year. Subsequent sampling (targeting groundwater only) should occur only in winter at stations exhibiting a signature of surface water dilution during the irrigation season.

While winter flow is expected at all proposed sampling locations, it is possible that some may not have flow or may have access limitations. If this is the case, other nearby sampling locations should be considered. Coordination with other entities (RSBOJC, USGS, others) is also recommended since they currently may be monitoring some of the proposed drain sampling locations. Field verification and marking of sampling locations should be performed as part of a future scope of work.

~~7.0~~6.0 ESTIMATED COSTS

Costs for well drilling, well sampling, and drain sampling are presented in the following subsections. Costs are planning-level estimates and will likely differ from actual costs depending on management decisions and market conditions.

In addition to drilling contractor costs, the GWMA will incur other costs related to drilling and sampling that are only briefly covered ~~not included~~ in the discussions to follow. Management decisions are required to select personnel for that work. The work includes technical oversight during drilling (geologic logging, in-field well design, documentation, well testing, and as-built reporting), and a professional survey of well head locations and elevations. Field services and data analysis cost estimates are included in Table 4 for reference, and are subject to the numerous assumptions listed at the bottom of Table 4.

Sampling supplies and lab costs are not included beyond the one year assumed for the initial effort summarized below.

~~7.1~~ 6.1 WELL DRILLING COSTS

Estimated drilling costs for the installation of monitoring wells is dependent on drilling method and depth. The estimates presented in Table 4 assume that a hollow-stem auger (HSA) drill rig will be used for installing 2-inch diameter monitoring wells up to 50 feet deep, while a sonic drill rig is assumed for installing 2-inch monitoring wells between 50 and 200 feet deep. HSA is generally the cheapest drilling method for installing shallow monitoring wells (estimated to be $79 per foot of completed well), but the method does not perform as well at depth (therefore a sonic drill rig, which is $98 per foot of completed well, was assumed for the deeper wells). The use of two drill rigs should help minimize costs if numerous wells are installed since the difference in per-foot drilling costs will offset additional mobilization costs; if only a few wells are installed however, it may be more cost effective to use only one drill rig. We assume that wells will be completed flush-to-ground and have one hour of development time.

Depending on the final number of wells the GWMA decides to install, it is possible that air rotary drilling may be a better choice for installing deep wells than sonic. Air rotary drilling is significantly faster~~more time efficient~~ in~~at~~ basalt ~~drilling~~ than sonic. Therefore, use of an air rotary rig for some or all of the deeper wells may be beneficial, especially if the GWMA ~~has~~ installs more than 9 wells (since Preliminary Drill Sites 9, 14, 18, and 24 have higher likelihoods of encountering basalt). While air rotary drilling is quicker than sonic drilling in basalt and at depth, a trade-off occurs if all deep wells are installed with air rotary since less detailed geologic information is generally obtained with that method compared to sonic (such as identifying fine grained material percentages, thin perching layers, and where the water table is encountered)~~ is generally obtained~~, which can increase the likelihood that wells may erroneously be installed at non-targeted depths. Once the total number of wells that will be installed is determined, air rotary cost estimates can be made and compared to cost estimates for mobilizing two deep well rigs (one sonic and one air-rotary).

~~7.2~~ 6.2 WELL SAMPLING COSTS

We assumed that passive samplers are used rather than sampling pumps. Passive samplers have lower upfront costs than pumps and should greatly reduce sampling time, resulting in additional cost savings. However, the passive samplers will require further vetting and quality assurance data that may require some duplication. Also, comparisons of long-term costs between passive samplers and pumps are sensitive to who does the sampling – which is not determined at this time.

The presented cost estimates in Table 4 are for one year of monitoring with six sampling events occurring at each well. Laboratory costs assume that ~~only~~ nitrate, nitrite, ammonium, and Total Kjehldahl nitrogen are~~is~~ analyzed in accordance with the Interim Final Groundwater Monitoring Plan (PGG, 2014). However, the separate analyses for nitrate and nitrite will require samples to be analyzed within 48 hours of collection – which will be difficult and expensive to achieve as a result of frequent shipments to the lab and possible lab surcharges for quick analysis. Combined analysis of nitrate-plus-nitrite is a

common analysis approach, would reduce cost, and is a recommended change to the Sampling and Analysis Plan for this project[6].

~~7.3~~ 6.3 DRAIN SAMPLING COSTS

We assume few ~~no GWMA~~ costs related to establishment of drain sampling stations are necessary, and include only updating the groundwater sampling and analysis plan and field verifying the sample locations. ~~As for well sampling, s~~Sampling costs in Table 5~~4~~ are for six rounds over one year. Samples would be obtained by filling bottles in the field. Sampling personnel have not been determined, but an estimate for the labor if performed by PGG is ~~and their cost is not~~ included.

~~8.0~~7.0 NETWORK INSTALLATION PROCESS & SCHEDULE

The table below summarizes a process for further work on the ambient monitoring networks. Possible dates are included for each step assuming that each step is pursued without delay following completion of prior necessary steps. The estimated schedule considers County, Data Committee, and GWAC management processes, but our assessment of the duration of management decision times may be optimistic. In summary, drain sampling should be possible in early 2017, and wells should be able to be installed in the next deep-water-table season (winter-spring 2017).

[6] Nitrite is very unlikely to comprise a significant portion of the total nitrogen content in groundwater.

Work Common to Wells and Drains	
Finalize this report after Data Committee review (August 2016).	
Determine who will conduct sampling, surveying, and technical oversight. Then develop cost estimates for ancillary work related to well installation and sampling and analysis of wells and drains (July - September 2016).	
Allocate available funds between well installation, well sampling and analysis, and drain sampling and analysis (September – October 2016).	
Work Specific to Well Network	**Work Specific to Drain Network**
Field verify and mark preliminary drill sites. Include evaluation of possible interference from underground utilities (One-Call). Revisit sites after utilities are marked, and move drill sites if necessary to avoid utilities. (October – November 2016).	Determine whether the USGS and RSBJC are collecting drain water quality data that will meet GWMA monitoring needs. (October 2016).
Develop drilling specifications. Generate bid package for well drilling. Select drilling contractor. (November 2016 – January 2017).	Field verify and mark drain sampling stations. Move stations to accommodate access if necessary. Obtain access agreements if necessary. (October - November 2016).
Obtain any permits necessary for drill site access, including traffic control during field work. (November – December 2016).	Develop a Drain Sampling and Analysis Plan (SAP). This document could be an addendum to the Interim Final Groundwater Monitoring Plan (PGG, 2014a) or its successor. (Submit to Data Committee October – November 2016).
Schedule drilling for late winter or spring when water table is deepest. Re-mark drill locations and utilities one week prior to drilling if delay has removed field marks. (January – March 2017).	Contract with samplers and laboratory. (November – December 2016).
Drill wells, logging geology and documenting well as-builts and brief well tests. Survey wellhead locations and elevations. (January – March 2017).	Begin sampling drains. Consider initial frequency of 6/year (stage and nitrate concentration) to assess seasonality and possible surface water dilution, followed by lower frequency to capture groundwater-only samples. (January – February 2017).

Document well installations (as-built report). (April – May 2017).	
Update the GWMA's Interim Final Groundwater Monitoring Plan (PGG, 2014a) if necessary to implement changes, such as use of passive samplers. (April – June 2017, includes two-month Data Committee approval time).	
Begin sampling wells. Consider initial frequency of 6/year to assess seasonality, followed by lower frequency to capture desired data. (July 2017).	

~~9.0~~8.0 REFERENCES

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APPENDIX A
LOCAL MAPS OF PRELIMINARY DRILL SITES

Table 1. Preliminary Drill Sites - Lower Yakima Valley GWMA

Rank	Lower Yakima Valley Vicinity	Location Description	Estimated Depth to Water (feet)	Estimated Well Depth (feet)	Distance Moved from General Well Location (feet)	Direction Moved	Movement Rationale
1	East outskirts of Sunnyside	Van DeGraff Blvd just north of E Lincoln Ave	10	30	1013	NW	Moved to nearest ROW intersection approximately 1/4-mile from Sulfur Creek Wasteway.
2	Northwest of Sunnyside & Northeast of Outlook	South side of Arrowsmith Rd between Maple Grove Rd and Scoon Rd	56	76	2030	E	Moved to ROW 1/4 mile from the SVID Main Canal and Joint Drains 32.0 and 33.4.
3	Northwest of Grandview	East side of N Forsell Rd about 770 feet north of Stover Rd	18	38	1226	NE	Moved to nearest ROW 1/4 mile from Joint Drain 43.9
4	South-southwest of Grandview	North side of E Euclid Rd and Riverfront Rd Intersection	37	57	179	W	Moved to nearest ROW intersection
5	West-southwest of Sunnyside	West side of S Lester Rd about 430 feet south of Gap Rd	44	64	654	SW	Moved to ROW and offset from mapped drain line
6	North-northeast of Sunnyside	NW corner of State Route 241 & Arrowsmith Rd	46	66	1505	NW	Moved to nearest ROW intersection
7	South-southwest of Sunnyside	Linderman Rd at Murray Rd	31	51	4676	SW	Moved to nearest ROW intersection that is 1/4 mile from Sunnyside sprayfields and nearby feedlots.
8	North of Outlook	South side of Van Belle Rd between Price Rd and N Outlook Rd	12	32	527	E	Moved to County Fire District No. 5 Station No. 12 parcel
9	East of Sunnyside & North of Grandview	NW corner of Bethany Rd and Sheller Rd	58	78	1594	E	Moved to nearest ROW intersection 1/4-mile from SVID Main Canal
10	North of Zillah	East side of Roza Dr between Gilbert Rd and Highlan Dr	88	108	422	NW	Moved to ROW
11	East-northeast of Zillah	West side of Eagle Peak Rd between Lamb Rd and E Zillah Dr	145	165	2541	W	Moved to nearest ROW 1/4-mile from SVID Main Canal
12	In Grandview	Intersection of King St and Velma Ave	61	81	879	N	Moved to ROW intersection 1/4 mile from Joint Drain 2, at city park and Grandview Water Tower
13	North-northwest of Sunnyside	SW corner of W Merz Rd and N Fordyce Rd	115	135	1781	NE	Moved to nearest ROW intersection
14	North of Grandview	NE corner of Harrison Rd and Alexander Ext	62	82	3517	NE	Moved to nearest ROW intersection 1/4-mile from SVID Main Canal
15	North of Sunnyside	East side of Scoon Rd between Williamson Rd and Phipps Rd	105	125	640	S	Moved to ROW 1/4-mile from Roza Canal
16	East of Granger	North side of Van Belle Rd between Liberty Rd and Arms Rd	19	39	2301	S	Moved to nearest ROW 1/4-mile from SVID Joint Drain 27.5 and 28.0
17	Northeast of Donald	Brooks Rd east of Konnowac Pass Rd	127	147	1421	E	Moved to nearest ROW intersection 1/4-mile from Union Gap Canal
18	South of Grandview, East-southeast of Mabton	South side of State Route 22 near 27990 SR 22 (between Byron Rd and Bus Rd)	50	70	1176	E	Moved to nearest ROW intersection (pullout to side road). South of WDFW Byron Unit and City of Grandview Wastwater Treatment Plant.
19	Northeast of Buena	NE corner of Darby Rd and Blue Goose Rd	44	64	1925	SE	Moved to nearest ROW intersection 1/4-mile from Union Gap Canal and SVID Main Canal
20	North of Sunnyside	SW corner of Cemetery Rd & E Woodin Rd	23	43	128	W	Moved to nearest ROW intersection

Table 1. Preliminary Drill Sites - Lower Yakima Valley GWMA (Continued)

Rank	Lower Yakima Valley Vicinity	Location Description	Estimated Depth to Water (feet)	Estimated Well Depth (feet)	Distance Moved from General Well Location (feet)	Direction Moved	Movement Rationale
21	West-southwest of Grandview	South side of Belma Rd just west of Hornby Rd	47	67	1343	NE	Moved to nearest ROW intersection
22	West of Grandview	South side of Green Valley Rd 150 ft west of Mabton Sunnyside Rd	19	39	2047	W	Moved to nearest ROW intersection
23	North of Granger	North side of Orchardvale Rd just east of N Granger Rd	35	55	3004	W	Moved to nearest ROW intersection 1/4-mile from SVID Main Canal
24	North of Grandview	North side of Olmstead Rd just east of Wilson Hwy	39	59	1979	E	Moved to nearest ROW intersection 1/4-mile from SVID Joint Drain 44.9
25	Northeast of Zillah	East side of Bailey Rd just north of Highland Dr	180*	200*	647	NE	Moved to ROW 1/4-mile from Roza Canal
26	East of Donald	End of Riggins Rd	145	165	2105	NE	Moved to nearest ROW intersection 1/4-mile from Union Gap Canal
27	Southeast of Sunnyside	West side of Braden Rd just south of Tear Rd	18	38	4050	E	Moved to nearest ROW intersection 1/4-mile from Sulfur Creek Wasteway and Joint Drain 40.2
28	Southeast of Mabton	East side of S Phillips Rd just north of Rusk Rd	33	53	704	N	Moved to nearest ROW intersection
29	South of Snipes Mountain	Southwest corner of Emerald Rd and S Emerald Rd intersection	10	30	4500	SE	Moved to ROW intersection south of Snipes Mountian
30	North of Sunnyside	South side of Reeves Rd just west of Cemetery Rd	60	80	1032	N	Moved to nearest ROW intersection

ROW = Right of Way; SVID = Sunnyside Valley Irrigation District

*Estimated depths to water at preliminary drill sites 15 and 25 were modified based on professional judgement since data from local monitoring wells suggest that depths to water based on USGS analyses alone appear to be over estimates in these areas. Using USGS data alone, preliminary drill site 15 has a predicted depth to water of 145 feet, while site 25 has a predicted depth to water of 283 feet.

Table 2. Soil and Irrigated Agriculture Land Use Categories

Category*	NRCS Nitrate Leaching Class	Irrigation type	Primary crops (similar rooting depth)
1	0.34-0.66	sprinkler	Corn, grapes, pasture, wheat, grass hay, sudangrass, triticale
2	0.34-0.66	sprinkler	Tree fruit, alfalfa, hops, asparagus
3	0.67-1.0	sprinkler	Tree fruit, alfalfa, hops, asparagus
4	0.34-0.66	surface	Corn, grapes, pasture, wheat, grass hay, sudangrass, triticale
5	0.67-1.0	sprinkler	Corn, grapes, pasture, wheat, grass hay, sudangrass, triticale
6	0.34-0.66	drip	Tree fruit, alfalfa, hops, asparagus
7	0.34-0.66	drip	Corn, grapes, pasture, wheat, grass hay, sudangrass, triticale
8	0.67-1.0	surface	Corn, grapes, pasture, wheat, grass hay, sudangrass, triticale
9	0.67-1.0	drip	Corn, grapes, pasture, wheat, grass hay, sudangrass, triticale
10	0.34-0.66	surface	Tree fruit, alfalfa, hops, asparagus

*These 10 categories account for 96 percent of the GWMA irrigated agricultural lands (fields with unknown crop type or unknown irrigation type are not included in this total). See PGG (2014b) for more information on the derivation of categories.

Table 3. Preliminary Drain Sampling Stations -Lower Yakima Valley GWMA

Drain Station Number	Lower Yakima Valley Vicinity	Latitude	Longitude	Location Description	Drain Sampled	Has Historical Nitrate Data?	Notes/Comments
1	Between Donald & Buena	46.46093054	-120.3684576	Roza Canal Wasteway #3 at Yakima Valley Highway	Roza Canal Wasteway #3	N	
2	Southeast of Buena	46.41417682	-120.3024766	Buena Drain on Westbound I-82 by Exit 50 to SR97 Sign	Buena Irrigation District Drain	N	Possible alternative access by red Golf Club barn accessed through Zillah Lakes housing development on Yakima Valley Highway
3	Zillah	46.40412261	-120.2768151	Manhole at SE corner of Chevron Station Property, I-82 Exit 52	Joint Drain 14.6	Y	Historical samples have been obtained from this location, unclear if current access feasible.
4	Granger	46.34273273	-120.2006477	Outfall pipe on cliff behind house at 307 W. Blvd in Granger	Drain 27	Y	Unclear if current access is possible
5	Granger	46.34317058	-120.1880148	Granger Drain at Mouth (E Avenue)	Joint Drain 26.6	Y	
6	Northeast of Granger	46.34728695	-120.1776299	Joint Drain 26.6 at Yakima Valley Highway & Schneider Ln	Joint Drain 26.6	Y	Additional upstream sampling could be pursued if winter flow is present
7	East of Granger	46.33953601	-120.1565564	Joint Drain 27.5 at Yakima Valley Highway	Joint Drain 27.5	Y	Location is immediately north of the Yakima Valley Highway. Additional upstream sampling could be pursued if winter flow is present
8	Between Granger & Outlook	46.33965613	-120.1413834	Joint Drain 28 immediately North of Yakima Valley Highway	Joint Drain 28	Y	Additional upstream sampling could be pursued if winter flow is present
9	Between Granger & Outlook	46.33899521	-120.1325244	Drain 2 at Yakima Valley Highway	Drain 2	Y	Sampling recommended north of the road where RSBOJC flume present. Additional upstream sampling could be pursued if winter flow is present
10	West of Outlook	46.33156352	-120.1045882	Joint Drain 32 at Outlook Road	Joint Drain 32	Y	Additional upstream sampling could be pursued if winter flow is present
11	South of Snipes Mountain	46.25878634	-120.0653944	DID7 at Green Valley Rd	Drainage Improvement District 7 Drain	Y	Historical samples have been collected at the culvert nearest to the drain mouth in the WDFW Sunnyside Wildlife Area. If accessible, this sampling location is preferred to the proposed Green Valley Rd location.
12	South of Sunnyside	46.25117068	-120.0201977	Sulphur Creek Wasteway at Holaday Rd	Sulphur Creek Wasteway	Y	
13	South of Sunnyside	46.28206839	-120.0096429	Joint Drain 33.4 South of Duffy Rd	Joint Drain 33.4	Y	
14	West Sunnyside	46.32867671	-120.0252698	Joint Drain 33.4 at Yakima Valley Highway	Joint Drain 33.4	Y	Historical samples have been collected behind a warehouse near 1st St, unclear if access to this location still exists.
15	Northwest of Sunnyside	46.33378121	-120.0333092	Joint Drain 33.4 accessed from Rougk Lane	Joint Drain 33.4	N	Additional upstream sampling could be pursued if winter flow is present
16	Northwest of Sunnyside	46.33835633	-120.0232698	Joint Drain 34.2 at E Woodin Rd	Joint Drain 34.2	N	Additional upstream sampling could be pursued if winter flow is present
17	South of Sunnyside	46.28332189	-119.9992253	Joint Drain 43.9 at Sunnyside-Mabton Rd	Joint Drain 43.9	Y	Additional upstream sampling could be pursued if winter flow is present
18	South of Sunnyside	46.28746282	-119.9974738	Joint Drain 40.2 mouth along Tear Rd	Joint Drain 40.2	Y	Additional upstream sampling could be pursued if winter flow is present

Table 3. Preliminary Drain Sampling Stations -Lower Yakima Valley GWMA (Continued)

Drain Station Number	Lower Yakima Valley Vicinity	Latitude	Longitude	Location Description	Drain Sampled	Has Historical Nitrate Data?	Notes/Comments
19	Southeast Sunnyside	46.30940881	-119.9914319	Joint Drain 35.4 at Allen Rd	Joint Drain 35.4	Y	Additional upstream sampling could be pursued if winter flow is present
20	East of Sunnyside	46.32450288	-119.9781487	Joint Drain 37.9 at Hanford Rd	Joint Drain 37.9	Y	Additional upstream sampling could be pursued if winter flow is present
21	East of Sunnyside	46.33163342	-119.9799318	Sulphur Creek Wasteway at Sheller Rd	Sulphur Creek Wasteway	N	East wasteway channel should be sampled. Additional upstream sampling could be pursued if winter flow is present
22	North of Mabton	46.24010344	-119.9992304	Drain 31 at West Charvet Rd	Drain 31	Y	Located at West Charvet Rd and Sunnyside-Mabton Rd intersection
23	Southwest of Grandview	46.2364516	-119.9629096	Drain 35 off of Charvet Rd	Drain 35	Y	Historical sampling location was at a broken pipe at the south end of a hops field at 1701 Charvet Rd. Uncertain if sampling access currently possible.
24	SSW of Grandview	46.22924162	-119.925942	Joint Drain 2 (Grandview Drain) at Chase Rd	Joint Drain 2	Y	Historical sampling location was at a private pond at 862 Chase Rd, near the mouth of the joint drain.
25	East of Mabton	46.19769036	-119.9184388	Joint Drain 1 at Bus Rd	Joint Drain 1	N	Downstream sampling between Byron Ponds in the WDFW Byron Unit may not be representative of groundwater concentrations due to water fowl usage of the wetlands.

Note:

-Historical nitrate data were queried from Ecology's EIM database to assess if data exist for the proposed sampling locations. Other data sources (such as USGS or RSBOJC) may exist that are not in the EIM database.

Table 4. Well Installation and Annual Monitoring Cost Estimate

Wells	Estimated Drilling Costs	Estimated Lab Costs, Wells[1]	Passive Sampling Devices[2]	Total Well Sampling Costs	Total Cost[3]
1 - 5	$24,580	$900	$2,750	$3,650	$28,230
1 - 10	$56,802	$1,650	$5,071	$6,721	$63,523
1 - 15	$114,426	$2,550	$7,821	$10,371	$124,797
1 - 20	$148,442	$3,300	$10,142	$13,442	$161,884
1 - 25	$188,861	$4,200	$12,892	$17,092	$205,953
1 - 30	$232,043	$4,950	$15,213	$20,163	$252,206

Drain Sampling Locations	Estimated Lab Costs, Drains[1]
1 - 25	$4,200

[1] Estimated laboratory costs are for one year of sampling with six sampling events. For quality assurance purposes, this estimate includes duplicate sample analyses, and assumes one duplicate is collected every 10 samples.

[2] Passive sampling device costs are estimated for one year with six sampling events. Passive sampling device costs will be slightly less (roughly 8 percent) following year one since hanging assemblies and weights will not need to be purchased.

[3] Total Costs are for well installation and one year of monitoring.

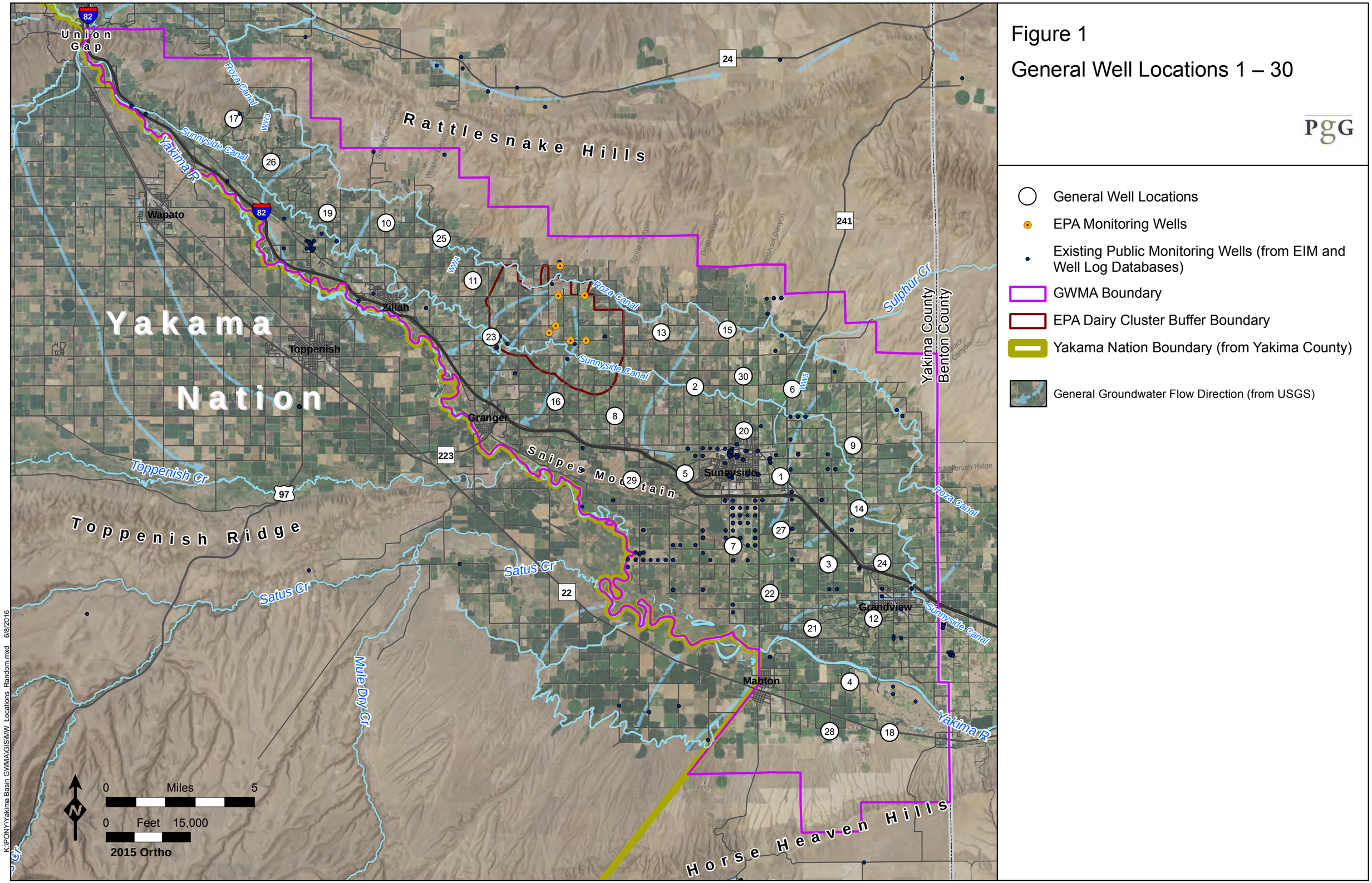

Figure 1

General Well Locations 1 – 30

PgG

General Well Locations

EPA Monitoring Wells

Existing Public Monitoring Wells (from EIM and Well Log Databases)

GWMA Boundary

EPA Dairy Cluster Buffer Boundary

Yakama Nation Boundary (from Yakima County)

General Groundwater Flow Direction (from USGS)

Figure 2

Preliminary Drill Sites and Land Use

PgG

- Preliminary Drill Site
- Dairy (from WADOA 2014)
- GWMA Boundary
- EPA Dairy Cluster Buffer Boundary
- Yakama Nation Boundary (from Yakima County)

Current Land Use

- Residential
- Manufacturing
- Transportation\Utilities
- Commercial Retail
- Commercial Services
- Cultural/Recreation
- Resource/Agriculture
- Undeveloped

General Groundwater Flow Direction (from USGS)

Union Gap
Wapato
Zillah
Toppenish
Granger
Sunnyside
Grandview
Mabton
Yakama Nation
Rattlesnake Hills
Toppenish Ridge
Snipes Mountain
Horse Heaven Hills
Yakima County
Benton County
Yakima R
Sunnyside Canal
Roza Canal
Toppenish Cr
Satus Cr
Mule Dry Cr
Sulphur Cr
82
24
241
223
97
22

0 Miles 5

0 Feet 15,000

2015 Ortho

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Figure 3

Preliminary Drill Sites and Irrigated Land Categories

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Preliminary Drill Site

Irrigated Land Category

(see Table 2 for Descriptions)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- Not Ranked

GWMA Boundary

EPA Dairy Cluster Buffer Boundary

Yakama Nation Boundary (from Yakima County)

Rattlesnake Hills

Toppenish Ridge

Horse Heaven Hills

Snipes Mountain

Union Gap

Wapato

Zillah

Toppenish

Granger

Sunnyside

Grandview

Mabton

Yakima County

Benton County

Yakima Nation

Yakima R

Sunnyside Canal

Roza Canal

Toppenish Cr

Satus Cr

Mule Dry Cr

Sulphur Cr

Rattlesnake Canyon

Spring Canyon

Deep Canyon

Washout Canyon

Black Canyon

Sagebrush Ridge

0 Miles 5

0 Feet 15,000

2015 Ortho

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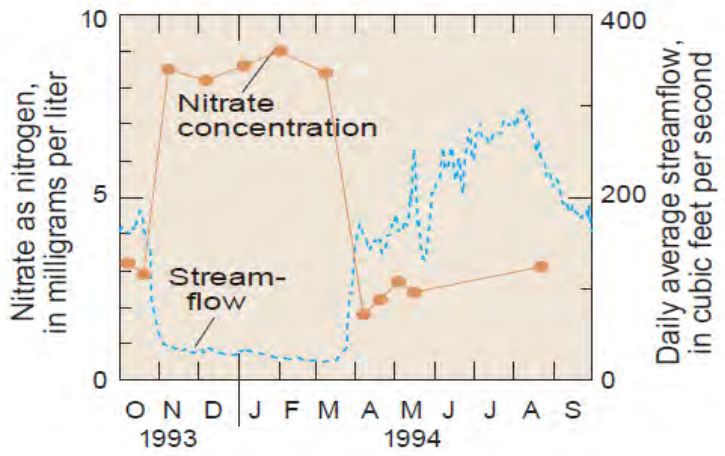
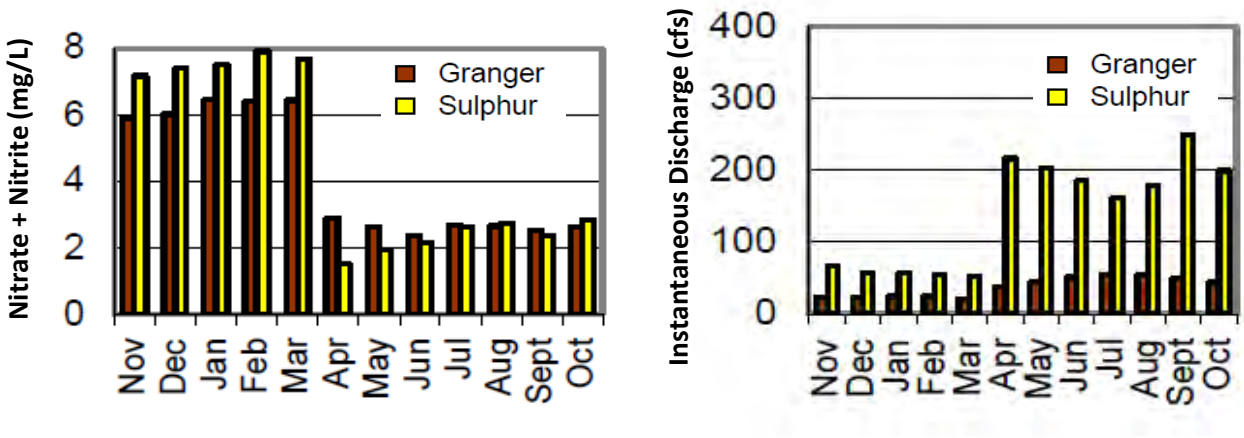


4a) Nitrate concentrations in wasteways are generally highest in the winter when their main source is groundwater discharge and negligible dilution from return flows occurs. Figure from Williamson & others (1998).



4b) Median monthly nitrate and discharge measurements from 2000 - 2008 for Granger Drain and Sulphur Creek Wasteway. Figures from Zuroske (2009).

Figure 4
Comparison of Drain Concentrations to Irrigation Flow

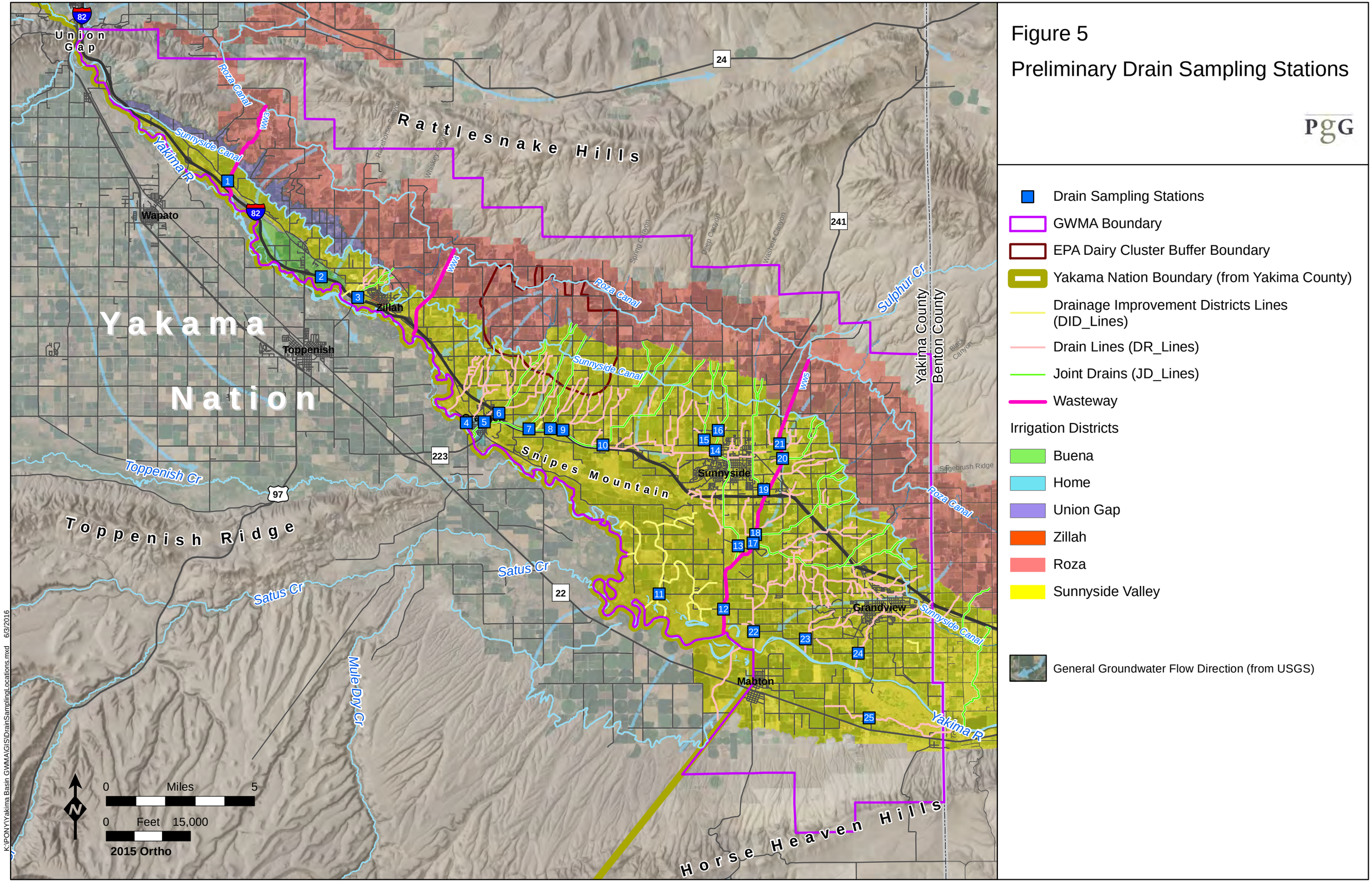


Figure 5
Preliminary Drain Sampling Stations
PgG
Drain Sampling Stations
GWMA Boundary
EPA Dairy Cluster Buffer Boundary
Yakama Nation Boundary (from Yakima County)
Drainage Improvement Districts Lines (DID_Lines)
Drain Lines (DR_Lines)
Joint Drains (JD_Lines)
Wasteway
Irrigation Districts
Buena
Home
Union Gap
Zillah
Roza
Sunnyside Valley
General Groundwater Flow Direction (from USGS)
Union Gap
Rattlesnake Hills
Yakama Nation
Toppenish Ridge
Snipes Mountain
Horse Heaven Hills
Wapato
Zillah
Toppenish
Sunnyside
Grandview
Mabton
Yakima County
Benton County
Roza Canal
Sunnyside Canal
Yakima R
Toppenish Cr
Satus Cr
Mule Dry Cr
Sulphur Cr
Sagebrush Ridge
0 Miles 5
0 Feet 15,000
2015 Ortho
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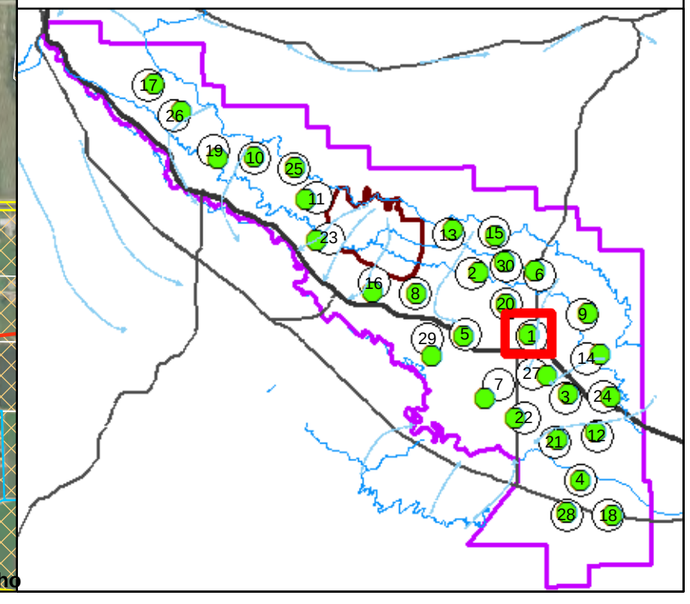
APPENDIX A
LOCAL MAPS OF PRELIMINARY DRILL SITES

Figure A1
General Well Location and Preliminary Drill Site 1

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Wasteway (Roza Irr. Dist)
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name



North Ave
Sheller Rd
Yakima Ave
Morgan Rd
Blaine Ave
E Blaine Ave
Roosevelt Ct
Arrowsmith Ave
Federal Wy
Decatur Ave
E Gregory Ave
E Edison Ave
Franklin Ave
Franklin Ct
E Franklin Ave
Barnes Ct
E Grant Ave
Harrison Ave
E Harrison Ave
Irving Ave
E Jackson Ave
Kearney Ave
E Lincoln Ave
Hilzer Alley
Idabelle Ln
South St
Kristen Ave
South Ave
Penn Ave
Asparagus Ln
Mint Ln
Julia Ave
Allen Rd
E South Hill Rd
Thornton Rd
I-82 Hwy
N McLean Rd
Saul Rd
Bountiful Ave
Harvest Pl
Golden St
Mabton Sunnyside Rd
Alphabet Ln
Baze Ln
Quail Ln
Chukar Ln
Wanita Rd
Yakima Valley Hwy
E Allen Rd
Clyde Circle Rd
Factory Rd
E Edison Rd
Reith Wy
Barnard Blvd
Van Nutley Blvd
State Route 241
N 9th St
N 10th St
N 11th St
N 13th St
N 14th St
N 15th St
N 16th St
S 9th St
S 10th St
S 11th St
S 12th St
S 13th St
S 14th St
S 15th St
S 16th St
S 17th St
Tacoma Ave

PORT OF SUNNYSIDE 200.5 ft 11/19/2006
City of Sunnyside 8 ft 2/5/2014
City of Sunnyside 8 ft 2/5/2014
City of Sunnyside 8 ft 2/5/2014
City of Sunnyside 8 ft 2/5/2014
SUNNYSIDE WA 20 ft
SUNNYSIDE WA 18 ft
PORT OF SUNNYSIDE 16 ft 12/9/1997
PORT OF SUNNYSIDE 12 ft 7/1/1997
PORT OF SUNNYSIDE 13 ft 9/14/1998
SUNNYSIDE FARM FAIR 20 ft 8/3/1993
SUNNYSIDE FARM FAIR 20 ft 8/3/1993
SUNNYSIDE FARM FAIR 20 ft 8/3/1993
PORT OF SUNNYSIDE 23 ft 9/14/1998
PORT OF SUNNYSIDE 30 ft 10/27/2008
PORT OF SUNNYSIDE 16 ft 12/9/1997
PORT OF SUNNYSIDE 16 ft 7/1/1997
PORT OF SUNNYSIDE 30 ft 10/27/2008
PORT OF SUNNYSIDE 16 ft 9/14/1998
PORT OF SUNNYSIDE 30 ft 10/27/2008

0 Miles 0.25
0 Feet 1,000
N
2015 Ortho

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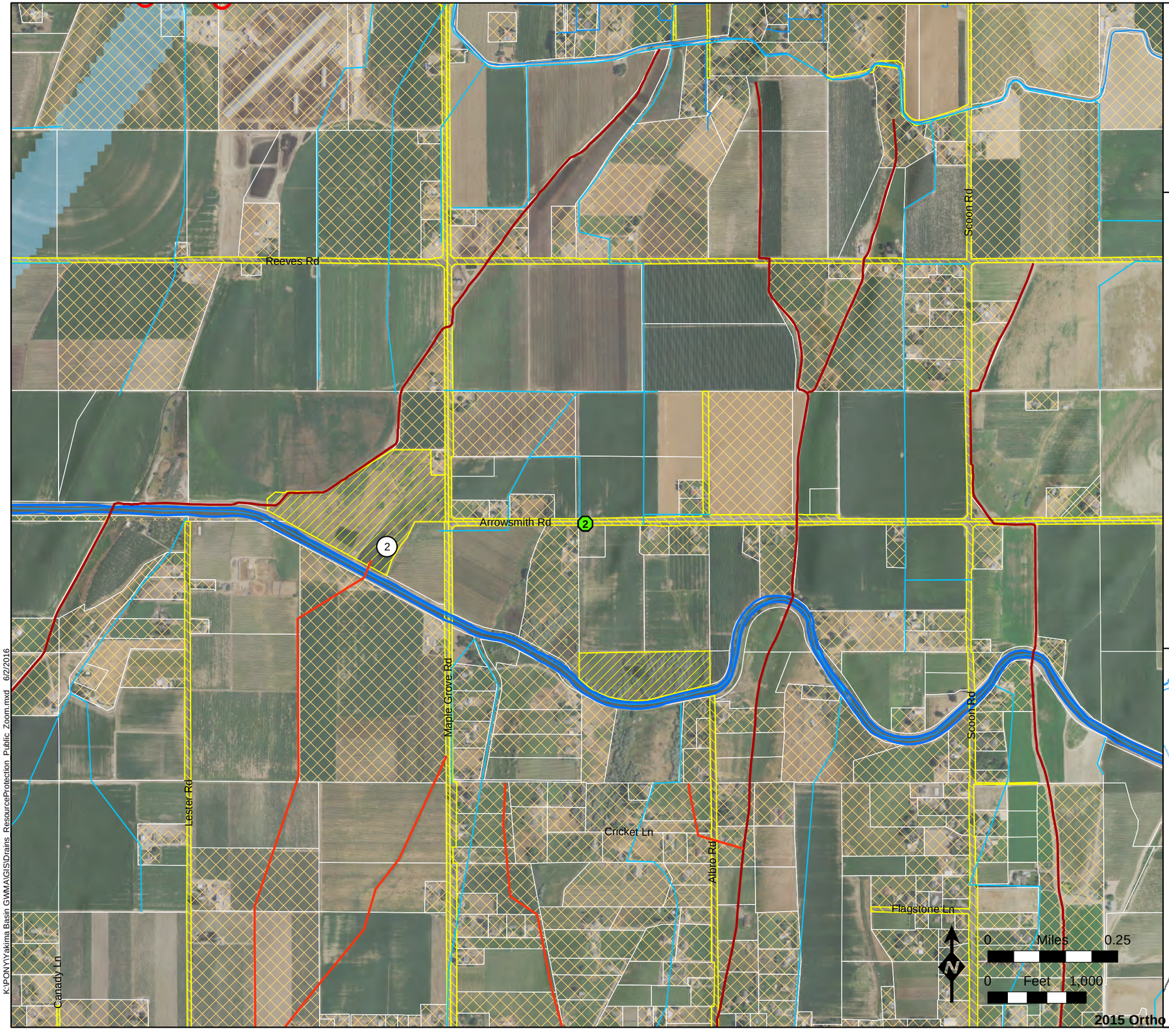
Figure A2
General Well Location and Preliminary Drill Site 2

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



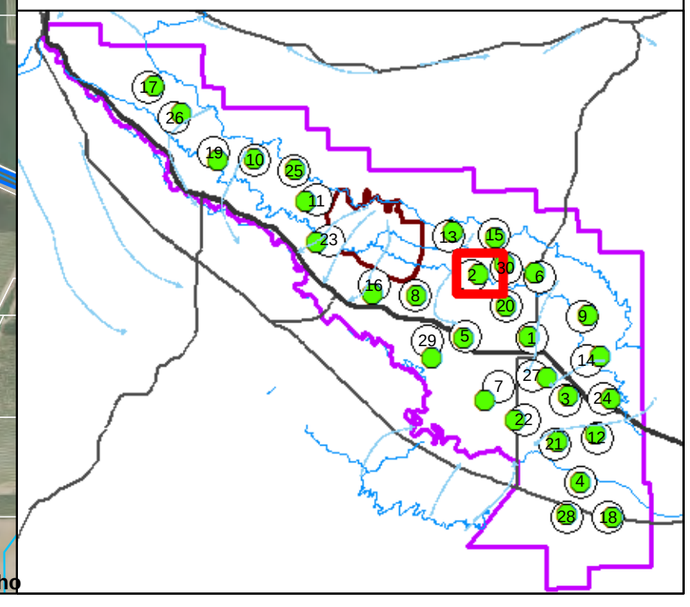


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Figure A3
General Well Location and Preliminary Drill Site 3

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

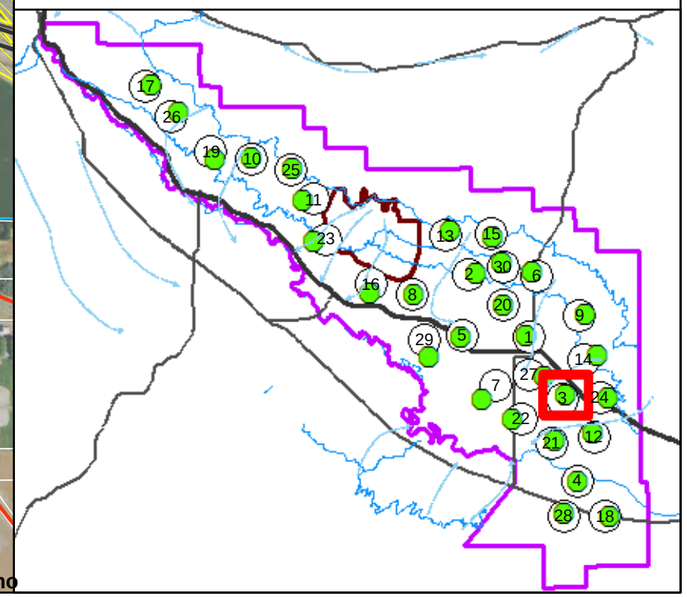

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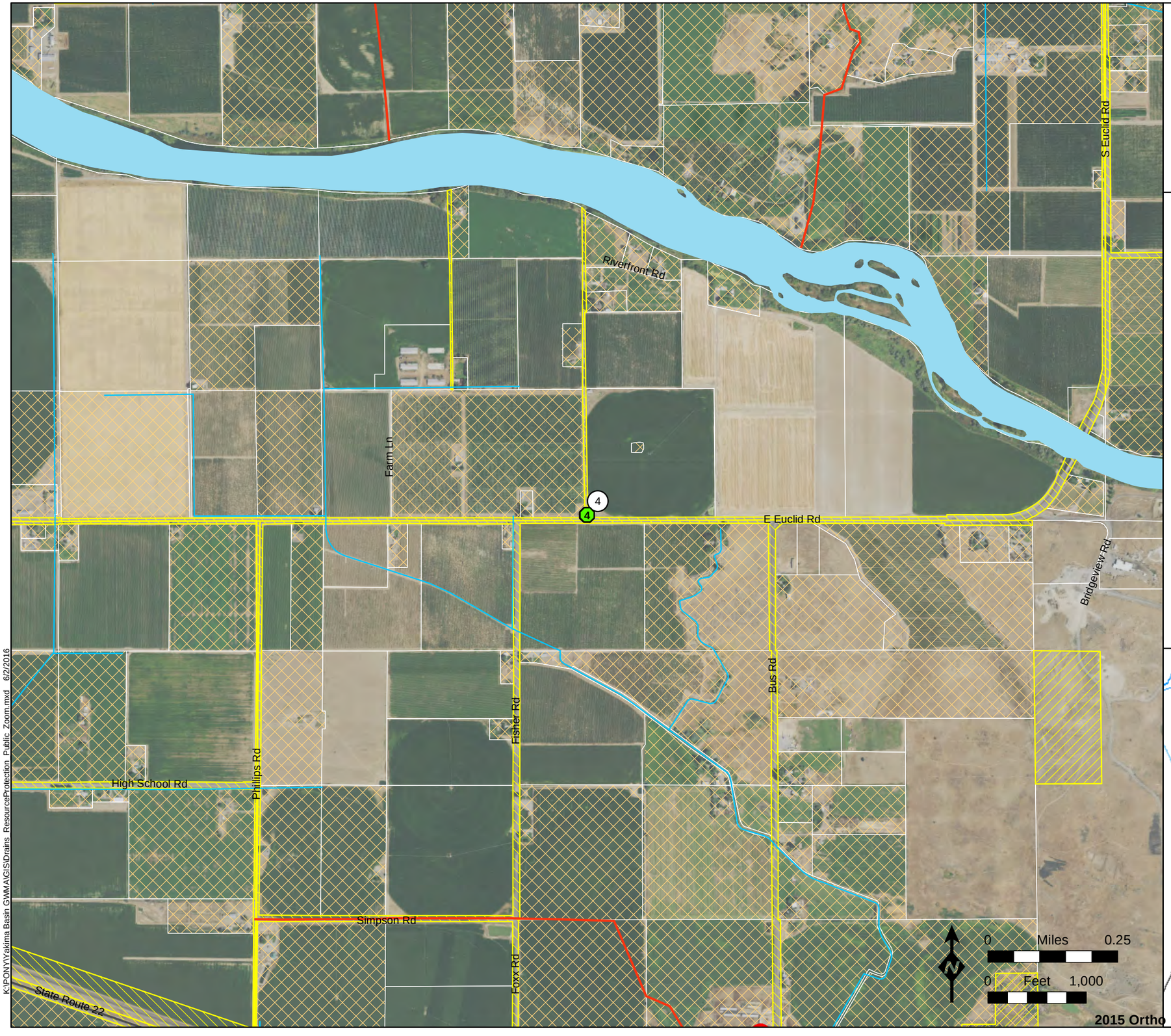
Figure A4
General Well Location and Preliminary Drill Site 4

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



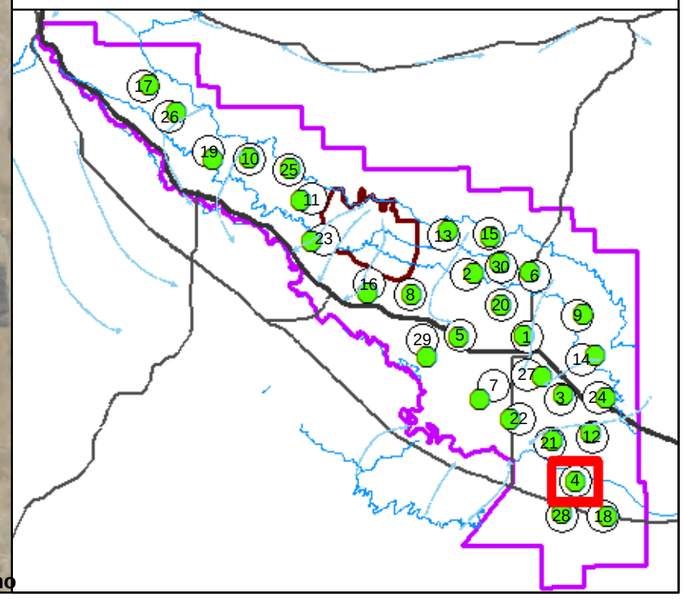


Figure A5
General Well Location and Preliminary Drill Site 5

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

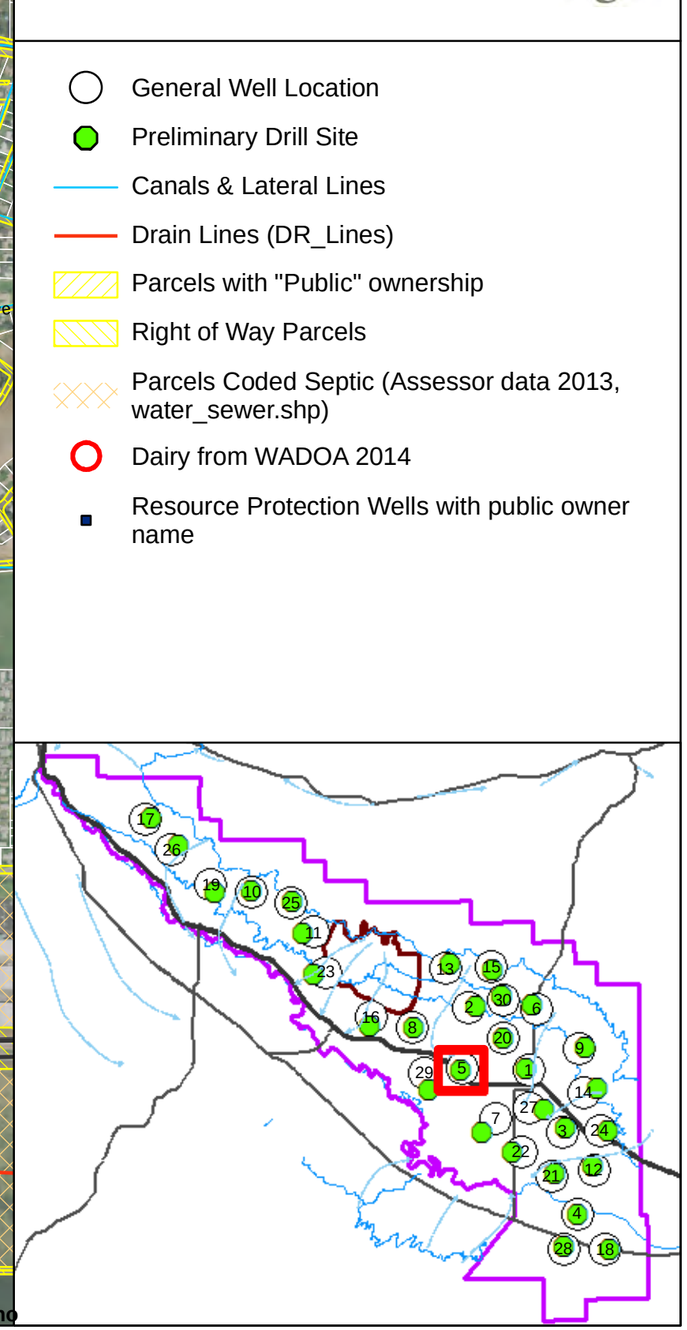


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Figure A6
General Well Location and Preliminary Drill Site 6

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Wasteway (Roza Irr. Dist)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)



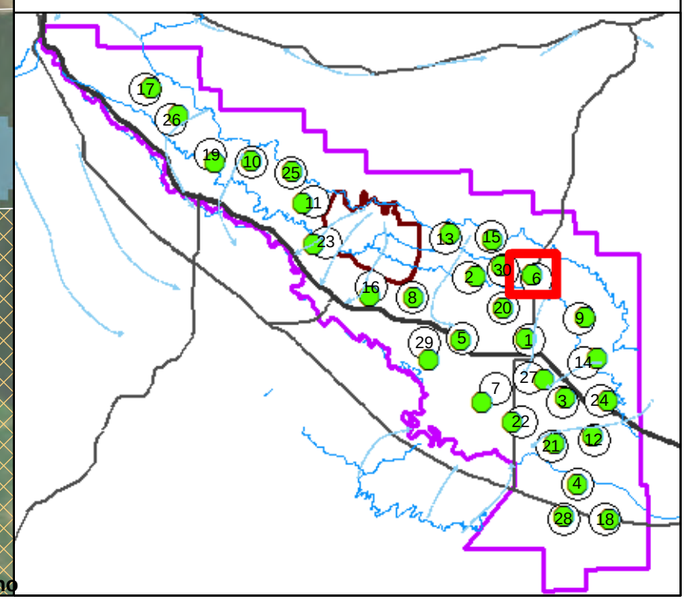

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Figure A7
General Well Location and Preliminary Drill Site 7

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Wasteway (Roza Irr. Dist)
- Drainage Improvement Districts Lines (DID_Lines)
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name

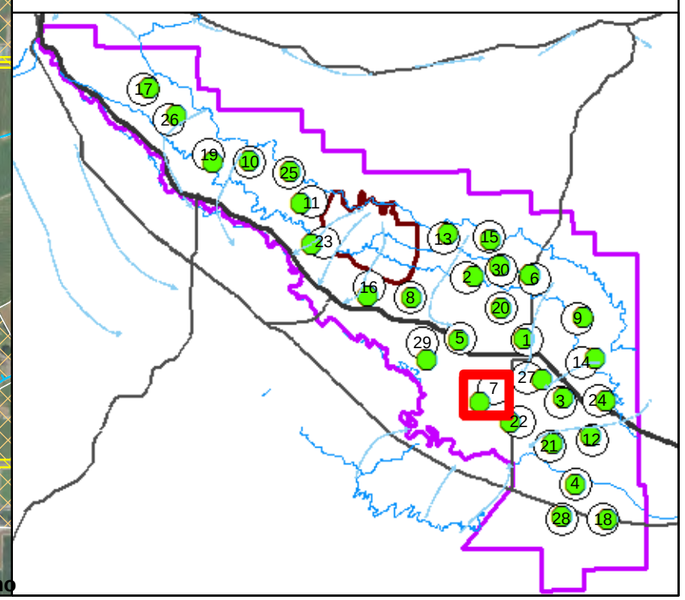
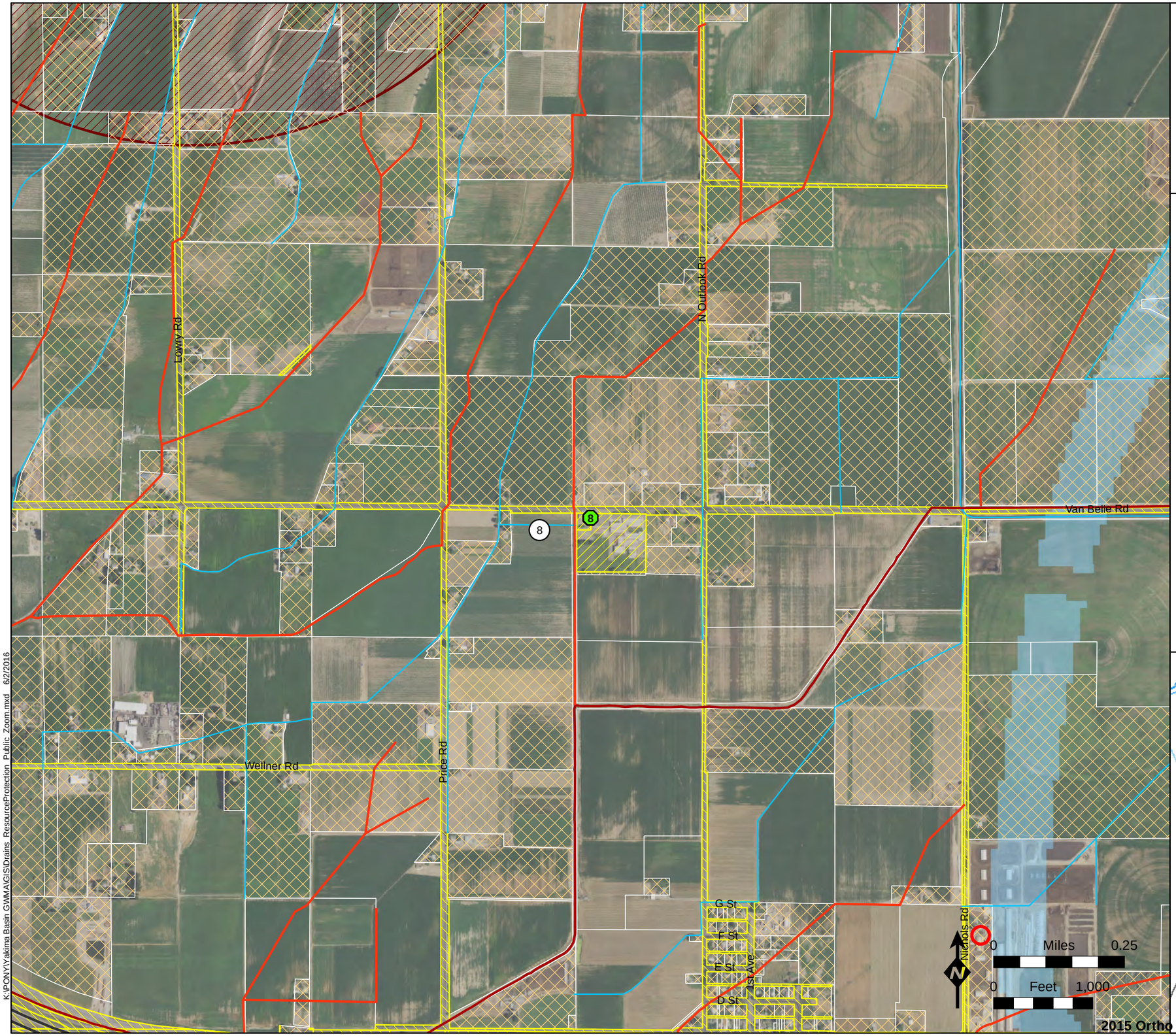


Figure A8
General Well Location and Preliminary Drill Site 8

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- EPA Dairy Cluster Buffer Boundary
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



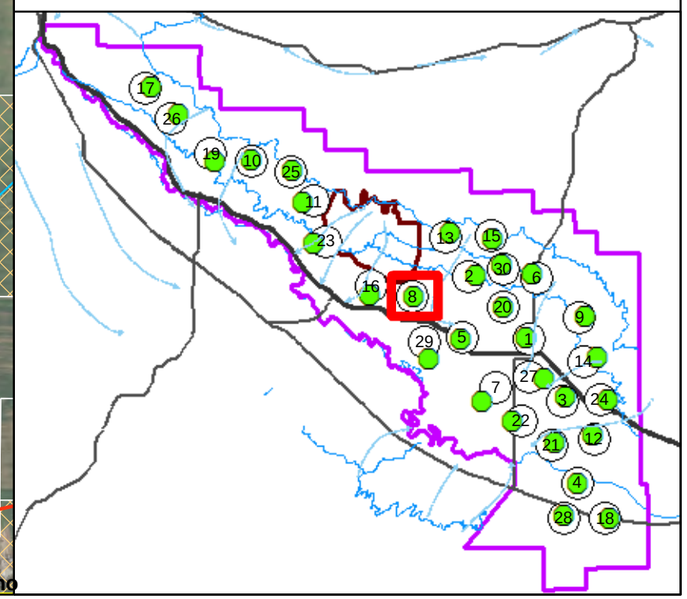


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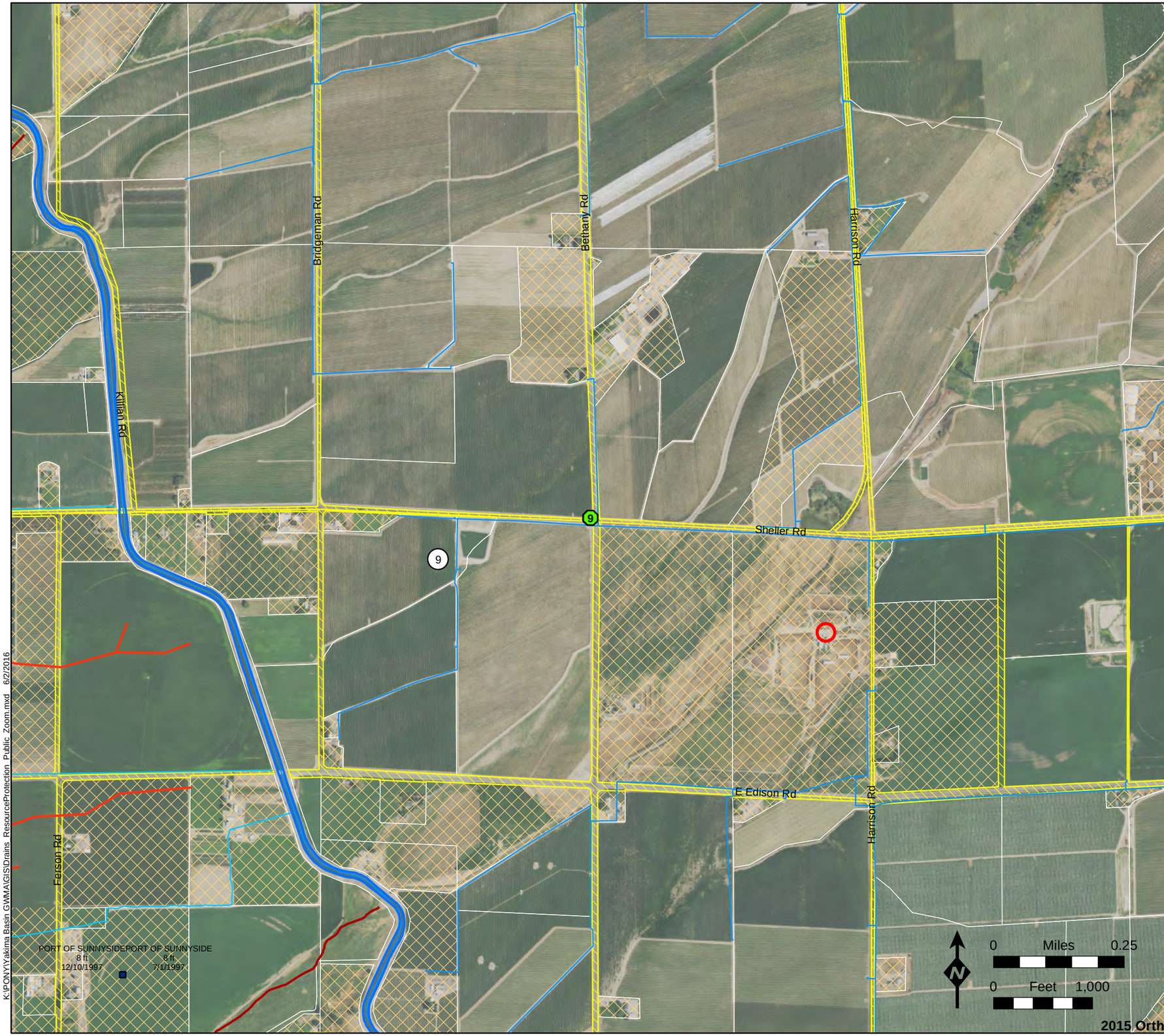
Figure A9
General Well Location and Preliminary Drill Site 9

PgG



- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

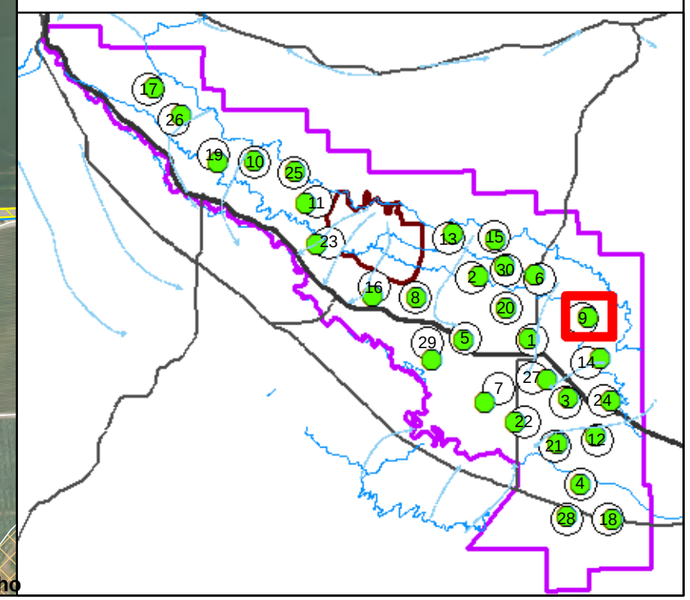


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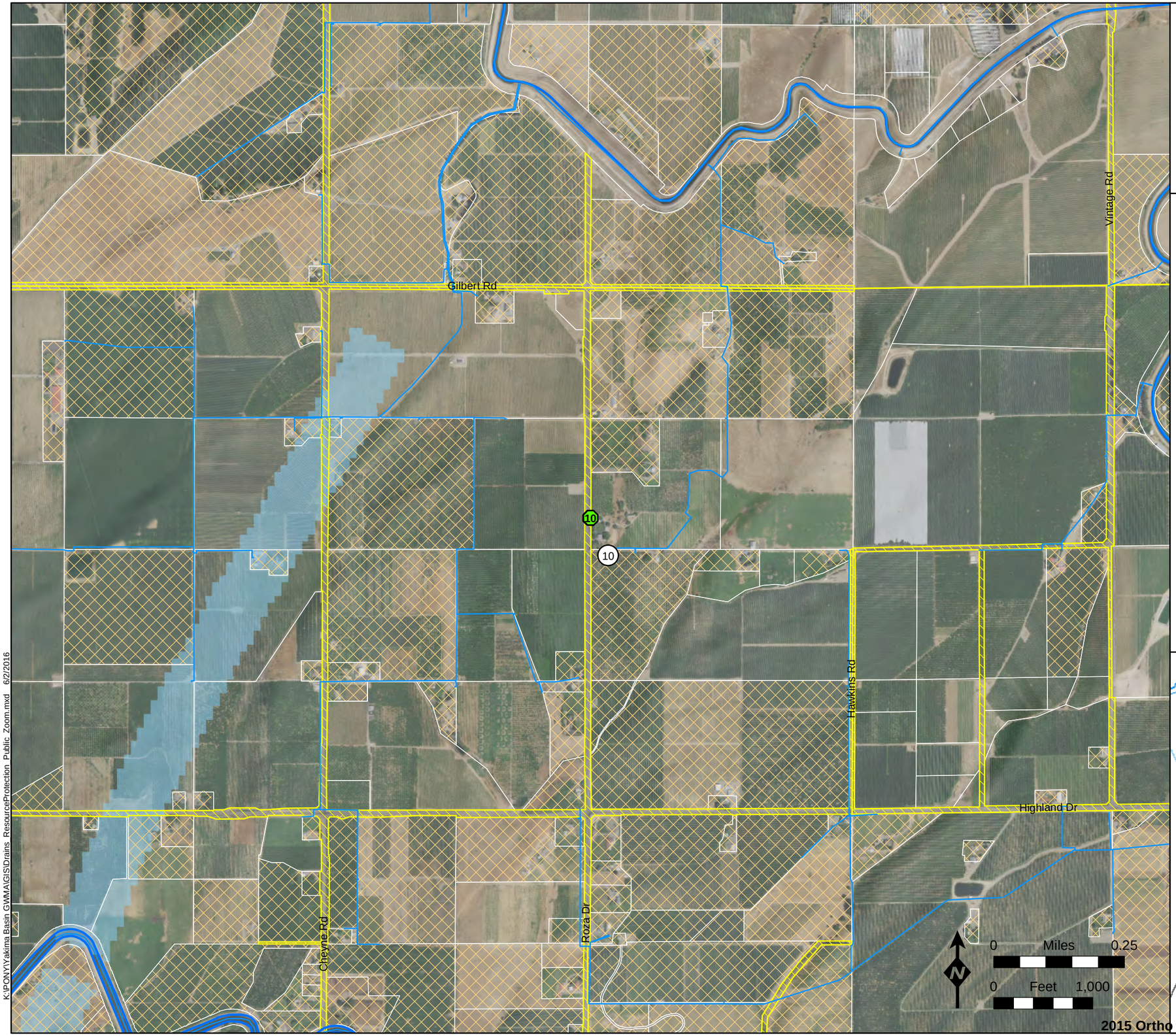
Figure A10
General Well Location and Preliminary Drill Site 10

PgG

- General Well Location
- Preliminary Drill Site
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)



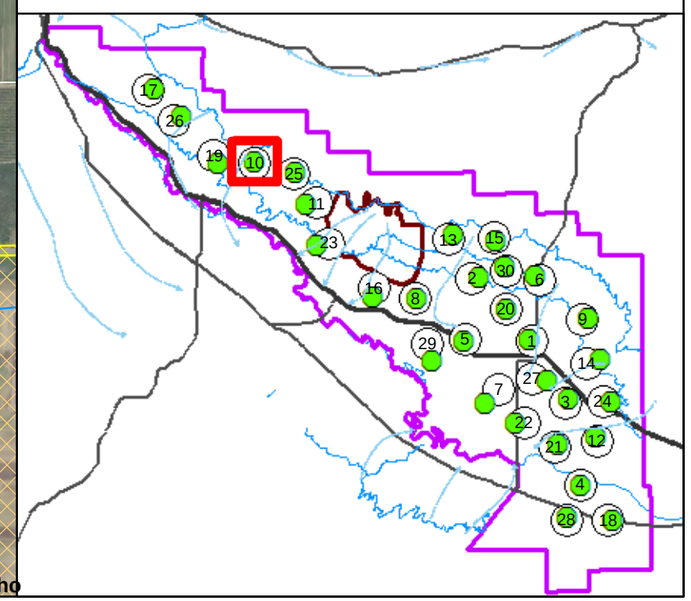


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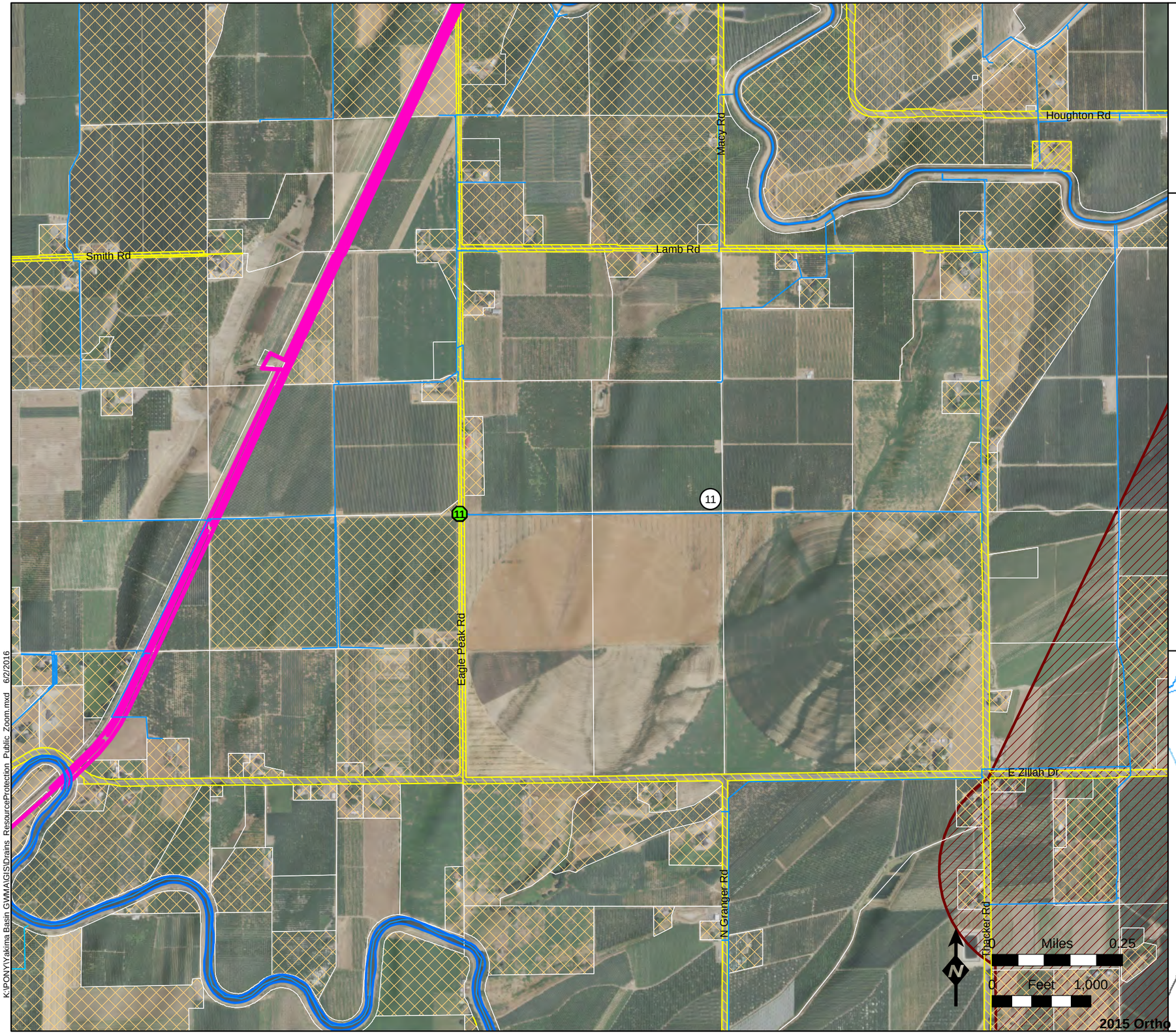
Figure A11
General Well Location and Preliminary Drill Site 11

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- EPA Dairy Cluster Buffer Boundary
- Wasteway (Roza Irr. Dist)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)



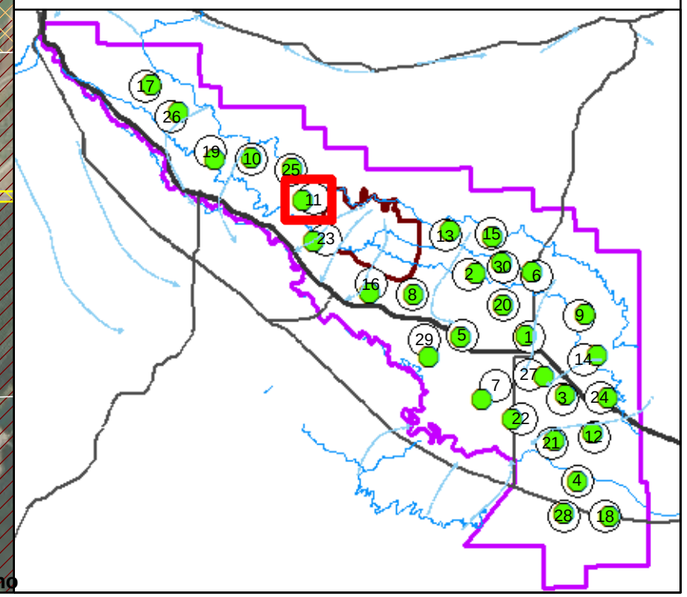


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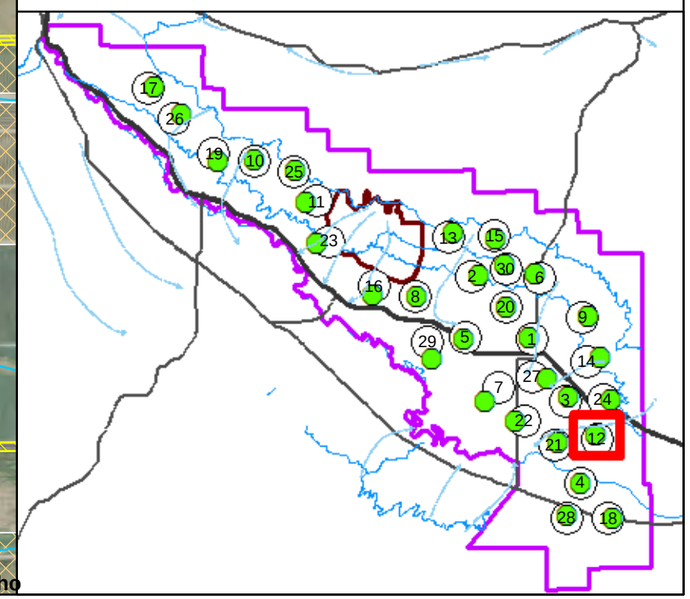
Figure A12
General Well Location and Preliminary Drill Site 12

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name



0 Miles 0.25

0 Feet 1,000

2015 Ortho

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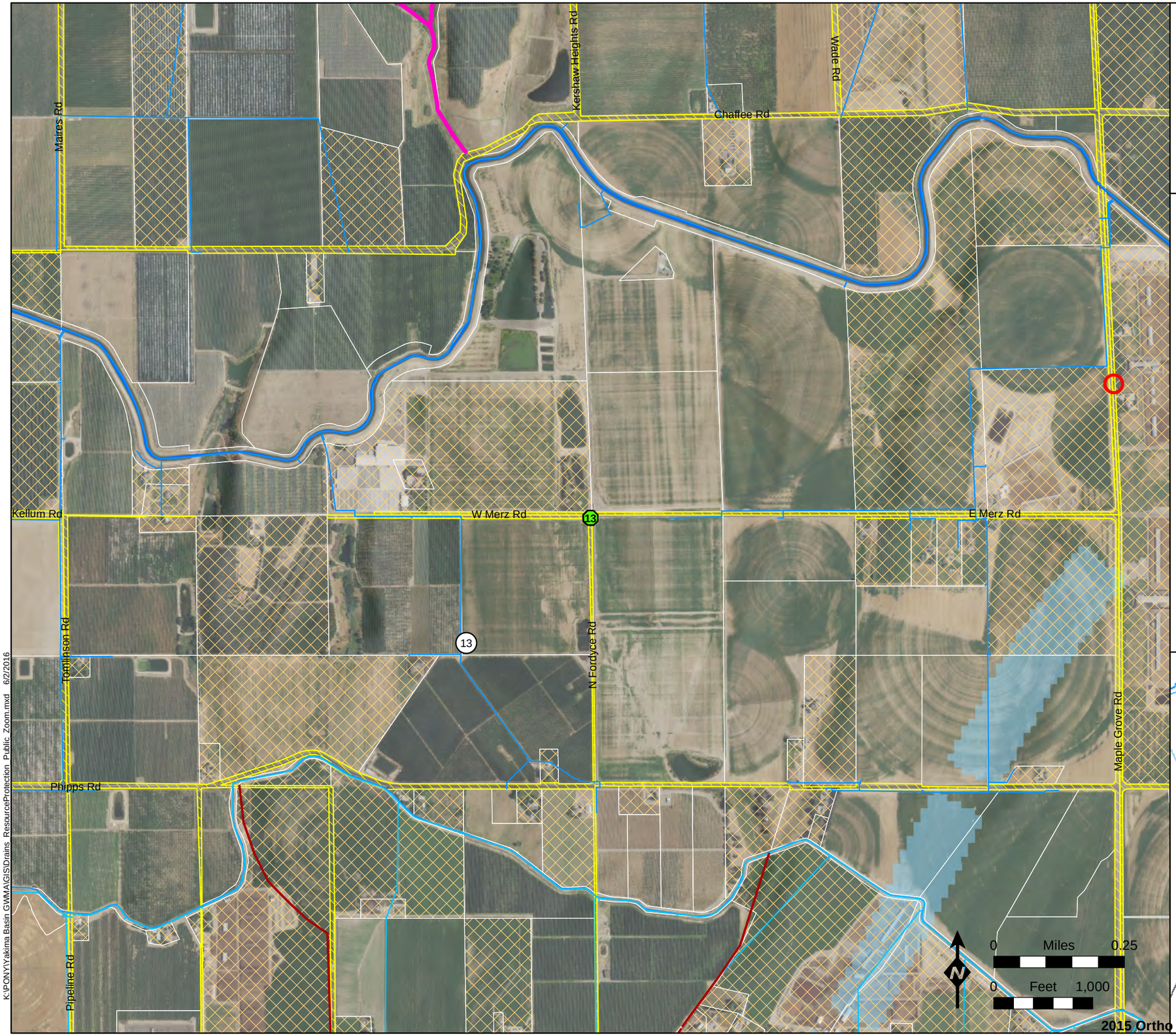
Figure A13
General Well Location and Preliminary Drill Site 13

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Wasteway (Roza Irr. Dist)
- Joint Drains (JD_Lines)
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



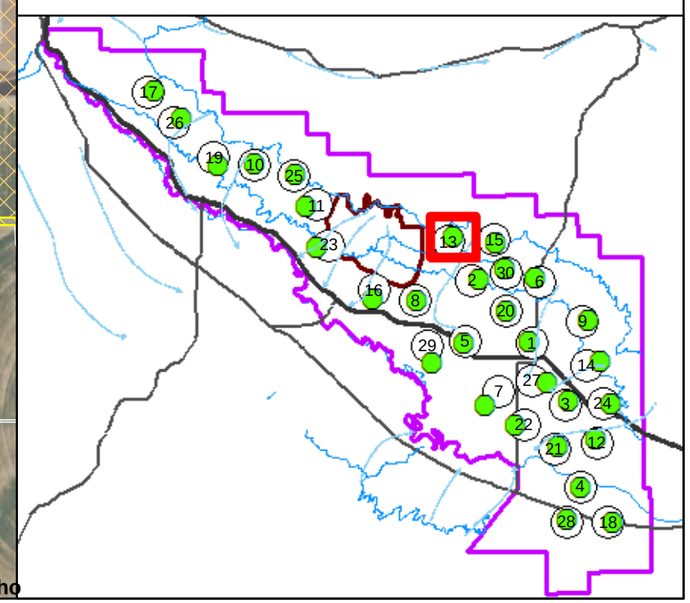


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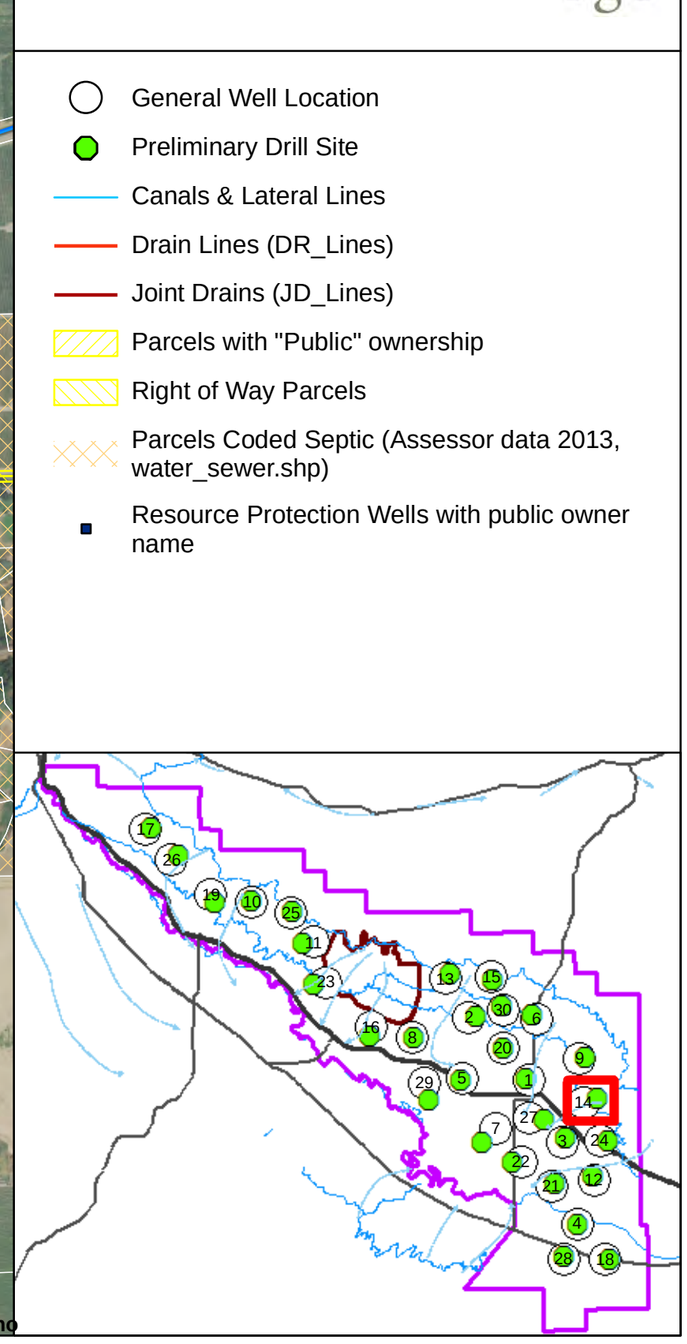
Figure A14
General Well Location and Preliminary Drill Site 14

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name



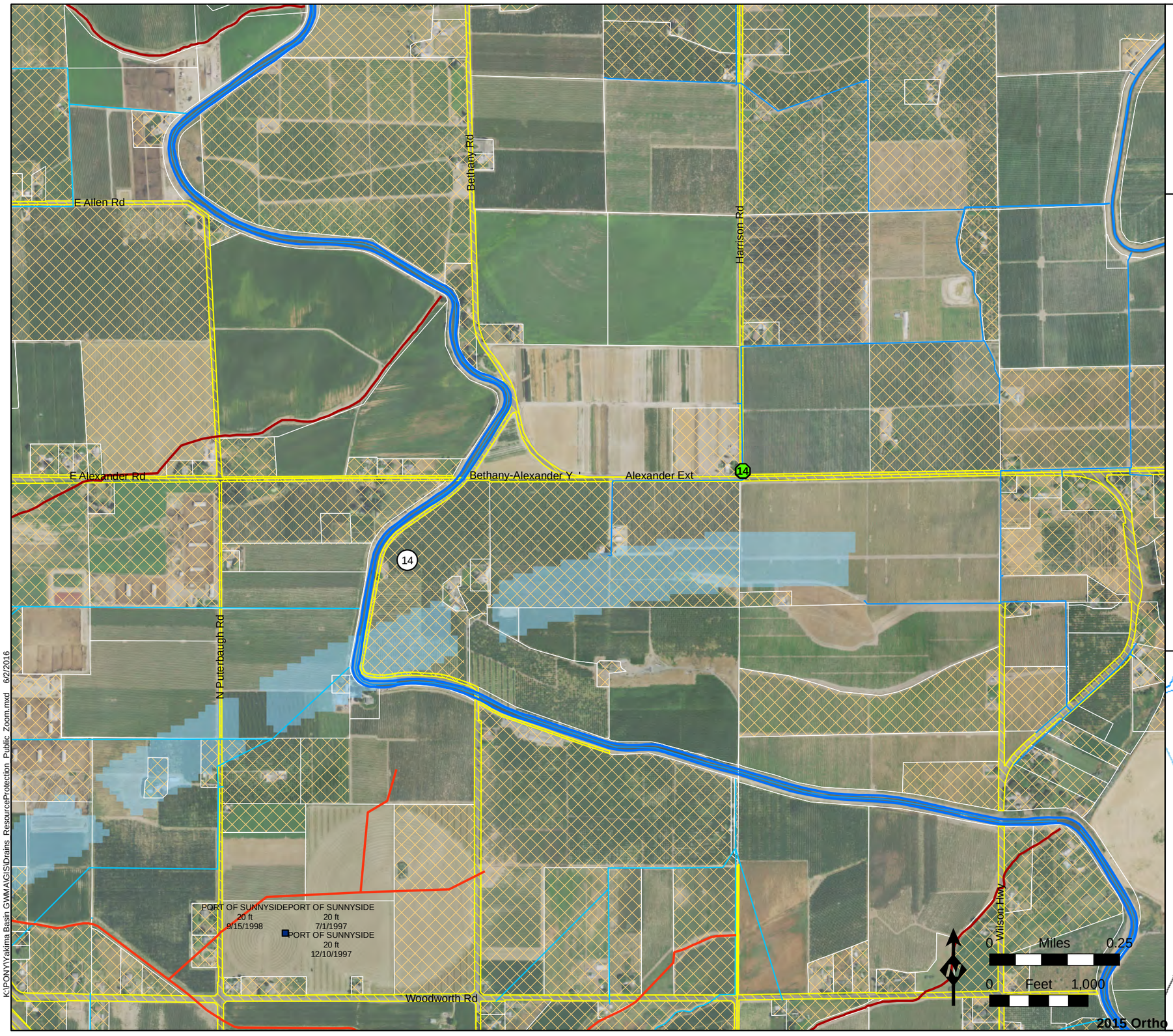


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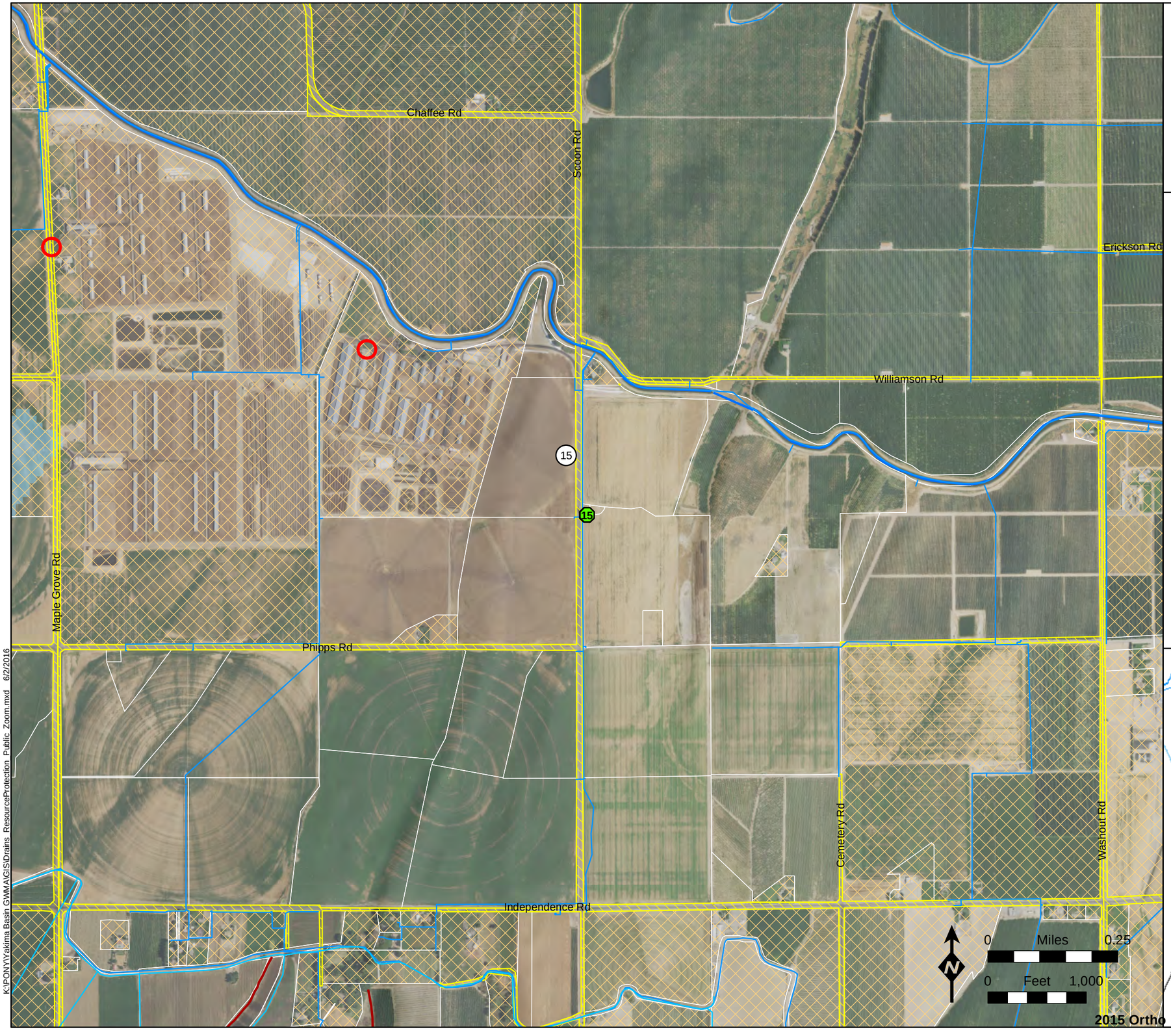
Figure A15
General Well Location and Preliminary Drill Site 15

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Joint Drains (JD_Lines)
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



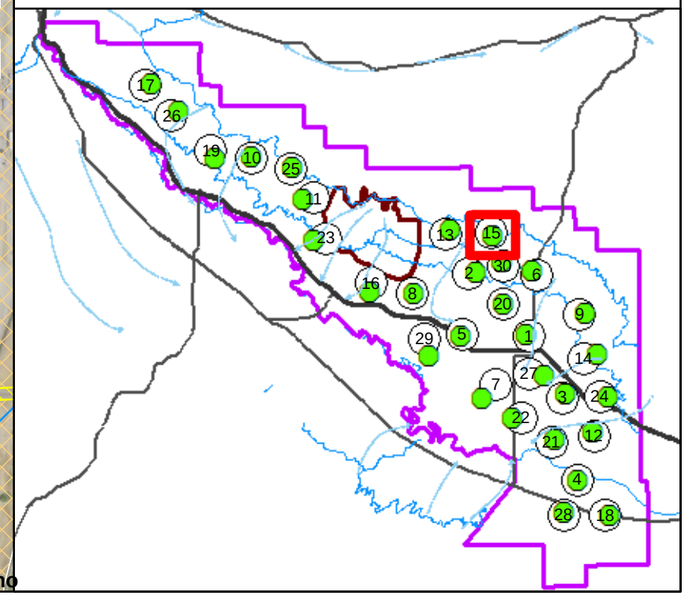


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Figure A16
General Well Location and Preliminary Drill Site 16

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- EPA Dairy Cluster Buffer Boundary
- Drainage Improvement Districts Lines (DID_Lines)
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014

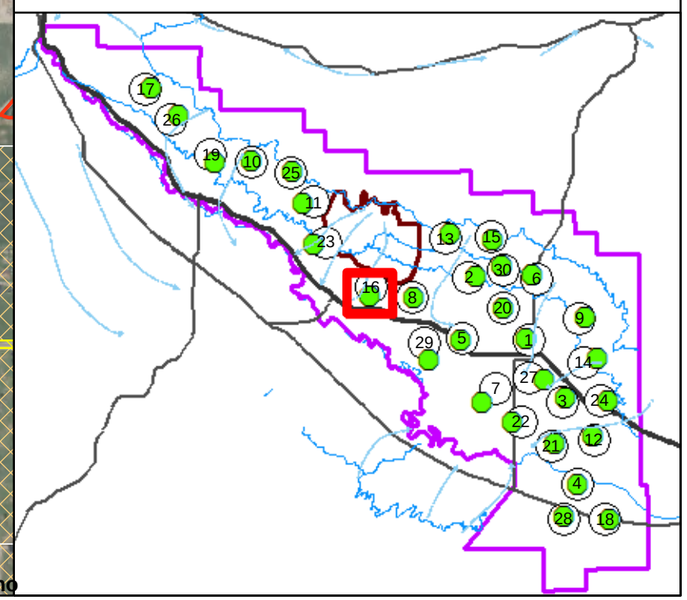

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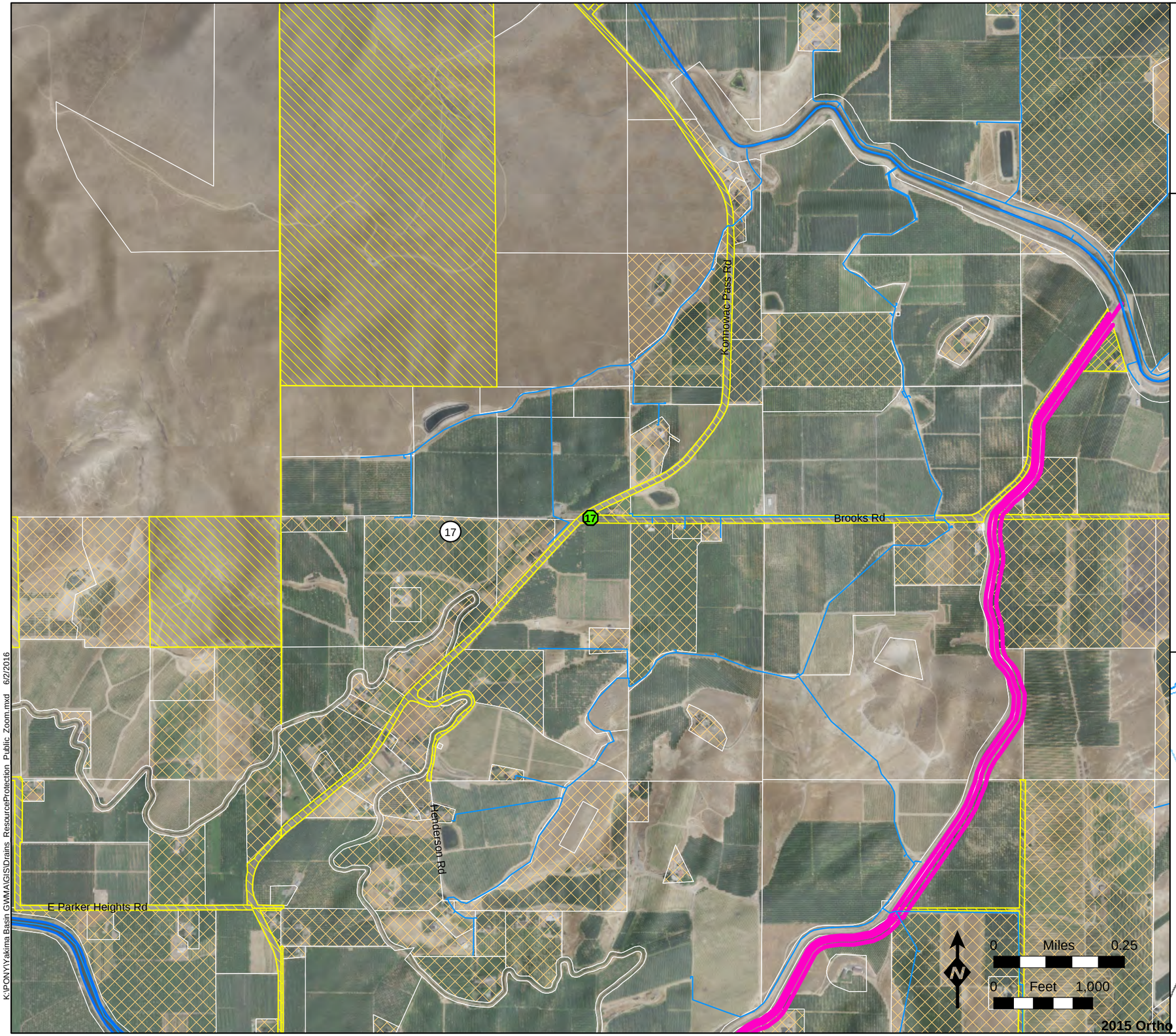
Figure A17
General Well Location and Preliminary Drill Site 17

PgG

- General Well Location
- Preliminary Drill Site
- Wasteway (Roza Irr. Dist)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)



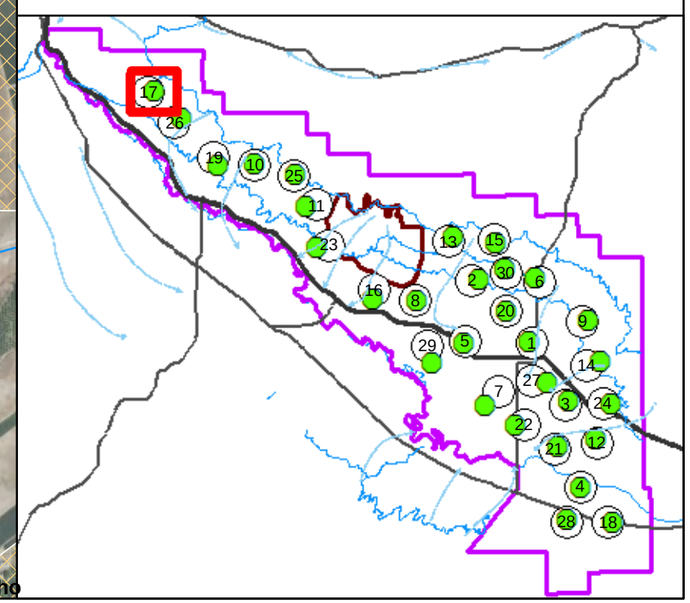


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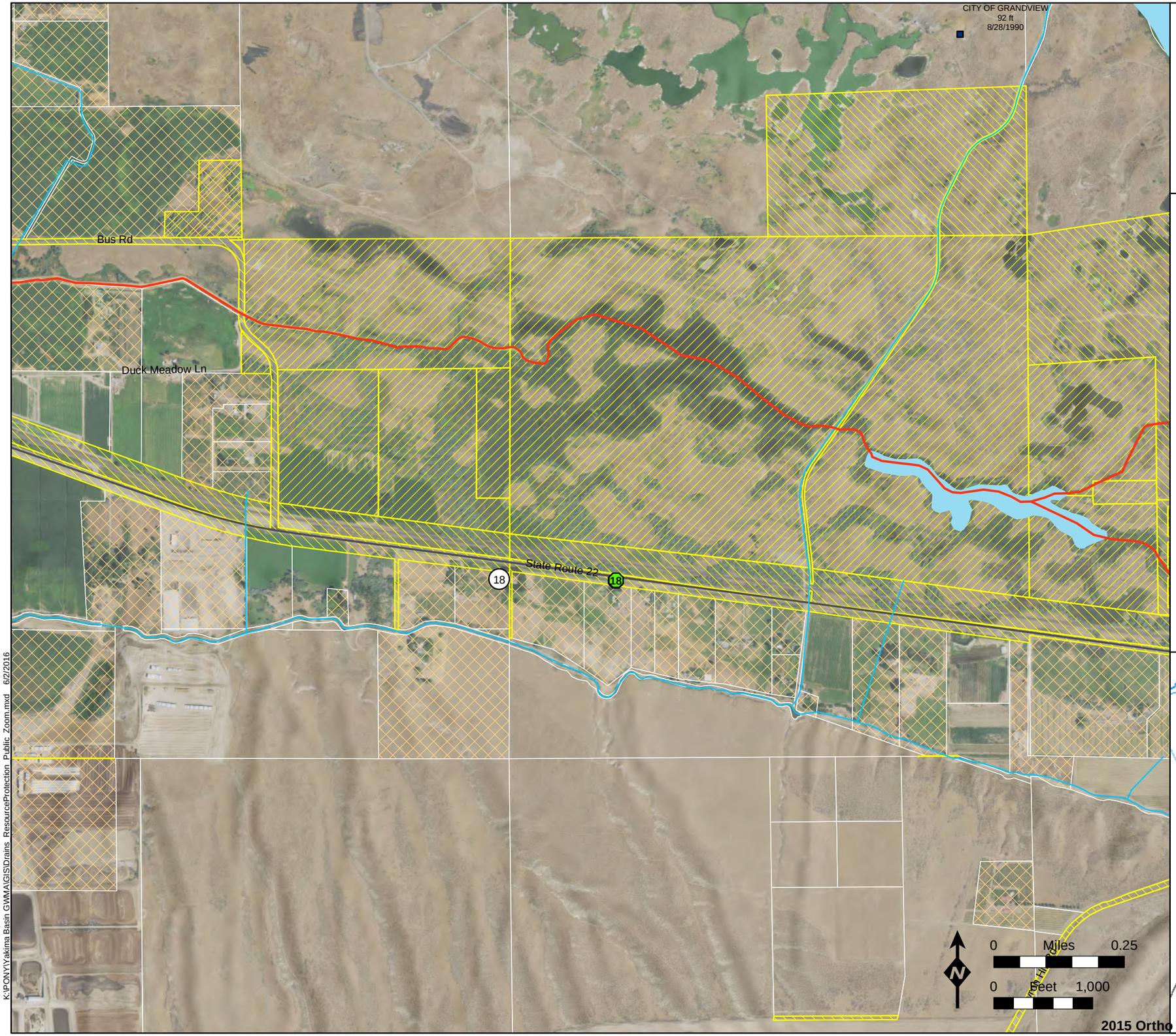
Figure A18
General Well Location and Preliminary Drill Site 18

PgG



- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name

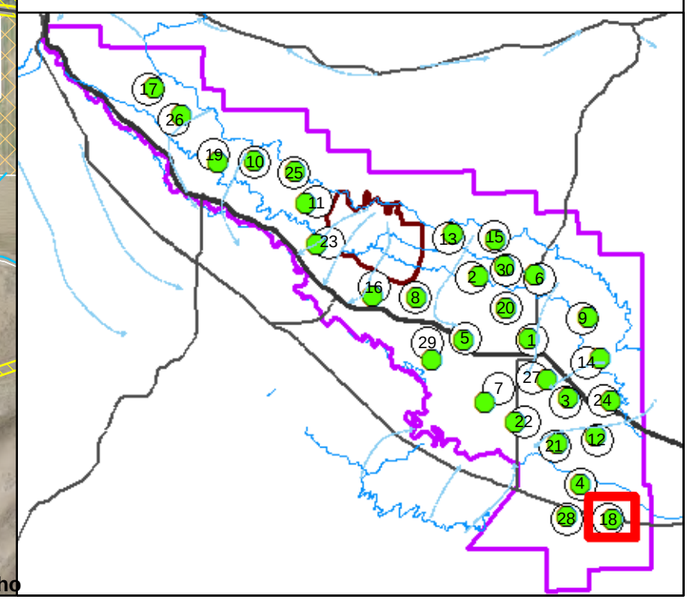


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Figure A19
General Well Location and Preliminary Drill Site 19

PgG

- General Well Location
- Preliminary Drill Site
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

N Zickler Rd
Ballard Rd
Gilbert Rd
19
While Rd
Bliss Rd
Eiler Rd
W Darby Rd
Darby Rd
Blue Goose Rd
N Bonair Rd
N Manuel Ln
YAKIMA COYAKIMA CO
50 ft
6/1/1999
50 ft
6/1/1999
Buena Rd
Highland Dr
City of Buena | Geo Engineers
8 ft
7/20/2010
City of Buena | Geo Engineers
8 ft
7/20/2010
DOE
15 ft
6/11/1997
City of Buena | Geo Engineers
8 ft
7/20/2010
City of Buena | Geo Engineers
8 ft
7/20/2010
DEPT OF ECOLOGY
13 ft
6/13/1997
DEPT OF ECOLOGY
13 ft
6/12/1997
DEPT OF ECOLOGY
15 ft
6/11/1997
DEPT OF ECOLOGY
15 ft
6/12/1997
1st St
Burr St
Bella Jerra Rd
S Bonair Rd
S Manuel Ln
City of Buena | Geo Engineers
14 ft
7/21/2010
DOE
13 ft
6/10/1997
DOE
20 ft
6/11/1997
0 Miles 0.25
0 Feet 1,000
2015 Ortho

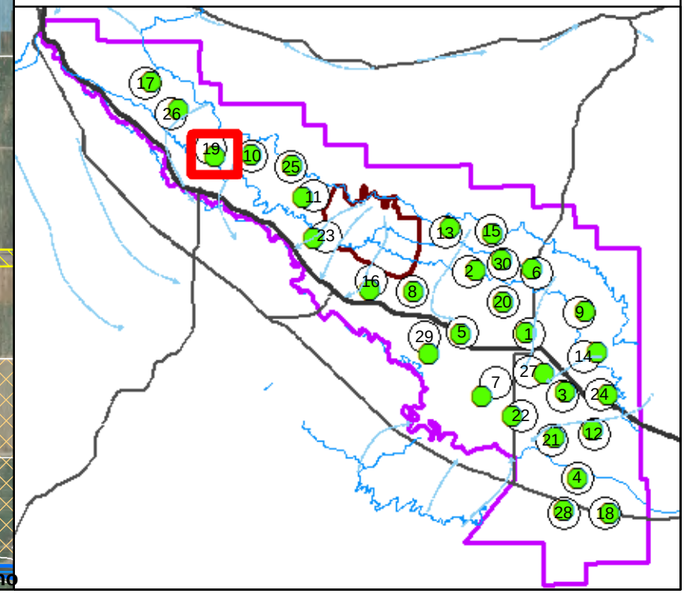

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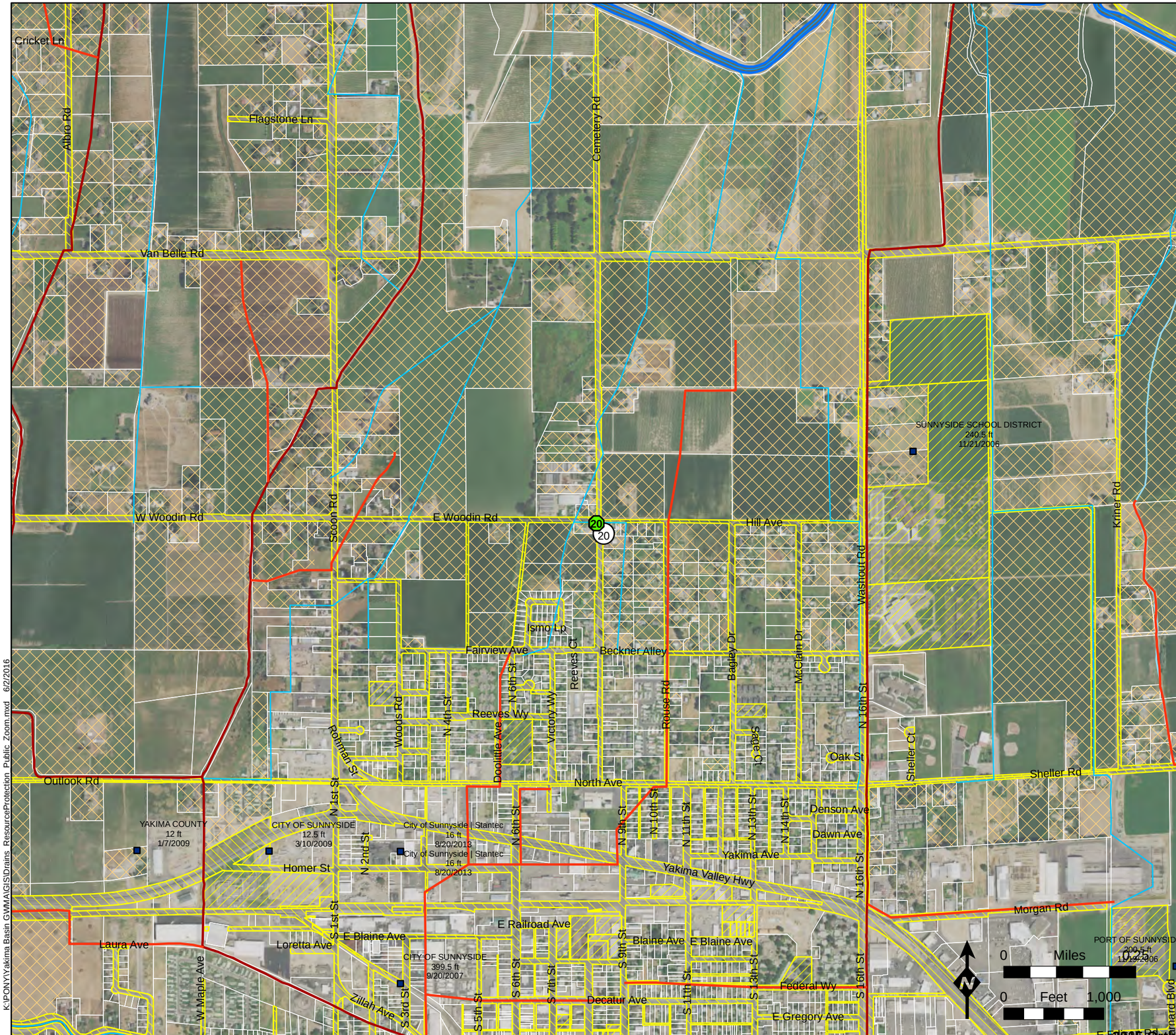
Figure A20
General Well Location and Preliminary Drill Site 20

PgG



- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name

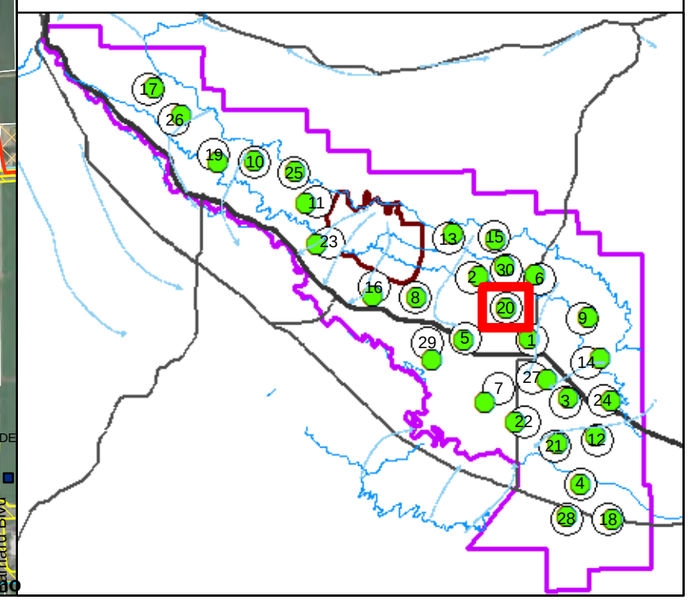


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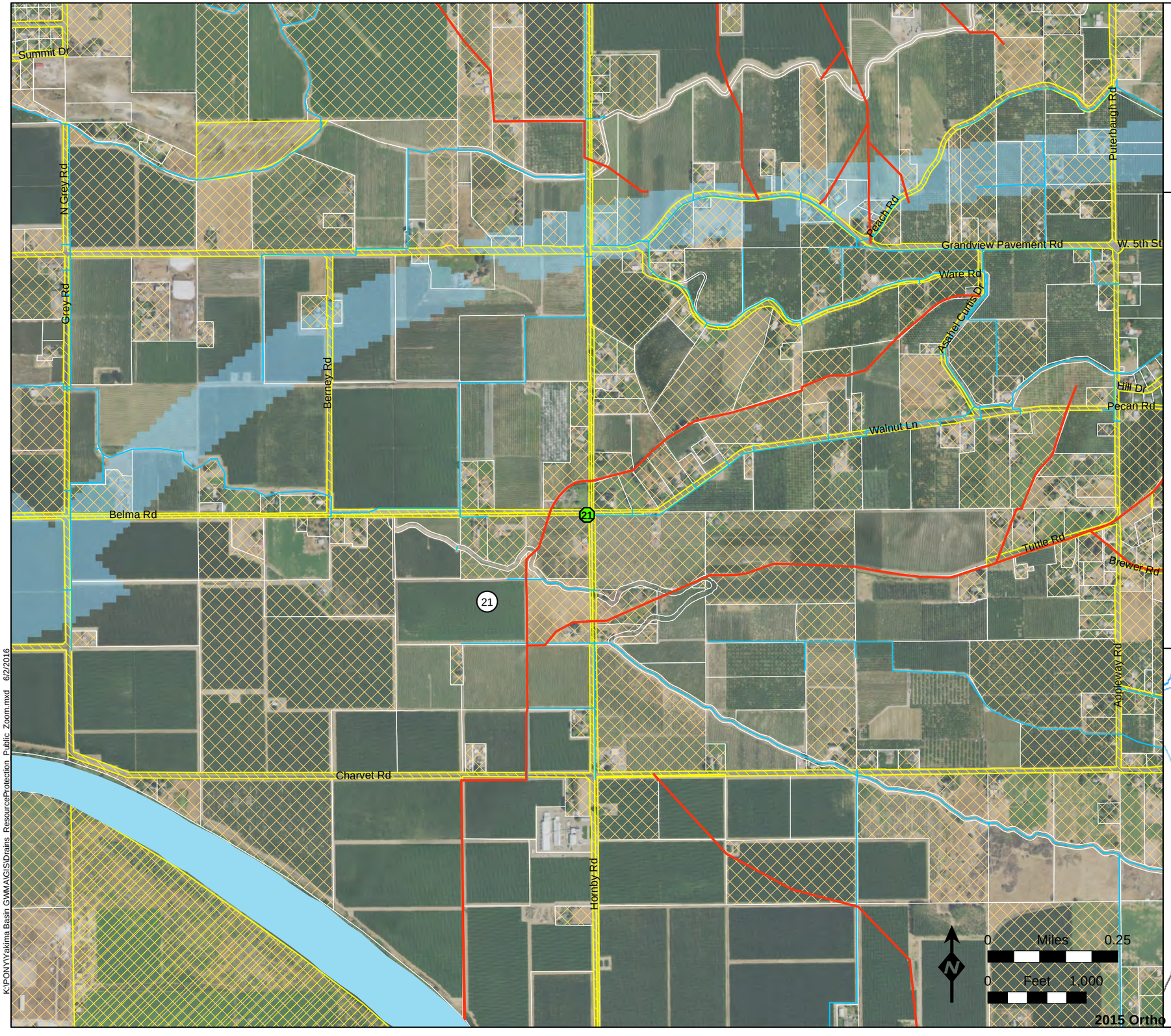
Figure A21
General Well Location and Preliminary Drill Site 21

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)



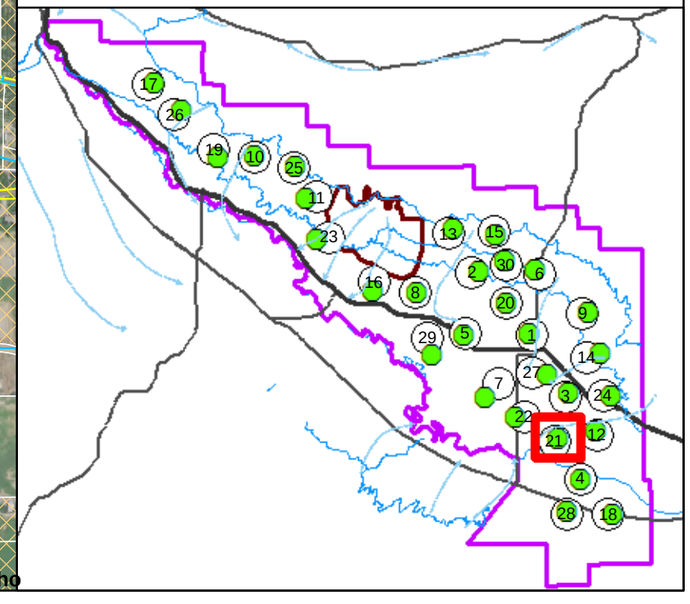


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Figure A22
General Well Location and Preliminary Drill Site 22

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Wasteway (Roza Irr. Dist)
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

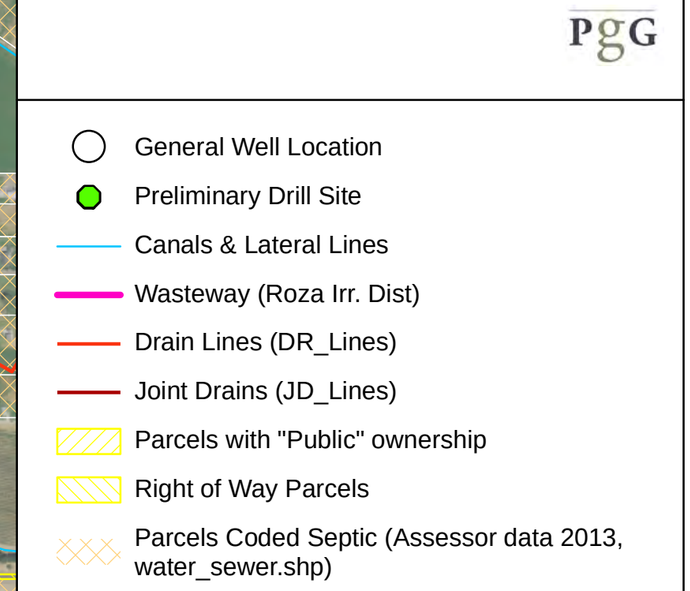

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Figure A23
General Well Location and Preliminary Drill Site 23

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- EPA Dairy Cluster Buffer Boundary
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

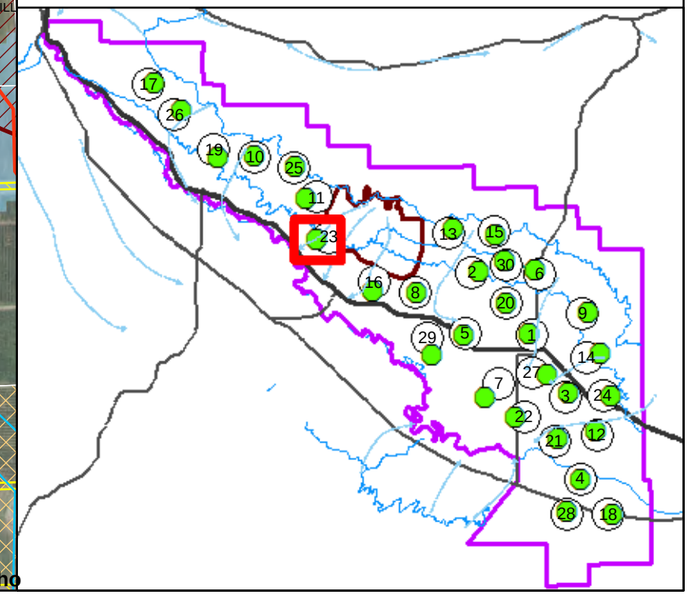

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Figure A24
General Well Location and Preliminary Drill Site 24

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name

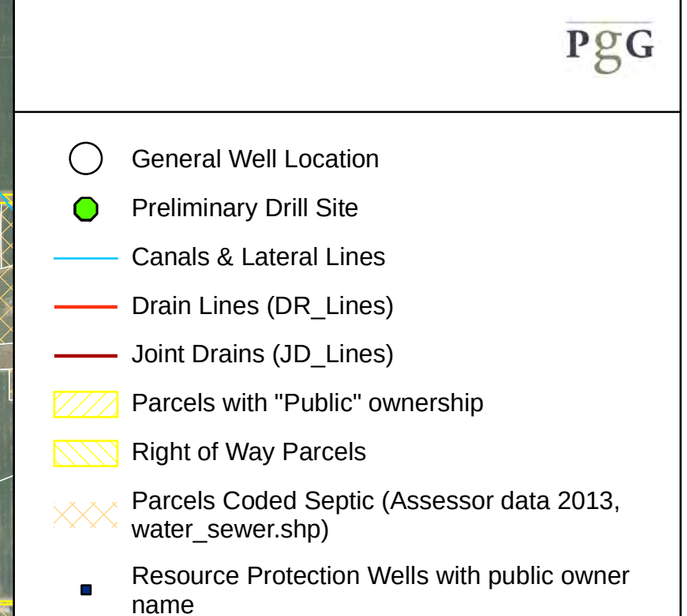
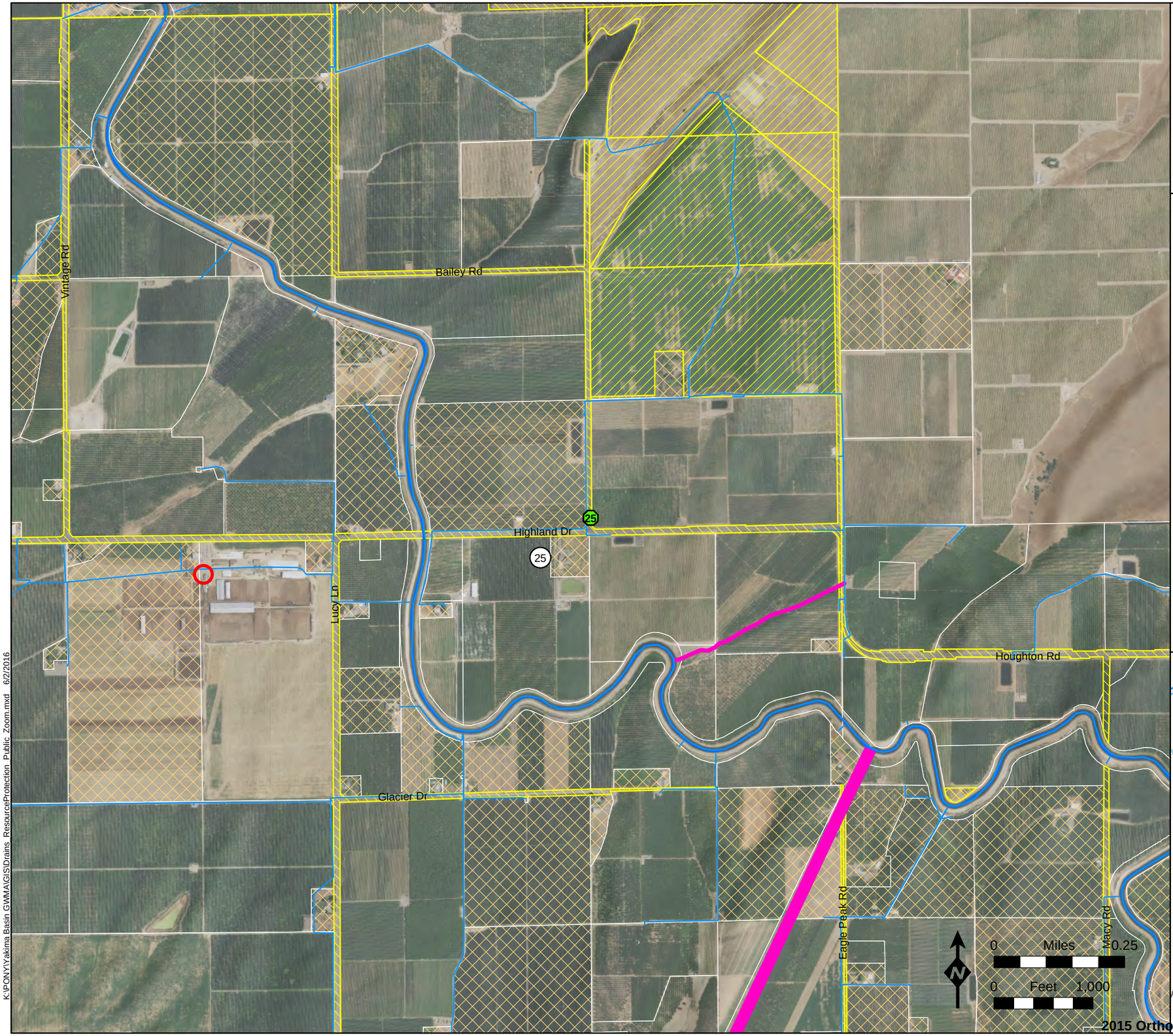


Figure A25
General Well Location and Preliminary Drill Site 25

PgG

- General Well Location
- Preliminary Drill Site
- Wasteway (Roza Irr. Dist)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



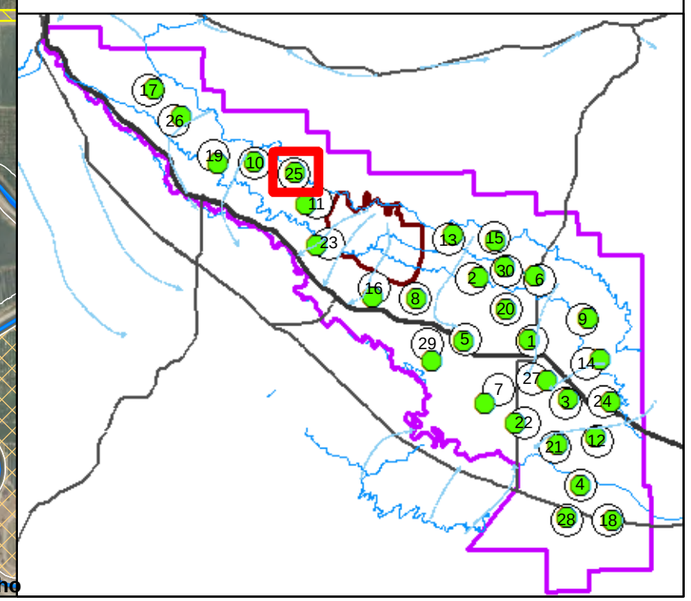


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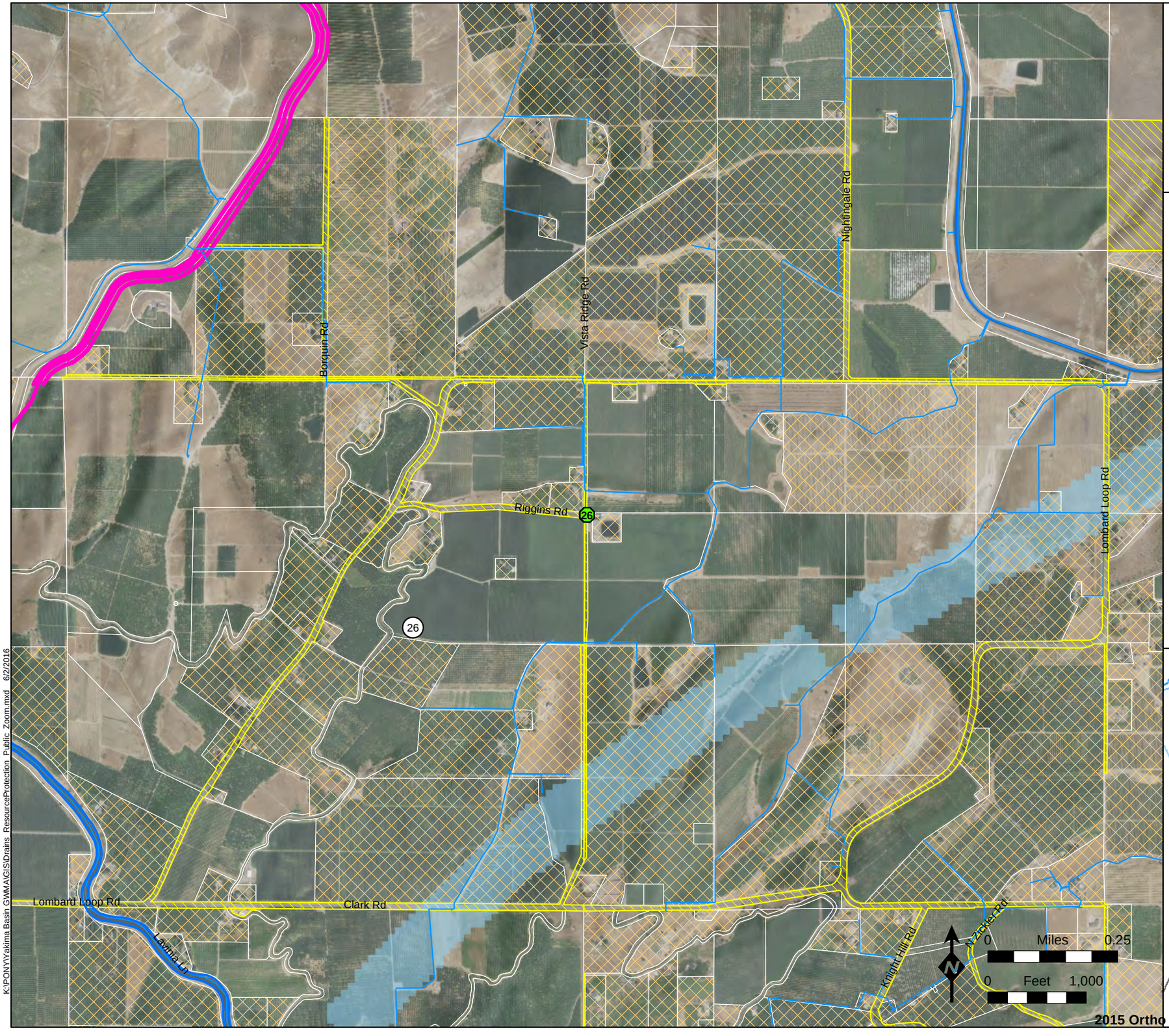
Figure A26
General Well Location and Preliminary Drill Site 26

PgG

- General Well Location
- Preliminary Drill Site
- Wasteway (Roza Irr. Dist)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)



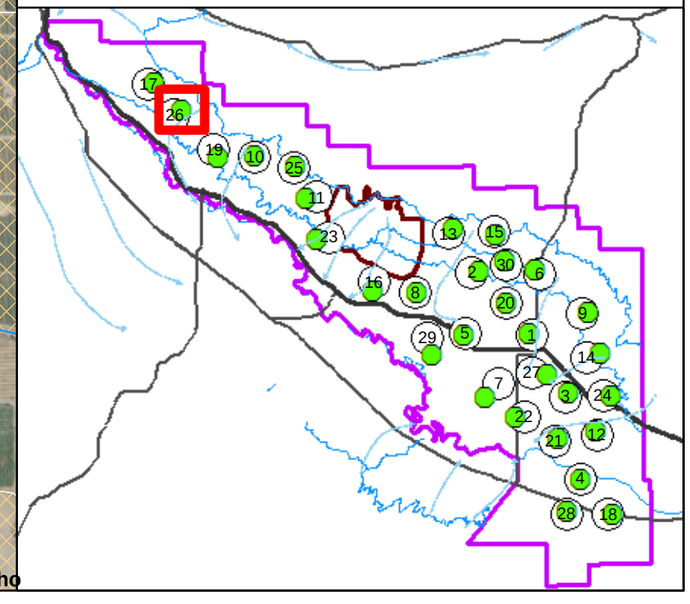


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Figure A27
General Well Location and Preliminary Drill Site 27

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Wasteway (Roza Irr. Dist)
- Drain Lines (DR_Lines)
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name

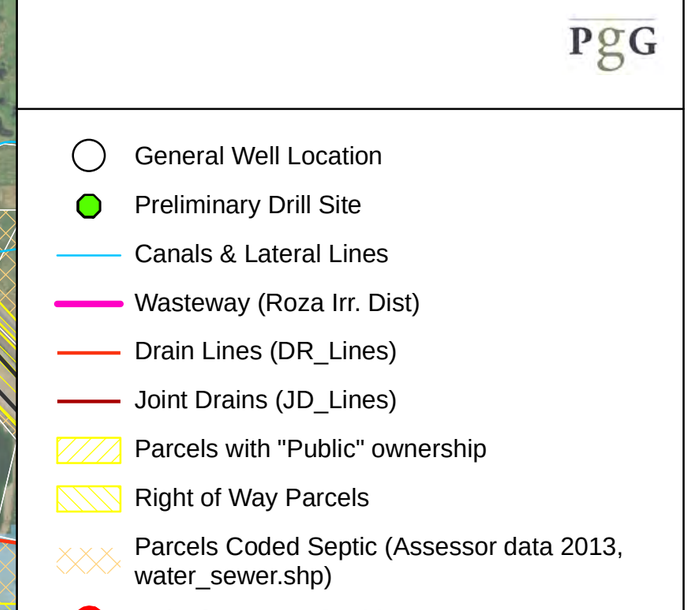

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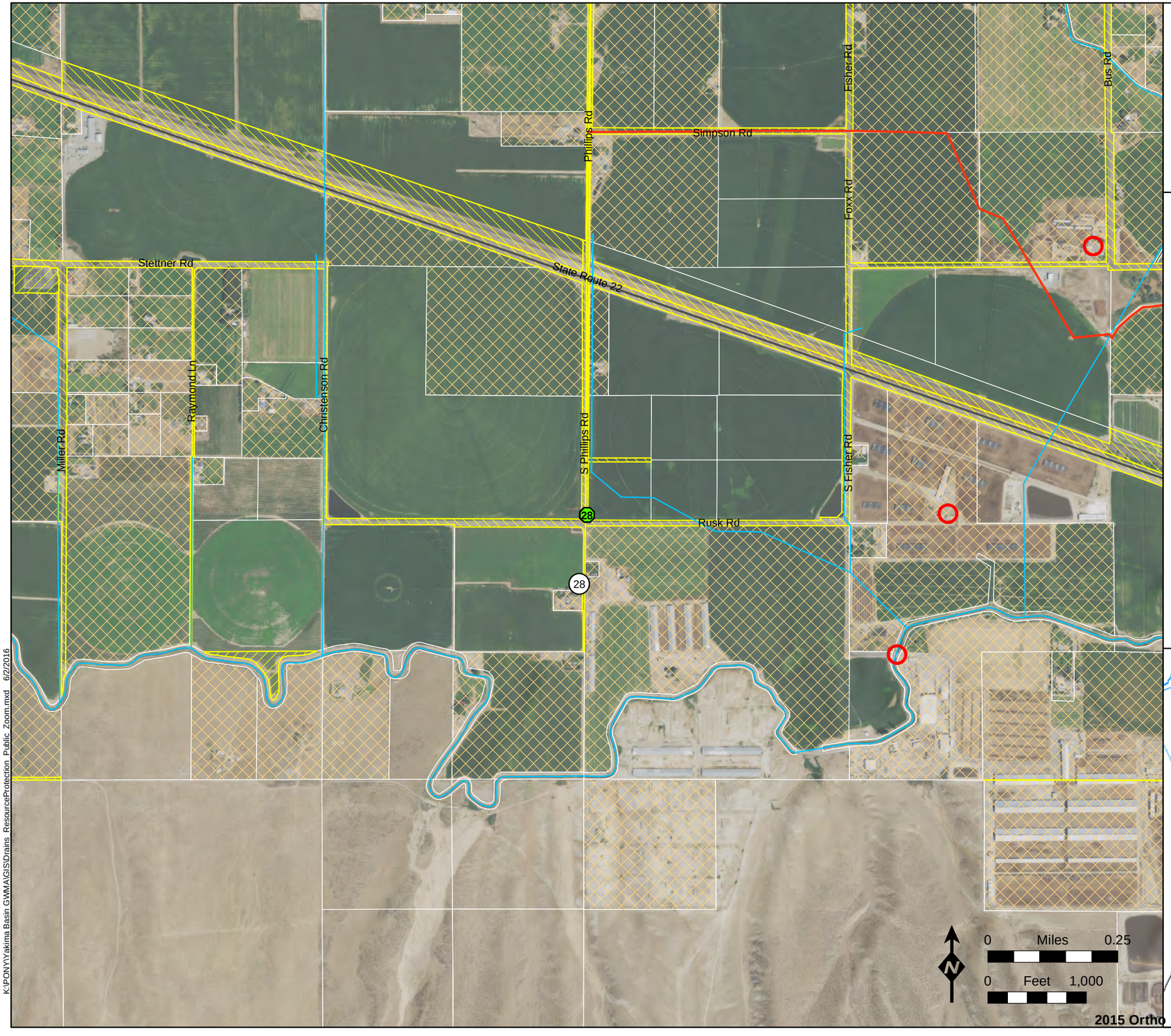
Figure A28
General Well Location and Preliminary Drill Site 28

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drain Lines (DR_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014



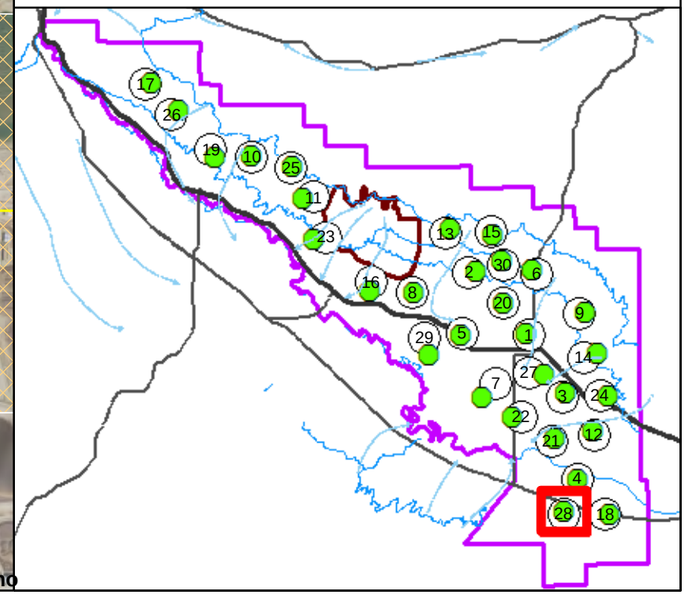


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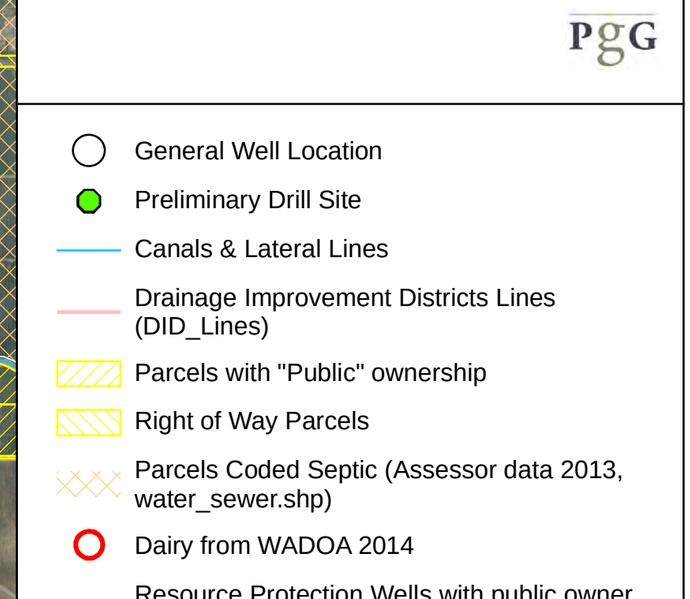
Figure A29
General Well Location and Preliminary Drill Site 29

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Drainage Improvement Districts Lines (DID_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Dairy from WADOA 2014
- Resource Protection Wells with public owner name



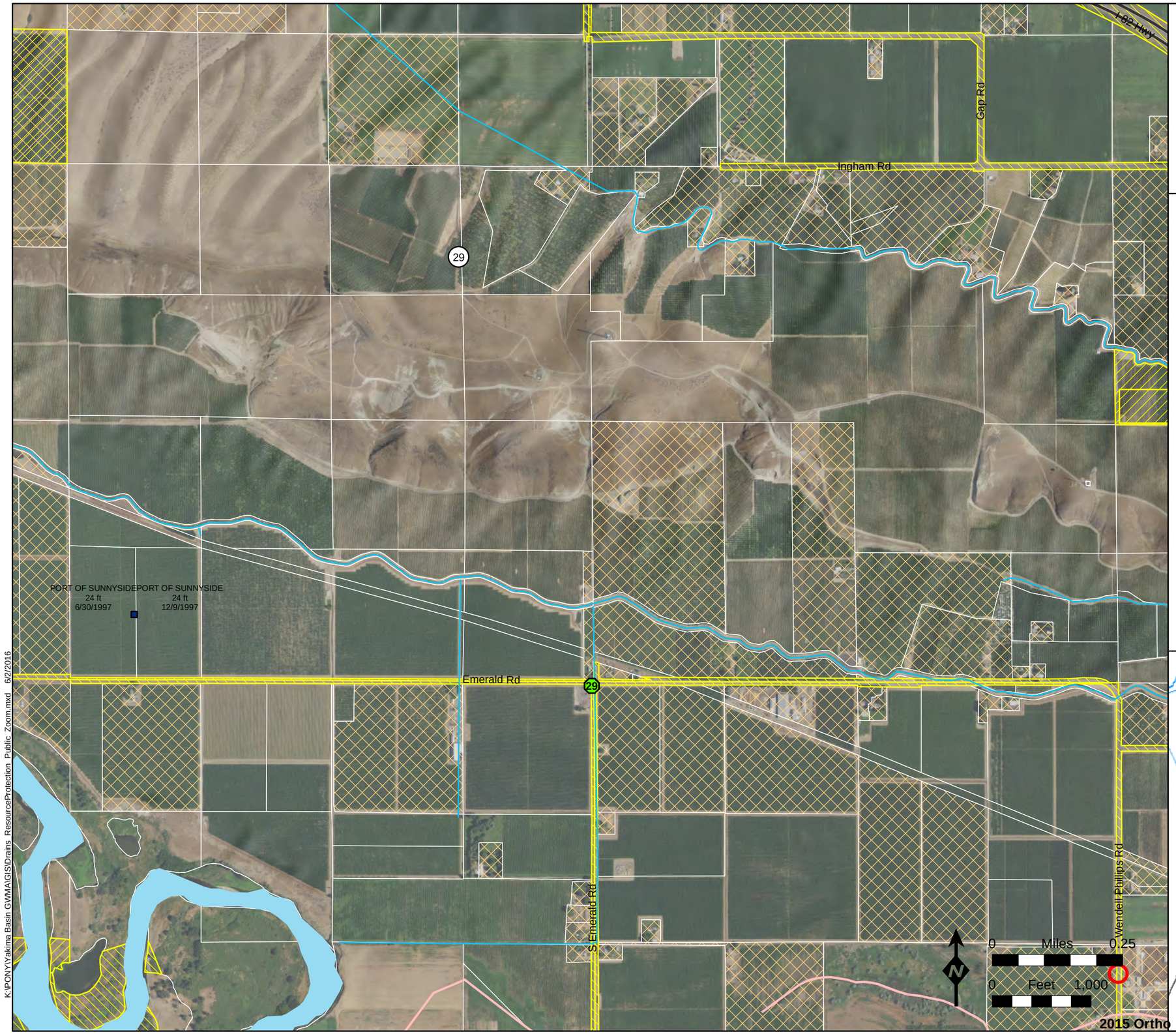


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Figure A30
General Well Location and Preliminary Drill Site 30

PgG

- General Well Location
- Preliminary Drill Site
- Canals & Lateral Lines
- Joint Drains (JD_Lines)
- Parcels with "Public" ownership
- Right of Way Parcels
- Parcels Coded Septic (Assessor data 2013, water_sewer.shp)
- Resource Protection Wells with public owner name

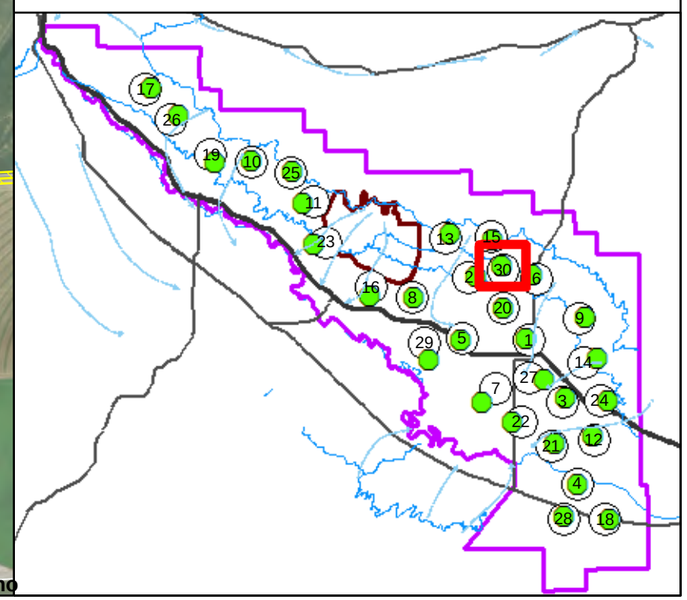
Yakima County Public Services | Ecology & Environment
66 ft
12/18/2012

Yakima County Public Services | Ecology & Environment
76 ft
12/16/2012

Scoon Rd
Cemetery Rd
Independence Rd
Reeves Rd
30
Stout Rd
Arrowsmith Rd
Scoon Rd
Washout Rd
Algio Rd

0 Miles 0.25
0 Feet 1,000

2015 Ortho



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Water Quality Law and Regulation

Phyllis Barney
Assistant Attorney General

1

1972 Clean Water Act (CWA) (33 U.S.C. §1251 et. seq.)



2

Clean Water Act

Makes it unlawful to discharge a pollutant from a point source to surface waters of the United States

UNLESS

You have a permit to do so

3

Clean Water Act

- Allows authority to enforce and manage NPDES program to be delegated to a state
- In WA, Ecology is CWA authority (delegation)
- RCW 90.48.260 authorizes Ecology to establish and administer the NPDES permit program
- CWA also delegates authority for non-point source pollution control to the states

4

RCW 90.48.010
Public policy is to maintain the highest possible standards to insure the purity of all waters

Require[s] the use of all known available and reasonable methods by industry and others to prevent and control the pollution of the waters of the state of Washington.

5

1945 Water Pollution Control Act RCW 90.48

- Grants Ecology broad authority to control and prevent pollution of the waters of the state
- "Waters of the state" has broad meaning, includes all surface waters, underground waters, waters in manmade ditches (including irrigation ditches), wetlands, and isolated bodies of water
- Ecology authorized to administer a state permit program (RCW 90.48.160)

6

Discharges Prohibited RCW 90.48.080

It shall be unlawful for any person to throw, drain, run, or otherwise discharge into any of the waters of this state, or to cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged into such waters any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of the department, as provided for in this chapter.

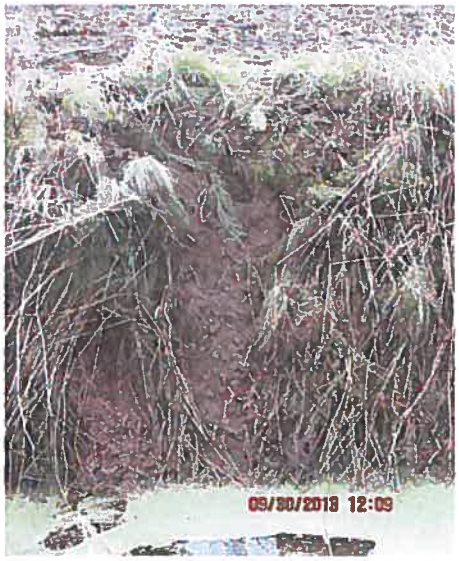
7



8



9



10

RCW 90.48.080

- Not limited to point sources, applies equally to non-point sources
- Applies to all "waters of the state" which includes groundwater

11

CWA NPDES Permits

- National Pollution Discharge Elimination System Permits
- Covers point source pollution discharges to surface waters
- Dischargers can be covered by either a general or an individual permit
- General permits cover a variety of dischargers – including industrial, wastewater treatment, and Concentrated Animal Feeding Operations (CAFOs)

12

EPA CAFO Rule

- First – to be a CAFO you have to be an Animal Feeding Operation (AFO) (40 CFR 122.23)
- To be an AFO:
  - Animals must be confined for 45 days or more, and
  - No crops are grown in the confinement area
- Categorized by size
- Different requirements may apply depending on size and what species of animals are involved

13

EPA CAFO Rule

- Initially rule required virtually all CAFOs apply for NPDES permit coverage
  - Waterkeeper Alliance v. EPA, 399 F.3d 486 (2nd Cir. 2005)
  - National Pork Producers v. EPA, 635 F.3d 738 (5th Cir. 2011)
- NPDES permit required only if CAFO actually discharges to surface water
- Result is fewer facilities under mandatory application requirement

14

Washington Regulatory Scheme

- Ecology is delegated NPDES agency (issues CAFO Permits)
  - Ecology issues a combined state and federal permit (WAC 173-220-170)
- WSDA is regulatory agency for dairies
- Ecology is regulatory agency for all other point and non-point source water quality matters

15

RCW 90.64 Dairy Nutrient Management Act

- Establishes an inspection and technical assistance program for dairies (RCW 90.64.005)
- Requires dairies to have a nutrient management plan (RCW 90.64.026)
- Makes discharge of pollutants into the waters of the state a violation, with exceptions for
  - Chronic or catastrophic events
  - Upset
  - Bypass

(RCW 90.64.010(17))

16

RCW 90.64 Dairy Nutrient Management Act

Role of WSDA

- Conducts inspection program for dairy farms
  - Survey for evidence of violations
  - Identify corrective actions
  - Monitor development of nutrient management plans
  - Identify candidates for technical assistance programs
- Investigate complaints
- Issue enforcement orders and penalties for violations of RCW 90.64 or RCW 90.48
- Operates under an MOA with Ecology

17

RCW 90.64 Dairy Nutrient Management Act

Role of Ecology

- If dairy discharges and/or are found to be significant contributors of pollution to surface or ground waters, designates dairy as a CAFO, issues permit
- Issues and regulates NPDES and/or state waste discharge permits to CAFOs
- Operates under an MOA with WSDA

18

RCW 90.64 Dairy Nutrient Management Act

Role of Washington State Conservation Commission and Conservation Districts

- WSCC
  - Develop elements for dairy nutrient management plans that, when implemented, will not violate water quality standards
  - Assist and provide coordination for conservation districts
- Conservation Districts
  - Apply dairy nutrient management plan technologies and methods appropriate to specific operations
  - Approve dairy nutrient management plans, certify their implementation
  - Provide technical assistance

19

Antidegradation Policy

- RCW 90.54.020(3)(b)
  - All wastes shall be provided with all known available and reasonable methods of treatment (AKART) prior to entry of waste materials into state waters
  - Wastes and other materials shall not be allowed to enter such waters which will reduce the existing quality of the waters

20

Antidegradation Policy

- Applies to surface waters (WAC 173-201A-260 through 410)
  - Purpose is to restore and maintain highest possible quality of surface waters
  - Ensure all human activities likely to lower water quality apply all known, available, and reasonable methods of prevention, control and treatment

21

Antidegradation Policy

- Applies to groundwater (WAC 173-200-030)
  - Goal is to ensure the purity of the state's groundwaters and to protect the natural environment
  - Existing and future beneficial uses maintained and protected, and degradation of groundwater quality that would interfere with or become injurious to beneficial uses shall not be allowed

22

Technical Assistance Programs RCW 43.05

- Applies to WSDA, Ecology, DOH, DNR, F&W
- Authorizes agencies to develop and provide technical assistance programs
  - Info on laws, rules, compliance methods, technologies
  - Info on methods for compliance
- Authorizes agencies to issue a Notice of Correction for violations, and, under specific conditions, a penalty

23

Water Quality Standards

- For surface waters, the standards are found in WAC 173-201A

  Standard for nitrogen is the standard for total ammonia
- For groundwater, the standards are found in WAC 173-200

  Nitrate standard is 10 ml/L (same as drinking water)
- Both list limits for a variety of other pollutants

24

Violation of WAC 173-201A Surface Water Quality Standards

- Means a discharge where specific water quality criteria are exceeded
- When applicable BMPs are not being implemented the department may conclude individual activities are causing pollution in violation of 90.48.080
- If BMPs are being applied and violation occurs, discharger must modify BMPs or apply further control measures, selected or approved by the department to achieve compliance (WAC 173-201A-510(3))

25



26

Violations WAC 173-200 Groundwater Quality Standards

- Applies where nutrients have been applied above agronomic rates (WAC 173-200-010(3)(a))
- If a potential to pollute exists, agency can request a plan for groundwater quality evaluation (WAC 173-200-080(2) see also RCW 90.48.120)
- Enforcement: agency may issue a order, then may follow the order with a penalty (WAC 173-200-100)

27



28



29

Land Applications

- Was there a discharge or substantial potential to discharge to surface or ground waters?
- Discharge as a result of rainfall or over application?
- Was the land under the control of the CAFO or, for dairies, at a location away from where the nutrients were produced?
- Was the land application at agronomic rate and in compliance with an NMP?

30

Land Applications

- Were site specific practices to reduce runoff utilized?
- Was manure transferred to 3rd party or applied by the facility?

Definition of Transfer: (from CAFO permit)

The transfer of manure, litter or process waste water to other persons when the receiving facility is in direct control of:

a) The application acreage; and
b) The application rate; and
c) The application times; and
d) The transfer rate and time

31

Notice of Violation RCW 90.48.120

RCW 90.48.120(1)

Whenever, in the opinion of the department, any person shall violate or creates a substantial potential to violate the provisions of RCW 90.48, or fails to control polluting content of waste discharged:

- Ecology shall notify such person
- In 30 days person must file a report stating what steps are taken to control or comply
- Ecology may then issue "such order or directive as it deems appropriate under the circumstances"

32

Actions to Correct WQ Problem

- Non-dairy point source or non-point source
  - If immediate action required to correct a WQ problem – Ecology may issue an Administrative Order
  - Significant contributor of pollution – may be required to obtain a permit

RCW 90.48.120(2)

- Dairy
  - If immediate action required to correct a WQ problem – WSDA to notify producer and refer to conservation district
  - Significant contributor of pollution – subject to enforcement provisions of RCW 90.48 and 43.05, including requirement for permit and penalties

RCW 90.64.030(7)&(6)

33

Civil Penalties RCW 90.48.144, 90.64.030(6)

Penalties may be issued for:

- Violations of the terms of a permit
- Discharging without a permit
- Violation of any part of 90.48, including 90.48.080
- Violation of rules promulgated under 90.48 (the WACs – including the standards)
- Violation of an administrative order

34

Groundwater Management Areas



35

GWMA Regulations WAC 173-100

- Establishes a process for identification and designation of Ground Water Management Area (GWMA) and development of groundwater management programs (GWMP)
- Provides for an advisory committee to oversee program development
- Provides for a public hearing on the program once developed
- Provides that implementation is through state regulation and local ordinance

36

Groundwater Management Areas and Programs WAC 173-100

- Lead Agency
  - WAC 173-100-080
  - Coordinates and undertakes activities (data collection, analysis, presenting draft materials for review, etc.)
  - Prepares work plan, contracts, schedule and budget
  - Coordinates SEPA review
- Groundwater Advisory Committee
  - WAC 173-100-090
  - Represents a broad spectrum of the public
  - Provides oversight advisory role

37

Groundwater Management Program

- LYV GWMA long-term goal:
  To reduce concentrations of nitrate in groundwater to below Washington State drinking water standards
- Is tailored to the specific conditions and reasons the GWMA was proposed (WAC 173-100-100)
- Is implemented through the actions of agency and local government regulations and ordinances
- Will have a public hearing
- Will undergo Ecology review and certification as consistent with intent of WAC 173-100
- Is appealable to the PCHB

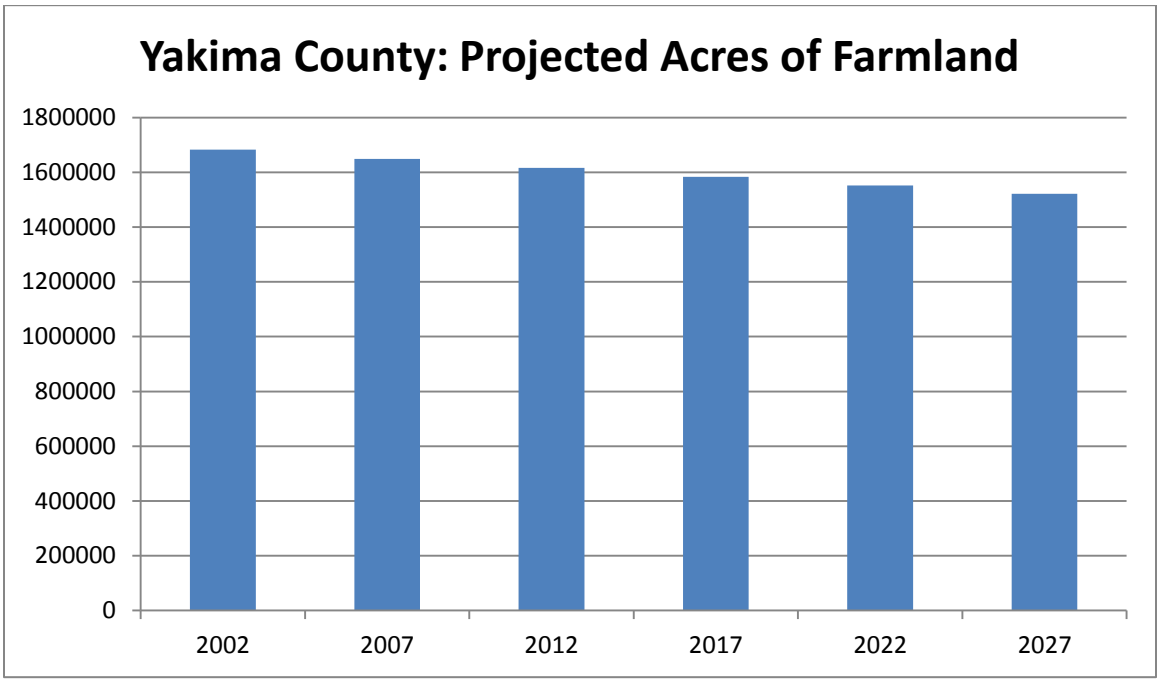
38

What will happen to the groundwater in the Lower Yakima Valley if we do nothing?

Acreage

- "Between the 1960's and the early 2000's the land in farms was relatively steady at about 1,750,000 acres." (Agricultural History of Yakima County, SYCD)
- "The area of cropland harvested has consistently remained between 200,000 and 250,000." (Agricultural History of Yakima County, SYCD)
- The number of acres in farm use (1,649,281acres), which are not necessarily zoned AG, dropped 2% between 2002 and 2007 (Office of Farmland Preservation, Yakima County)

Graph 1. Hypothetical decrease in Yakima County acreage for farming at a rate of 2% decline every five years

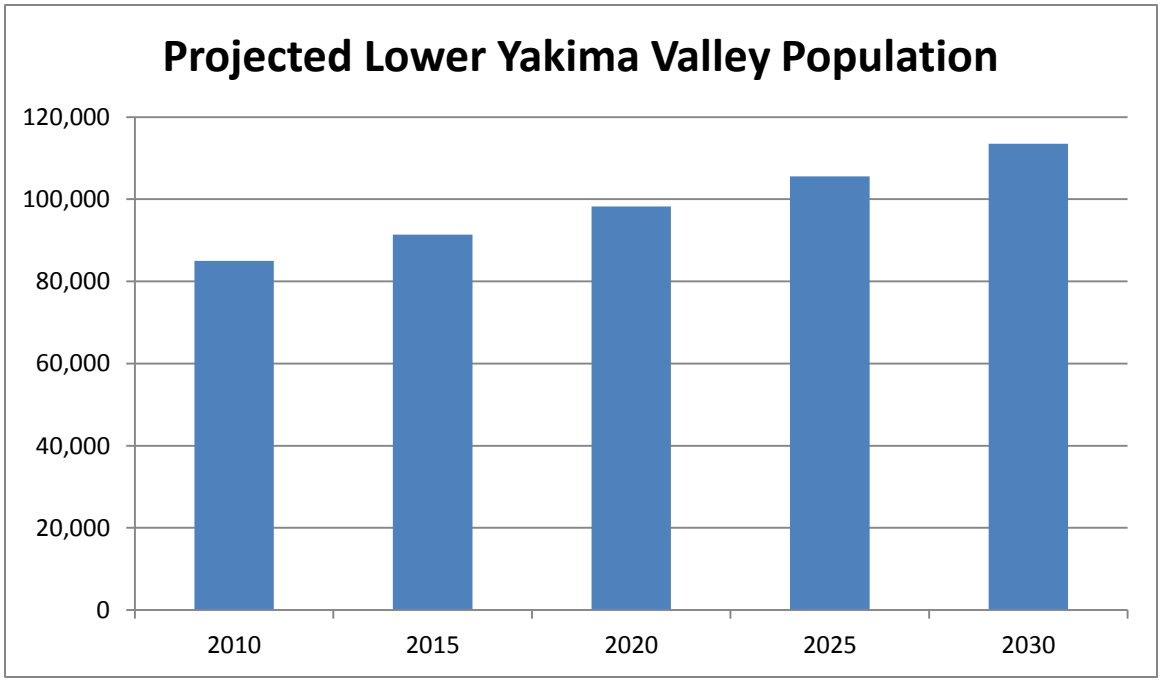


Population

- Population in 2000 – 222,581 (U.S. Census, 2000)
- Population in 2010 – 243,231 (U.S. Census, 2010)
- Change – 20,650 or 2,065 per year or approximately an increase of 0.8% per year
- By 2020 there will be about 263,881 people

- There will be an unknown increase in urban sprawl by 2020
- Yakima County grew at .93% per year
- The City of Yakima grew at 2.68% per year
- Selah grew at 1.33% per year
- Union Gap grew at .76% per year
- Toppenish did not grow
- Sunnyside grew at 1.4% per year
- Grandview grew at 2.97 % per year
- The Lower Valley grew at about 1.5% per year Source: U.S. Census 2000 & 2010

Graph 2. Lower Yakima Valley Population based on a rate of increase at 1.5% per year



Crops

- Land in orchards and vineyards has stayed between 95,000 and 110,000 or almost 40% of cropland since 1997 (Agricultural History of Yakima County, SYCD)
- Between 25,000 and 40,000 acres has been planted in alfalfa between 1980 and the present. This is about 15% of cropland (Agricultural History of Yakima County, SYCD)

- Between 1988 and 2007 the land in corn increased from about 14,000 acres to about 42,000 acres. Corn is now planted on about 16.5% of cropland (Agricultural History of Yakima County, SYCD)
- Land in wheat has decreased from 73,000 acres in the 1970's to about 20,000 acres at present. This is a change from about 30% to about 8% of the cropland (Agricultural History of Yakima County, SYCD)
- Hops have been grown on 5% - 10% of the cropland or 16,000 to 27,000 acres since 1970 (Agricultural History of Yakima County, SYCD)
- Mint has been grown on 4% - 10% of cropland or 10,000 to 20,000 acres since 1980 (Agricultural History of Yakima County, SYCD)
- Land planted in vegetables has decreased from about 20,000 acres in 1980 to about 10,000 acres at present or a decrease of about 10% to about 5% (Agricultural History of Yakima County, SYCD)
- Most recent cropping patterns for the Lower Yakima Valley, according to WSDA, are: corn - 16%, CRP Conservation – 12%, Apples – 11%, Pasture – 9%, Wheat 9%, Hops – 7%, Alfalfa Hay – 6%, Juice Grapes – 5%, Fallow – 3%, Mint – 3%, Cherries – 3%, Fallow Wheat – 2%, Wine Grapes – 2% and Pears – 2%.

Current Irrigation Practices

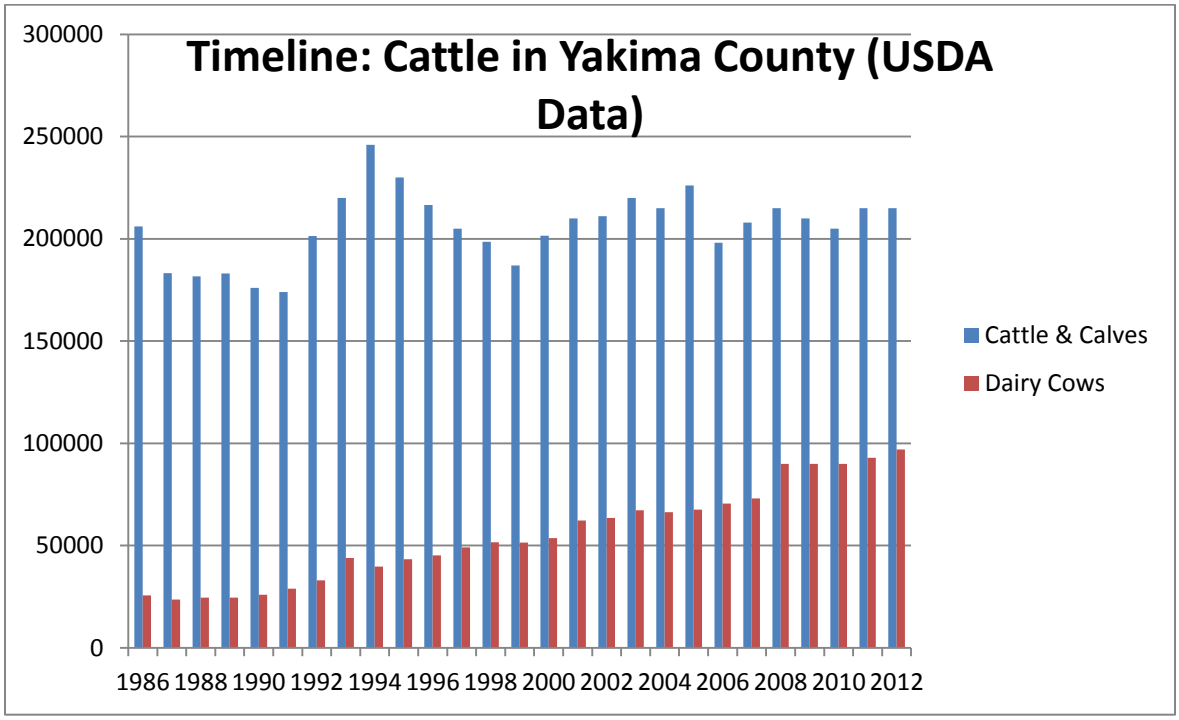
- Roza Irrigation District – 90 percent of total acreage in sprinkler or drip systems.
- Sunnyside Valley Irrigation District – 68 percent sprinkler or drip irrigated.
- Yakima-Tieton Irrigation District – More than 90 percent sprinkler irrigated
- Wapato Irrigation Project (WIP) – An estimated 55 percent sprinkler or drip irrigated.

Source: U.S. Bureau of Reclamation - Tables 6 and 7 of the Volume 2 Technical Memorandum, Water Needs for Out-of-Stream Uses.

All Cattle in Yakima County

- The number of cows increased from about 150,000 in 1980 to about 213,000 in 2007 at a rate of about 2,300 per year (Agricultural History of Yakima County, SYCD)
- The number of dairy cows increased from about 18,000 in 1980 to about 90,000 in 2007 at a rate of about 2,700 per year (Agricultural History of Yakima County, SYCD)

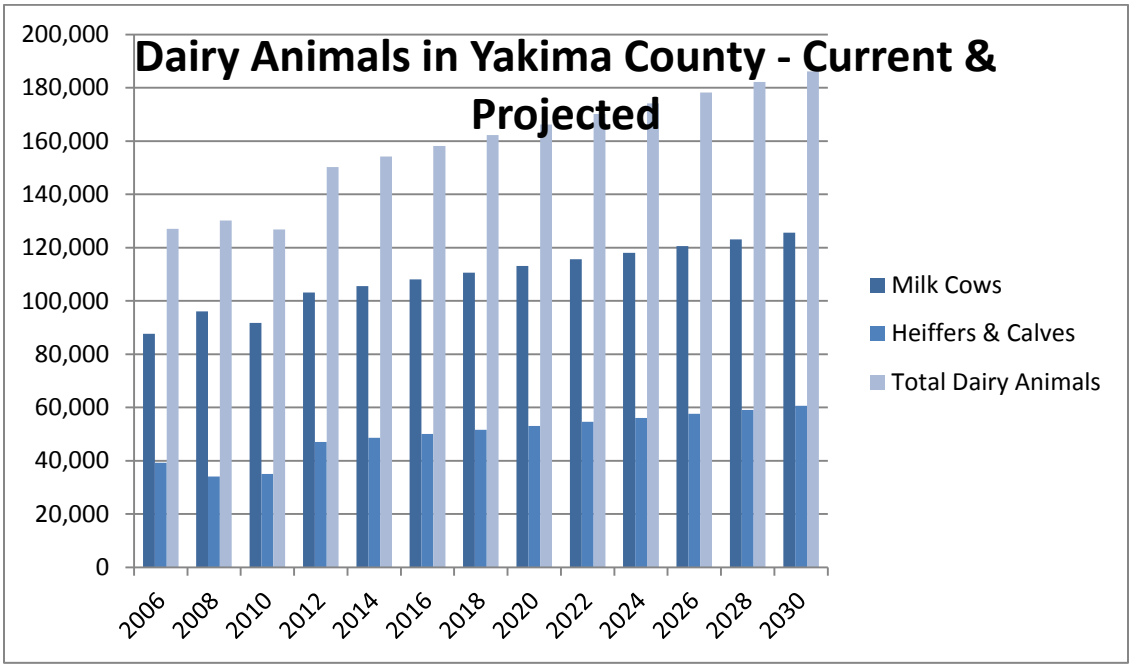
Graph 3.Cattle Timeline from USDA data



Dairy Concentrated Animal Feeding Operations (CAFOs) in Yakima County – Current and Projected

- Since 2006 the total number of dairy animals has increased by 4,000 head per year and the number of dairy cows has increased by 2,500 per year (WSDA – See Attachment A)
- Infrastructure is being built to process more milk. The port of Sunnyside is spending $6 million to build a new pre-treatment waste-water facility and Darigold is planning a $22 million expansion

Graph 4. Projected Increase in the Numbers of Dairy Animals in Yakima County from WSDA Data



Based on information provided by the WSDA Nutrient Management Program (Attachment A)

Fertilizer Application

- In the 1970's about 200,000 acres of agricultural land in the Yakima Valley was fertilized and about 100,000 of those acres received commercial fertilizer (Agricultural History of Yakima County, SYCD)
- In 1997 > 8,000 kg nitrogen/sq. kilometer of land were applied in the Lower Yakima Valley (County Level Estimates of Nutrient Inputs, USGS)
- In 1997 between 2,000 and 4,000 kg nitrogen from animal manure /sq. kilometer of land were applied in the Lower Yakima Valley (County Level Estimates of Nutrient Inputs, USGS)
- Between 1987 and 1997 the percentage of nitrogen from livestock manure in Yakima County increased between 10 and 50% (County Level Estimates of Nutrients, USGS)
- Approximately half of the current nitrogen from fertilizer in the Lower Yakima Valley comes from animal manure
- 63.6% of dairy owned land in Washington State where manure is over applied (3,420 acres) is in Yakima County (Dairy Nutrient Management Program, WSDA)

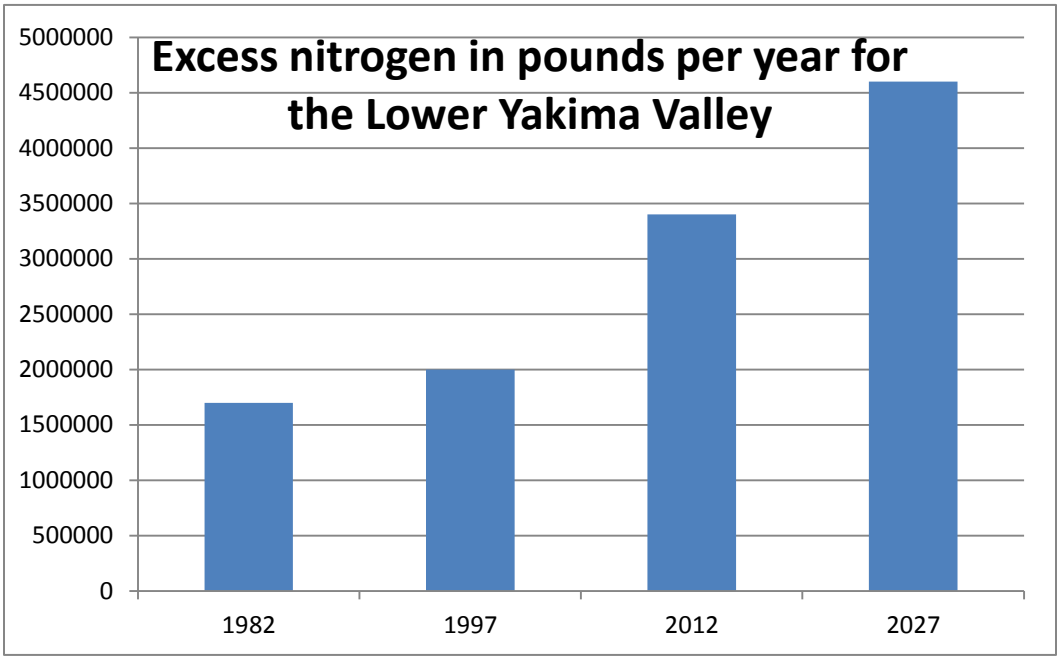
Excess Nitrogen

- According to the Natural Resources Conservation Service (NRCS) in 1997 Yakima County had the capacity to assimilate 25 million to 40 million pounds of nitrogen and 5 to 10 million pounds of phosphorous at a rate of > 140 pounds per acre for nitrogen and 15 to 20 pounds per acre for

phosphorous (Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States, NRCS)

- In 1997 NRCS said that, assuming no manure export off the farm, we had > 2,000,000 excess pounds of nitrogen and > 2,000,000 excess pounds of phosphorous. At that time there were about 60,000 cows on dairy CAFOs here.
- Between 1982 and 1997 there was an increase of > 300,000 excess pounds of nitrogen and between 50,000 and 300,000 excess pounds of phosphorous in Yakima County. (Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States, NRCS)
- In 2012 we had 103,000 cows on dairy CAFOs, an increase of 43,000 in 15 years or 72%. This implies that we now have at least 3,400,000 excess pounds of nitrogen and at least 3,400,000 pounds of excess phosphorous with the same acreage available for spreading.
- If the number of cows on dairy CAFOs continues to increase at a rate of 2,500 head per year there will be 140,500 dairy cows in 2027 and there will be at least 4,600,000 excess pounds of nitrogen and at least 4,600,000 excess pounds of phosphorous with the same acreage available for spreading.

Graph 6. Projected increase in nitrogen over time



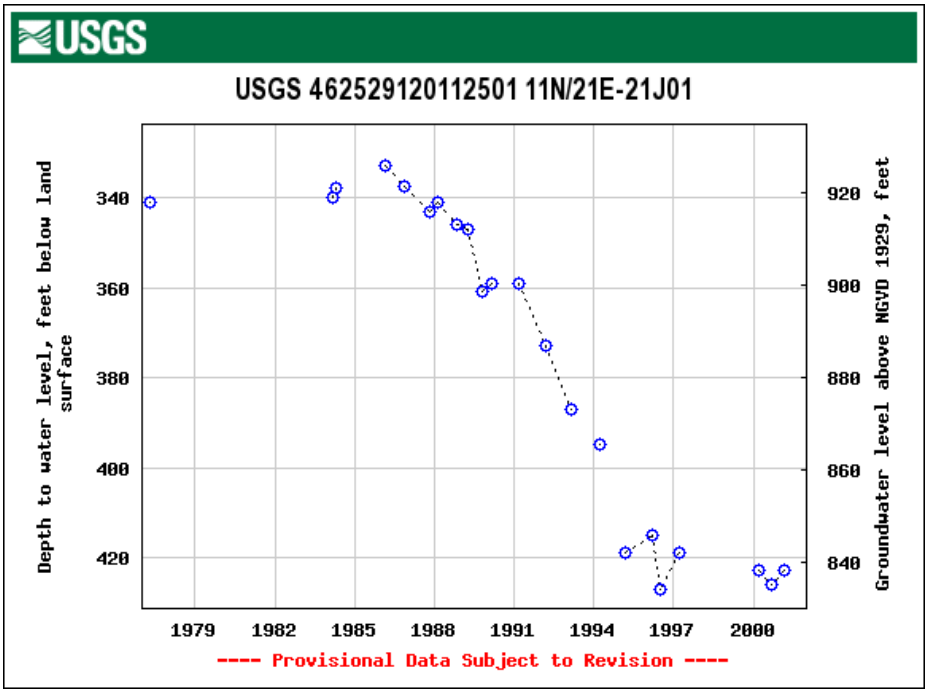
Groundwater Quantity

Deep Wells

Analysis of deep wells in the basalt aquifers from the United States Geological Service shows:

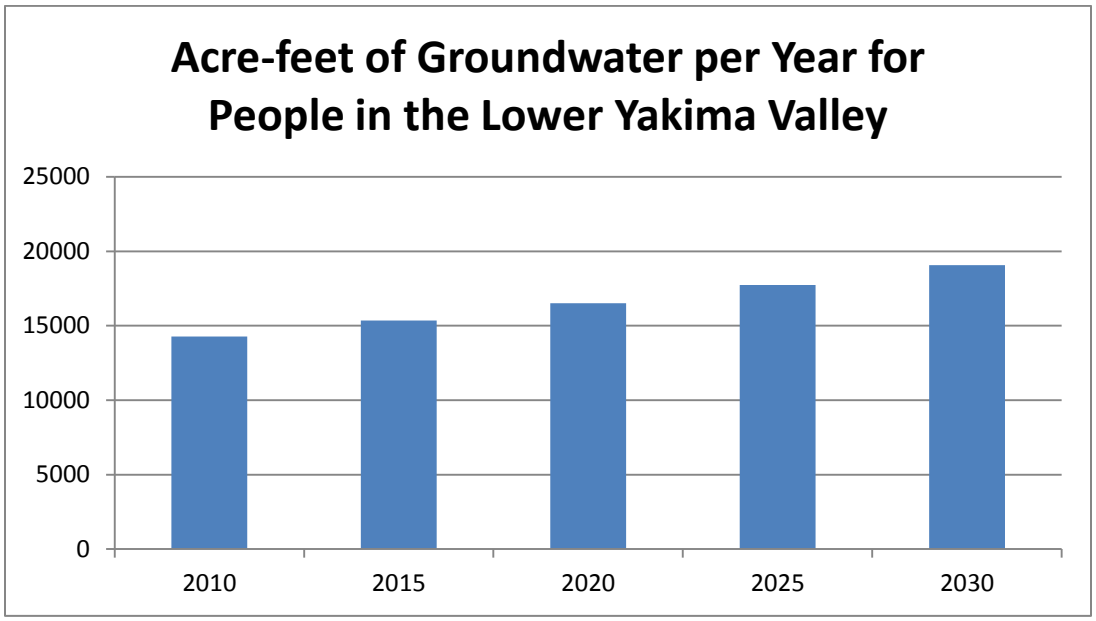
- In the area south of Mabton the only well studied had levels decreasing at a rate of 2.78 ft/year
- On the Yakama Reservation 21 wells showed levels decreasing in a range from 0.16 to 3.33 ft/year
- In the area north and east of Granger and south of Zillah 14 wells showed levels decreasing in a range from 0.25 to 9.58 ft/year
- In the area north of Sunnyside four wells showed a range from increasing at 0.83 ft/year to decreasing at 2.62 ft/year
- In the area north of Zillah and south of Konnowac Pass 12 wells showed a range from increasing at 7.5 ft/year to decreasing at 10.24 ft/year
- In the Moxee area and eastward 25 wells showed a range from increasing at 1.43 ft/year to decreasing at 16.67 ft/year
- In the Ahtanum and West Valley area 17 wells showed a range from increasing at 2.95 ft/year to decreasing at 4.17 ft/year
- In the Selah area 8 wells ranged from no change to decreasing at 1.14 ft/year
- In the Gleed and Naches area one well decreased at 2 ft/year and one well decreased at 1.98 ft/year
- Overall 84 wells showed decreasing water levels, 8 showed increases and 10 stayed almost level

Graph 7. A 605 foot well north of Granger and east of Zillah

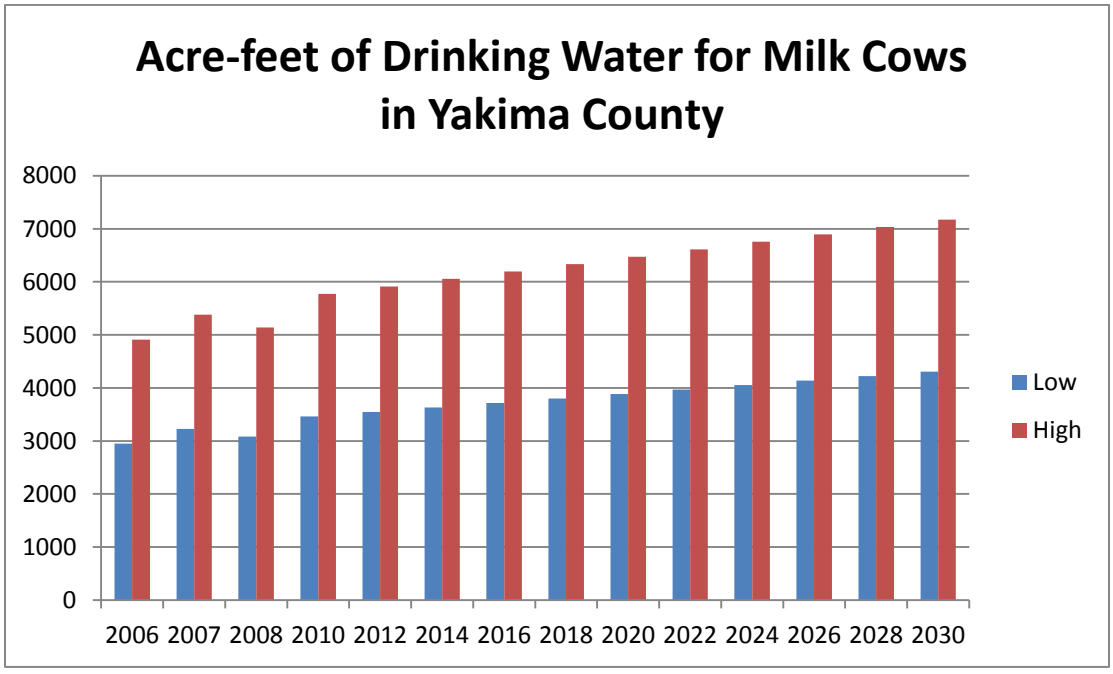


Groundwater Withdrawals

Graph 8. Groundwater demands if the population in the Lower Yakima Valley grows at a rate of 1.5% per year and need is 150 gallons per day per person:



Graph 9. Groundwater demand for dairy cows (A producing milk cow requires from 30 to 50 gallons of drinking water per day or 10,950 to 18,250 gallons per year)



- Between 2000 and 2030 the quantity of groundwater required for people and for drinking water for dairy cows is projected to increase by 31%
- We do not know how much ground water is used for washing milk cows and flushing barns
- This estimate does not include groundwater for beef cattle, dairy heifers and calves, or other domestic animals

Groundwater Quality

The Pacific Groundwater Group identified 7 wells from 46 frequently sampled sites with increasing nitrate trends and 9 with decreasing trends. Six of the seven wells had maximum nitrate levels greater than 8 mg/L and three had nitrate levels above the safe standard of 10 mg/L. The shallowest well was 130 feet.

Well ID	Number of Samples	Max Nitrate	Well Depth & Capacity	Location
2897001	32	9.0 to 10.0 mg/L	180 ft, 180 gpm	Grandview
2897010	139	> 12.5 mg/L	620 ft, 410 gpm	Grandview
2897011	29	8.0 to 9.0 mg/L	250 ft, 60 gpm	Grandview
6494002	21	10.0 to 11.0 mg/L	130 ft, 75 gpm	Outlook School
6591901	37	11.0 to 12.5 mg/L	280 ft, 360 gpm	Panorama Place
8540005	12	2.0 to 4.0 mg/L	166 ft, 500 gpm	Sunnyside
AB 70001	10	11.0 to 12.5 mg/L	Unknown	Wineglass Cellars

(If one accepts a value of $p< 0.10$ there are 13 wells out of 46 with increasing trends and 10 with decreasing trends.)

Factors that point to decreasing groundwater quality

- Increasing demands on the aquifer
- Growing nitrogen imbalance
- Municipalities are already forced to drill new wells
- Decreasing acreage in farmland – more farming on less acreage
- In 1990 only eight out of twenty seven wells in a lower valley study had detectable nitrates. In 2000 21% of the wells in the lower valley had nitrate levels above the safe drinking water standard. (Sell & Knutson, 2002).

Mitigating Factors

- Opportunity to improve irrigation practices in the Sunnyside and Wapato Irrigation Districts

Costs

- $ 1 – 2 million per year public expenditure for bottled water
- Drill new wells - $18 to $20 per foot
- Water treatment systems at $1,000 to $12,000 per home
- Groundwater Management Area - $2.3 million so far
- WSDA Nutrient Management Program - $0.6 million per year
- New wells for cities and schools
- Annual well water testing for 2,200 wells at $75 per well = $165,000 per year
- Health effects have not been quantified

Respectfully Submitted to the Lower Yakima Valley Groundwater Management Area – August 21, 2014

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Friends of TOPPENISH CREEK

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Attachment A

Washington State Department of Agriculture Data on Dairies – Yakima County

Source: Maia Bellon, Director of WA State Dept. of Ecology, who cites Ginny Prest from the WSDA Nutrient Management Program

	2012	**2010**	**2008**	**2006**
Number of dairies	68	67	68	65
Mature animals (milking and dry)	103,088	91,726	96,076	87,694
Heifers (heifers and calves)	47,085	35,076	34,048	39,298
Acreage for land application (owned and rented)	35,727	31,520	27,426	34,044
Number of dairies reporting exporting manure	57	57	No data collected	No data collected
Number of dairies reporting composting	37	No data collected	No data collected	No data collected
Number of dairies reporting animals offsite	37	No data collected	No data collected	No data collected
Number of routine inspections	58	55	64	80
Number of other inspections	14	25	83	33

Attachment B (Please note the difference in numbers between survey data and census data).

USDA Census Data for Yakima County

	Cattle Inventory	Beef Cattle	Milk Cows	Cattle and Calves
2007	118,169	28,594	89,575	212,762
2002	90,209	22,866	67,343	230,275
1997	82,813	31,676	51,137	192,271

National Agricultural Statistics Service - http://quickstats.nass.usda.gov/results/3864427B-6E95-3506-926A-5EA71B3442CD , http://quickstats.nass.usda.gov/results/1D0A8BFB-20CB-349A-AA6E-9D8FDD410CCF , http://quickstats.nass.usda.gov/results/A504D574-A9E8-3D48-AA61-FD1A28B2E443 and http://quickstats.nass.usda.gov/results/FF9658AF-4CB9-381A-AB4A-FAEF52171DD0

USDA Survey Estimates for the Number of Cattle in Yakima County

Year	Cattle, including Calves	Dairy Cows
2012	215,000	97,000
2011	215,000	93,000
2010	205,000	90,000
2009	210,000	90,000
2008	215,000	90,000
2007	208,000	73,000
2006	198.000	70,500
2005	226,000	67,600
2004	215,000	66,300
2003	220,000	67,200
2002	211,000	63,500
2001	210,000	62,200
2000	201,500	53,700
1999	187,000	51,400
1998	198,500	51,600
1997	205,000	49,200
1996	216,500	45,200
1995	230,000	43,300
1994	246,000	39,800
1993	220,000	44,000
1992	201,400	33,000
1991	174,000	29,000
1990	176,000	25,900
1989	183,000	24,500
1988	181,700	24,600
1987	183,200	23,700
1986	206,000	25,700

Source: National Agricultural Statistics Service - http://quickstats.nass.usda.gov/results/A504D574-A9E8-3D48-AA61-FD1A28B2E443 and http://quickstats.nass.usda.gov/results/FF9658AF-4CB9-381A-AB4A-FAEF52171DD0

Attachment C

Washington State Department of Agriculture Statistics on Cropping Patterns in the Yakima Valley supplied by Kirk Cook, WSDA

	Acres	# Parcels		Percentage
Corn, Field	48785	1520		16%
CRP/Conservation	38175	291		12%
Apple	33451	1555		11%
Pasture	28514	1442		9%
Wheat	27009	527		9%
Hops	21110	684		7%
Alfalfa Hay	19848	671		6%
Grape, Juice	13882	775		5%
Fallow	10277	824		3%
Mint	9432	319		3%
Cherry	7737	831		3%
Wheat Fallow	7068	58		2%
Grape, Wine	5650	352		2%
Pear	5299	535		2%
GrassHay	4135	265		1%
Alfalfa Grass	3972	204		1%
Asparagus	2344	115		1%
Nectarine/Peach	1847	170		1%
Timothy	1618	32		1%
Dill	1609	38		1%
Sudan Grass	1404	54		
Triticale	1236	29		
Developed	1211	169		
Potato	1187	21		
Market Crops	1107	82		
Green Bean	855	65		
Wildlife Feed	750	17		
Onion	634	26		
Dry Bean	504	12		
Apricot	444	73		
Pepper	430	21		
Nursery Ornamental	426	28		
Barley	410	23		
Driving Range	317	16		

Squash		317	20		
Orchard Nursery		311	20		
Green Manure		289	13		
Oat		272	21		
Plum		261	52		
Sunflower Seed		197	6		
Bluegrass Seed		188	6		
Carrot Seed		183	6		
Pumpkin		182	13		
Sage		156	4		
Alfalfa Seed		136	2		
Cucumber		128	9		
Rye		116	6		
Caneberry		107	6		
Research Station		77	6		
Blueberry		73	9		
Unknown		67	1		
Tomato		61	8		
Sorghum		40	1		
Clover Seed		35	2		
Sugar Beet Seed		32	1		
Corn, Seed		30	1		
Iris		17	3		
Artichoke		16	1		
Poplar		14	3		
Walnut		12	4		
Cantelope		10	1		
Watermelon		8	2		
Nursery		7	2		
Driving Range		6	2		
Christmas Tree		4	1		
Rhubarb		3	1		
Silvaculture		3	1		
Green Pea		2	1		
Nursery Lavender		1	1		
Total		306038	12080		

Note: According to the WA State Dept. of Ecology, there were 1,211,127 square meters or 299 acres of manure lagoons in Yakima County in 2003. (Summer PM 2.5 Non-attainment Process)

Second Opinion re the *INTERIM FINAL GROUNDWATER MONITORING PLAN LOWER YAKIMA VALLEY GWMA INITIAL CHARACTERIZATION*

August, 2014

This document, as currently written, is a blank check. There is no mechanism for accountability to the GWAC or the tax paying public. The document is not an area characterization[1]. Valid recommendations from the Data Work Group were ignored.

Accountability

Section 1.0 of the document states,

> *This interim final Groundwater Monitoring Plan addresses:*
> *• Sampling Procedures*
> *• Sampling Schedule (developed following identification of the sampling network)*
> *• Sampling Network (sampling network has not been established as of the date of issue for the interim final Groundwater Monitoring Plan)*
> *• Quality Assurance/Quality Control*
> *• Reporting (frequency developed following identification of the sampling network and schedule)*
>
> *While this Monitoring Plan is intended to be comprehensive, revisions and/or amendments may be required as the project evolves.*

The document does not provide a sampling schedule, a sampling network, or a reporting schedule. If the GWAC signs off on this document we have lost any control over where the monitoring wells will be located, when sampling will be done and how often reports are made.

The document does not talk about how many wells will be located in shallow aquifers, how many at middle levels and how many in deep aquifers. It does not guarantee that all areas in the GWMA will be monitored. It does not talk about groundwater flow. It does not address critical aquifers. It does not talk about soil characteristics. It does not talk about farming practices or cropping patterns.

Area Characterization

WAC 173 – 100 – 100 (1) requires:

> *The program for each groundwater management area will be tailored to the specific conditions of the area. The following guidelines on program content are intended to serve as a general framework for the program, to be adapted to the particular needs of each area. Each program shall include, as appropriate, the following:*

[1] "Characterization includes the measurement, description, and interpretation of the hydrogeologic setting that groundwater occurs in; monitoring is the point measurement of water quality or water-level conditions of the groundwater present in such a setting." WA State Dept. of Ecology *Strategic Recommendations for Groundwater Assessment Efforts of the Environmental Assessment Program. 2003*

(1) An area characterization section comprised of:

(a) A delineation of the groundwater area, subarea or depth zone boundaries and the rationale for those boundaries;

(b) A map showing the jurisdictional boundaries of all state, local, tribal, and federal governments within the groundwater management area;

(c) Land and water use management authorities, policies, goals and responsibilities of state, local, tribal, and federal governments that may affect the area's groundwater quality and quantity;

(d) A general description of the locale, including a brief description of the topography, geology, climate, population, land use, water use and water resources;

(e) A description of the area's hydrogeology, including the delineation of aquifers, aquitards, hydrogeologic cross-sections, porosity and horizontal and vertical permeability estimates, direction and quantity of groundwater flow, water-table contour and potentiometric maps by aquifer, locations of wells, perennial streams and springs, the locations of aquifer recharge and discharge areas, and the distribution and quantity of natural and man-induced aquifer recharge and discharge;

(f) Characterization of the historical and existing groundwater quality;

(g) Estimates of the historical and current rates of groundwater use and purposes of such use within the area;

(h) Projections of groundwater supply needs and rates of withdrawal based upon alternative population and land use projections;

(i) References including sources of data, methods and accuracy of measurements, quality control used in data collection and measurement programs, and documentation for and construction details of any computer models used.

These are criteria for Area Characterization. We have contracted with PgG to do an area characterization and I do not see one. Just calling a monitoring plan a characterization does not make it so. The characterization should have been done prior to development of a monitoring plan.

The meeting summary for the May 8, 2014 meeting of the Data Work Group says, "As of now, the topic of who will be leading the characterization report is under discussion between the County and others. The scope and level of detail of the characterization report still needs to be decided."

Data Work Group Input

The Data Work Group has only met once in 2014. It is inaccurate to say that the work group has approved any actions because there has been only one meeting this year. The chair appears to be acting independently from the work group.

There is evidence of consultation with some members of the group. An e-mail from Kirk Cook to Don Gatchalian on April 14, 2014 (obtained through the Freedom of Information Act) says "Document has been forwarded to key working group members for review, with a deadline of April 30th." This does not constitute work group input and shows that information has been withheld from some members of the group.

A paid consultant and hydrogeologist from the Pacific Groundwater Group (PgG) suggested adding chloride to the list of contaminants tested. Chloride has been part of the sampling and analysis for nitrates in groundwater in most other studies. Chloride has been used as a marker for lagoon leakage and manure over application. The addition was not made. We do not know who made that decision.

However, Stuart Turner, a paid consultant for the dairy industry who has never participated in a Data Work group meeting, did review and critique comments that other work group members made and his recommendation was to not include chloride testing.

More supportive information is available on request.

Respectfully submitted.

Jean Mendoza

Jean Mendoza

Lower Yakima Valley Deep Soil Sampling Summary Analysis

By Jean Mendoza

August 2017

Between the fall of 2014 and the spring of 2016 the Lower Yakima Valley (LYV) Groundwater Management Area (GWMA) conducted four rounds of deep soil sampling (DSS) on agricultural land in the GWMA target area. All fields were voluntarily submitted and anonymously recorded. Soil sampling was done under contract by the South Yakima Conservation District and Landau Associates.

Purposes of the DSS as stated in *Deep Soil Sampling Plan Lower Yakima Valley Groundwater Management Area*, *March 2014* were:

1) Providing baseline data regarding the nitrogen content (nitrate, ammonium, and organic matter) of soils underlying a variety of soil, crop, and irrigation systems that represent a cross-section of agricultural activities.
2) Provide an initial assessment of current nitrogen and water management practices in place today and in the past.
3) Provide information regarding availability of soil nitrogen to crops.
4) Provide the foundation for a technically based education program.
5) Provide information about project design, practical realities, time requirements and costs that can be used in developing subsequent project scopes.

There has been no analysis of the collected data. This summary is an attempt by one member of the GWMA advisory committee to begin that process. This summary indicates that analysis is possible for a limited number of crops – triticale, alfalfa & corn silage. These were the majority of the crops in the study – 60% of crops in fall samplings and 78% of crops in spring samplings.

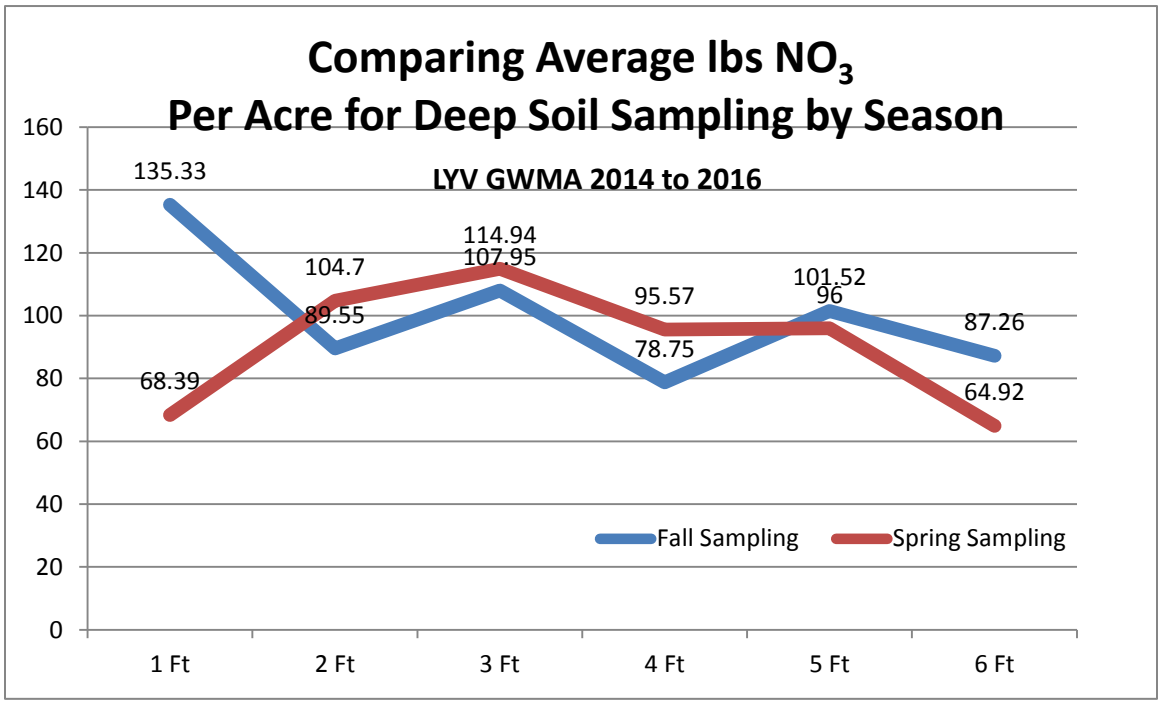
Summary of Data Parameters

There is a difference between the nitrate levels in the soil samples from the fall testing and the spring testing. This could be due to winter moisture that drives nitrates downward in the soil column. It could be due to differences in the fields and nature of the crops that were tested in each season.

Table 1. Average Nitrate Levels for Fall & Spring DSS

Seasonal Averages	1 Ft #N/Acre	2 Ft #N/Acre	3 Ft #N/Acre	4 Ft #N/Acre	5 Ft #N/Acre	6 Ft #N/Acre	Total #N/Acre	Ammonia #N/Acre	Organic Matter
Fall (N = 93)	135.33	89.55	107.95	78.75	101.52	87.26	531.78	22.7	2.01%
Spring (N = 82)	68.39	104.7	114.94	95.57	96	64.92	448.41	23.8	2.13%

Graph 1.



There are results for 93 fields in the fall sampling and 82 fields in the spring sampling for a total of 175. Part or all of the survey results are missing for 17 of the sites in the spring 2016 study. Analysis by crop, crop yield, fertilizations practices and irrigation type for the 2016 spring testing was calculated for those samples with available information. Soil information was available for all samples.

Average acreage per field was 34.23 acres for the fall testing and 45.61acres for the spring testing.

Total acreage: According to the Washington State Department of Agriculture (WSDA) there are about 96,380 acres of land in agriculture in the GWMA target area. Survey results were obtained for 6,091 acres or 6% of those fields. Acreage was missing for 3 of the fields in the fall samplings and 16 fields in the spring samplings. We do not know if any fields were tested twice and we do not know the locations of the fields.

Soil testing had been done by 74% of the growers in the fall survey and 99% of the growers in the spring survey with 3 unknown in the fall and 15 unknown in the spring. Those fields that were not routinely tested had lower nitrate levels. This indicates that many farmers know where they should be testing.

Irrigation types were:

- Rill = 21 fields or 23% for fall sampling and 7 fields or 11% for spring sampling with 17 unknown in the spring
- Sprinkler = 66 fields or 73% for fall sampling and 51fields or 78% for spring sampling with 17 unknown in the spring
- Drip = 5 fields or 3% for fall samplings and 7 fields or 11% for spring sampling with 17 unknown in the spring
- No irrigation = 1 field or 1% for the fall sampling

Crop history was provided for the past four to five years for most fields. Some fields were planted in only one crop throughout that time period while others were planted with multiple crops. This complicates the analysis. Unless otherwise stated the crop listed for each sample and analysis is the most recently harvested crop under the category *Crop #1* in the DSS spreadsheets. Remember that previous crops impact the nitrogen levels in soils.

Percentage of crops in the DSS is described below in Table 2. WSDA's percentage of crops in the GWMA target area is in parentheses. WSDA data is taken from Attachment 2, *Summary of Proposed Allocation Process.* Most DSS fields in triticale were double cropped in silage corn. Perhaps WSDA only counted triticale as a crop when it was the only crop on a field. This would account for WSDA's low estimate of land in triticale.

Table 2. Percentage of Crops in the LYV GWMA DSS

Fall	% of Crops in the Sampling	N	Spring	% of Crops in the Sampling	N
Triticale	22% (WSDA 1%)	20	Triticale	46% (WSDA 1%)	31
Alfalfa	15% (WSDA 7%)	14	Alfalfa	19% (WSDA 7%)	13
Corn Silage	14% (WSDA 19% for silage + grain)	13	Corn Silage	12% (WSDA 19% for silage + grain)	8
Corn Grain	10% (WSDA 19% for silage + grain)	9	Hops	7% (Hops 5%)	5
Grapes	6% (WSDA 11%)	6	Asparagus	3% (WSDA 1%)	2
Hops	5% (WSDA 5%)	5	Mint	3% (WSDA 1%)	2
Mint	5% (WSDA 1%)	5	Wheat	3% (WSDA 2%)	2
Pasture	5% (WSDA 6%)	5	Apples	1% (WSDA 17%)	1
Wheat	4% (WSDA 2%)	4	Cherries	1 % (WSDA 7%)	1
Apples	3% (WSDA 17%)	3	Pasture	1% (WSDA 6%)	1
Hay	3% (WSDA 1%)	3	Wine Grapes	1% (WSDA 5%)	1
Cherries	2% (WSDA 7%)	2	None	1%	1
Barley	1% (WSDA < 1%)	1			
Fallow	1%	1			
Pears	1% (WSDA 4%)	1			
Sudan Grass	1% (WSDA 1%)	1			
Wine Grapes	1% (WSDA 5%)	1			
Double Crop	24%	22	Double Crop	46%	31
Multiple Crops	30%	28	Multiple Crops	25%	17

Based on these numbers it is possible to draw limited conclusions regarding triticale, alfalfa and corn silage for the fields in this data set of voluntary samples. This descriptive analysis begins on page 8. Statistical analysis for significance begins on page 37.

Fertilization Practices were:

- Liquid Manure = 29 fields (31%) for fall sampling and 36 fields (55%) for spring
- Solid Manure = 18 fields (19%) for fall sampling and 10 fields (15%) for spring
- Commercial Fertilizer = 59 fields (63%) for fall sampling and 36 fields (55%) for spring sampling
- Biosolids = 1 field (1%) for fall sampling and 0% for spring sampling
- Compost = 2 fields (2%) for fall sampling and 0% for spring sampling
- Other = 3 fields (3%) for fall sampling and 1 field (2%) for spring sampling
- 23 fields or 25% of the fall sampling received more than one type of fertilizer
- 23 fields or 35% of the spring sampling received more than one type of fertilizer

Leaching estimates were obtained using the *Capacity of the Most Limiting Layer to Transmit Water (Ksat)* classifications found on the Natural Resource Conservation Services (NRCS) *Soils Website* at https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

Ksat soil classes for this analysis were:

- Very Low to Moderately Low =5 fields or 5% for fall, 9 fields or 11% for spring and 14 fields or 8% overall
- Moderately High to High = 78 fields or 84% for fall, 68 fields or 83% for spring and 146 fields or 83% overall.
- High to Very High = 10 fields or 11% for fall, 15 fields or 6% for spring and 25 fields or 9% overall

See Attachment 3 for a listing of the soil types and classifications in the DSS. None of the sampled fields fell into other classes.

Most frequent soil types listed in the DSS spread sheet were:

Fall –

- Warden Silt Loam 2-5% Slopes (Moderately High to High) – 24% (22)
- Quincy Loamy Fine Sand 0-10% Slopes (Moderately High to High) – 9% (8)
- Warden Silt Loam 5-8% Slopes (Moderately High to High) – 9% (8)
- Ezquatel Silt Loam 0-2% Slopes (Moderately High to High) – 8% (7)
- Warden Silt Loam 8-15% Slopes (Moderately High to High) – 6% (6)

Spring –

- Warden Silt Loam 2-5% Slopes (Moderately High to High) – 15% (12)
- Cleman Very Find Sandy Loam 0-2% Slopes (Moderately High to High) – 12%(10)
- Warden Fine Sandy Loam 0-2% Slopes (Moderately High to High) – 7%(6)
- Scoon Silt Loam 2-5% Slopes (Very Low to Moderately Low) – 6% (5)
- Sinloc Silt Loam 2-5% Slopes (Moderately High to High) – 6% (5)

Deep Soil Sampling Plan

Prior to implementation of the LYV GWMA DSS planners from the Irrigated Ag Work Group presented the advisory committee with an estimated breakdown of categories for the GWMA target area. (Attachment 2 – *Summary of Proposed Allocation Process*) These groupings were:

1. Crops by root depths:
   - More than 4 Ft – alfalfa, asparagus, tree fruits & hops ~42% of total crops
   - 2.5 Ft to 4 Ft – corn, wheat, grains/triticale, sorghum/Sudan, pasture, grapes ~54% of total crops
   - Less than 2.5 Ft – mint ~1% of total crops
   - Miscellaneous ~3% of total crops

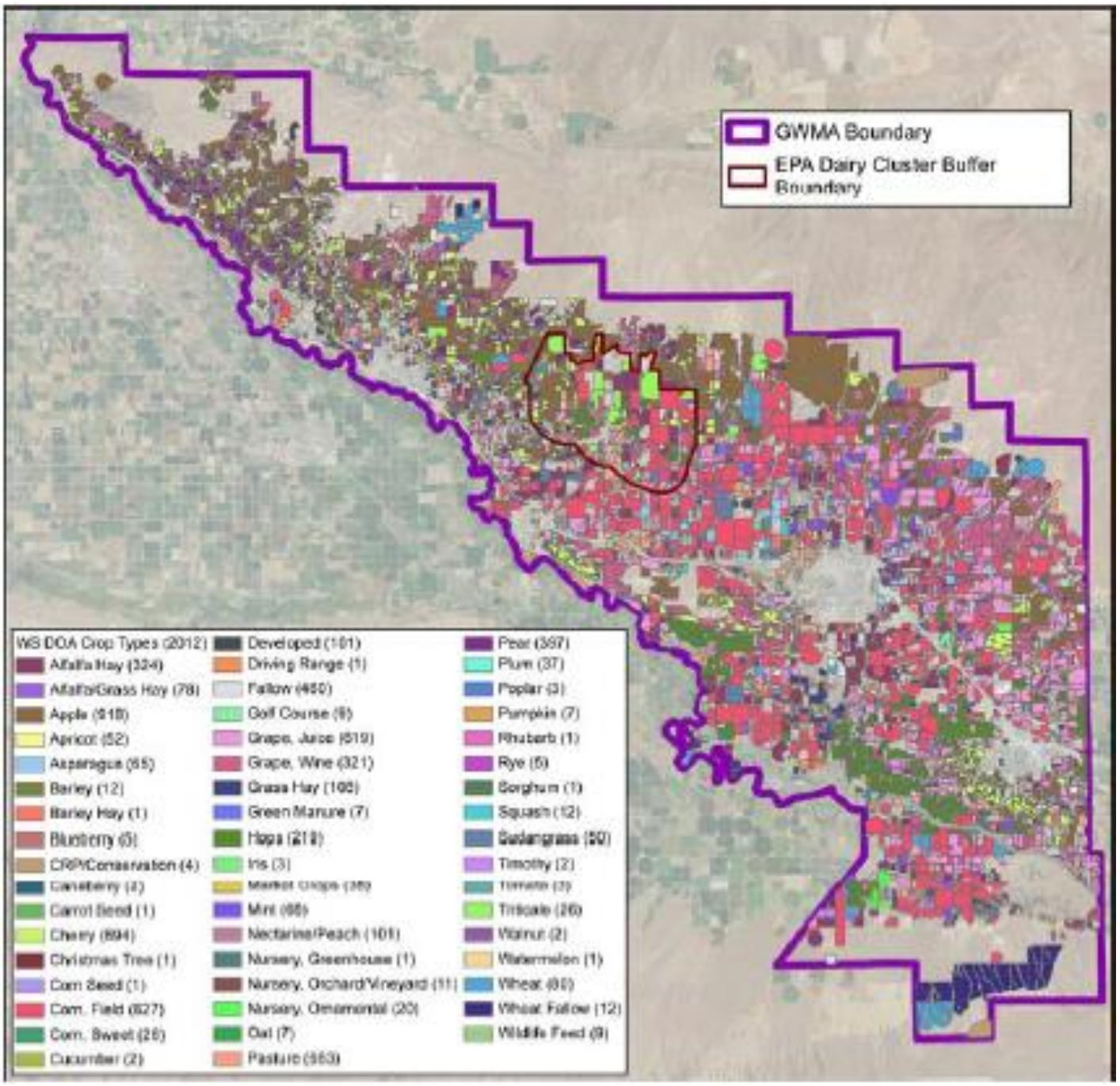
2. Irrigation Types
   - None, none + anything, unknown ~6% of area irrigation
   - Drip, micro sprinkler, drip + anything ~13% of area irrigation
   - Sprinklers, sprinklers + anything, hand ~63% of area irrigation
   - Flood, rill, rill + sprinkler ~ 16% of area irrigation

3. Leaching Potentials (percentages unknown)
   - Low
   - Medium
   - High
   - Possibly a fourth category – medium to high

The plan was to calculate total acreage for each of 36 to 96 categories and to rank categories according to acreage. Analysists would determine which categories were most prevalent in the GWMA target area. They would sample 6 fields from each of the most prevalent, 4 fields from each of the next highest grouping and 3 fields from each of the next highest grouping. There would be no sampling from approximately half of the combinations with low prevalence.

In order to determine the percentage of GWMA land in each category someone would use the WSDA map of GWMA area crops below and search the NRCS Web Soils site to determine soil type for each parcel. These calculations were apparently not done.

Map 1. WSDA Crop Map for the GWMA Target Area



Comparison of the Plan with the Collected DSS Data

For purposes of this comparison the number of categories is reduced to 27 possible combinations: (Irrigation = 3) x (Crops = 3) x (Leaching = 3).

Irrigation

The plan states there is rill irrigation on 16% of the target area. 19% of the fields in the study had rill irrigation

The plan states there is sprinkler irrigation on 63% of the fields in the target area. 74% of the fields in the study had sprinkler irrigation

The plan states there is drip irrigation on 13% of the fields in the target area. 7% of the fields in the study had drip irrigation

There is no irrigation on 6% of the fields in the target area and about 1% of the fields in the study had none. That category is omitted in this analysis of the DSS

Crops by Rooting Depth

The plan states that 1% of the crops in the target area have roots < 2.5 Ft deep. About 5% of the fields in the study had crops (mint) in this category

The plan states that 54% of the crops in the target area have roots 2.5 Ft to 4 Ft. About 66% of the fields in the study had crops in this category.

The plan states that 42% of the crops in the target area have roots > 4 Ft. About 29% of the fields in the study had crops in this category

Analysis of DSS by crops is complicated by double cropping. Most of the DSS fields planted in triticale and corn silage were double cropped. Double cropping was done on 24% of the fields in the fall soil sampling and 46% of the crops in the spring soil sampling

Crops in the DSS are not always typical of the crops grown in the area. For example 2.5% of the fields in the DSS were planted in apples but 19% of the cropland in the area is actually planted in apples according to the WSDA. For example 17% of the fields in the DSS were planted in alfalfa but 7% of the cropland in the area is actually planted in alfalfa according to the WSDA. The composition of the > 4 Ft root depth group in the DSS includes both of these crops and is especially not typical of the area.

Leaching Potential

In the collected data the DSS leaching potential categories were:

- Very low to moderately low – 6% of fields
- Moderately high to high – 84% of fields
- High to very high – 10% of fields

We do not know the actual percentages of leaching categories in the GWMA target area.

Results for Most Prevalent Categories in the DSS

The DSS gathered data for 15 out of the 27 categories.

Table 3. LYV GWMA DSS Categories with Soil Testing Results

Irrigation	Root Depth	Leaching Potential	Number of fields in the DSS	% of DSS Fields
Rill	< 2.5 Ft	Moderately High, Moderately High to High	6	4%
Rill	2.5 Ft to 4 Ft	Moderately High, Moderately High to High	19	12%
Rill	2.5 Ft to 4 Ft	High to Very High	1	1%
Rill	> 4 Ft	Moderately High, Moderately High to High	3	2%
Rill	> 4 Ft	High to Very High	1	1%
Sprinkler	< 2.5 Ft	Moderately High, Moderately High to High	2	1%
Sprinkler	2.5 Ft to 4 Ft	Very Low to Moderately Low	8	5%
Sprinkler	2.5 Ft to 4 Ft	Moderately High, Moderately High to High	65	40%
Sprinkler	2.5 Ft to 4 Ft	High to Very High	12	7%
Sprinkler	> 4 Ft	Moderately High, Moderately High to High	31	19%
Sprinkler	> 4 Ft	High to Very High	2	1%
Drip	2.5 Ft to 4 Ft	Very Low to Moderately Low	1	1%
Drip	2.5 Ft to 4 Ft	Moderately High, Moderately High to High	1	1%
Drip	> 4 Ft	Very Low to Moderately Low	1	1%
Drip	> 4 Ft	Moderately High, Moderately High to High	9	6%

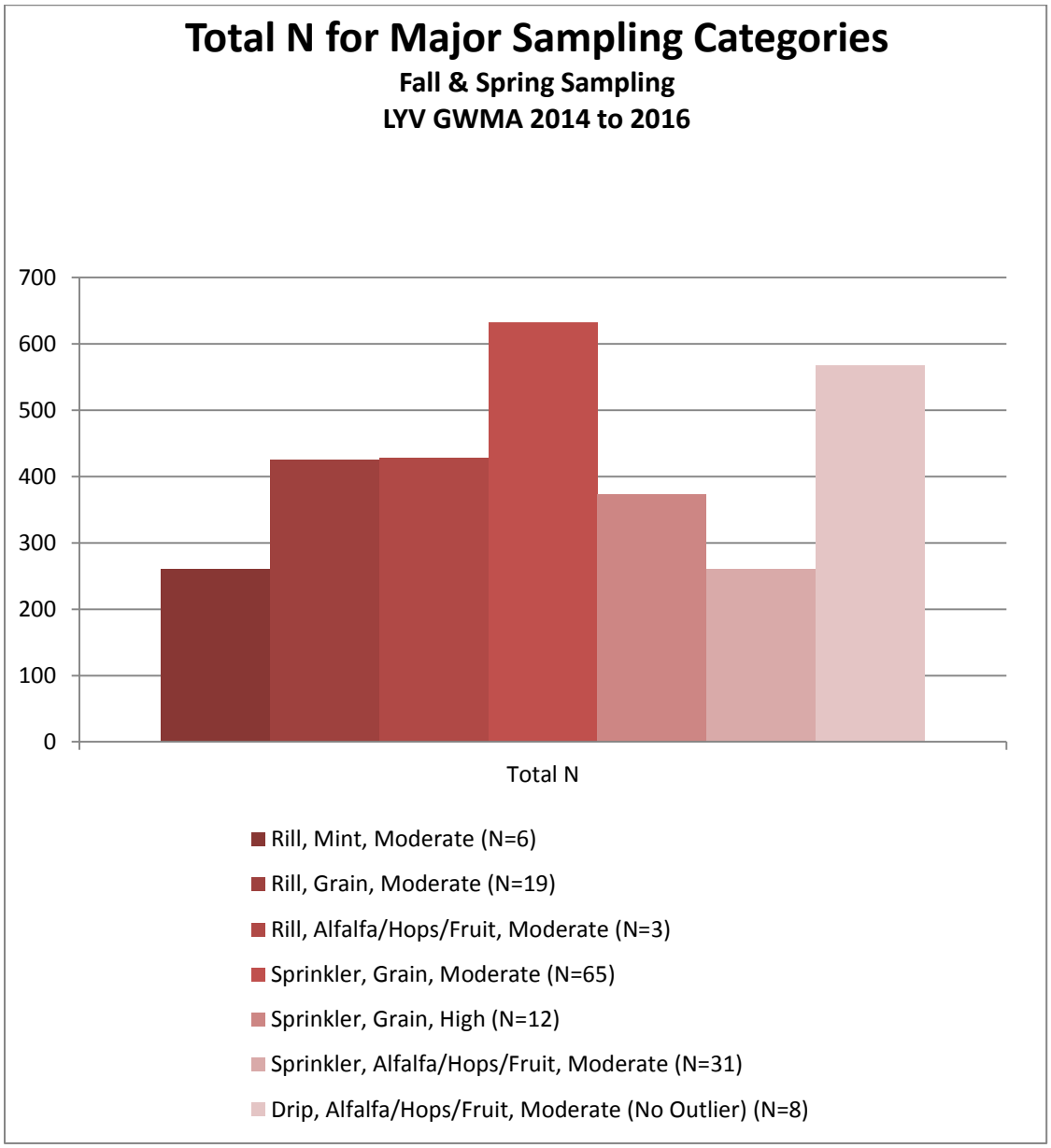
Here are the average readings for nitrates in the soil for the categories with more than three samples. The bar graph that follows shows the calculated total nitrogen for these major groups. Note that early refusal of the auger results in fewer samples and a lower total N. For this reason the category "Sprinkler, Grain, Low" was omitted from the bar graph since that grouping had no measurements below 3 ft.

Table 4. Average NO_3 Levels by Sampling Category for LYV GWMA DSS

Category	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total N
Rill, Mint, Moderate (N=6)	85.33	26.17	63.67	18.67	57.17	9.17	260.17
Rill, Grain, Moderate (N=19)	157.95	74.42	69.74	47.37	52.88	33.69	425.16
Rill, Alfalfa/Hops/Fruit, Moderate (N = 3)	138.33	84.67	63	62.67	58	21	427.67
Sprinkler, Grain, Low (N=8)	92.88	80.83	103.67		Early Refusal		
Sprinkler, Grain, Moderate (N=65)	101.09	130.69	145.08	124.88	111.7	102.77	631.43
Sprinkler, Grain, High (N=12)	102.5	61.5	89.1	60	62.67	50.44	373.08
Sprinkler, Alfalfa/Hops/Fruit, Moderate (N = 31)	60.83	35.72	53.56	53.67	65.67	37.75	260.72
Drip, Alfalfa/Hops/Fruit, Moderate with Outlier (N = 9) *	287.44	168.56	164.67	36.56	217.86	187.57	972.44
Drip, Alfalfa/Hops/Fruit, Moderate without Outlier (N = 8)	204.63	182.25	110.75	34	30.17	18.17	567.75

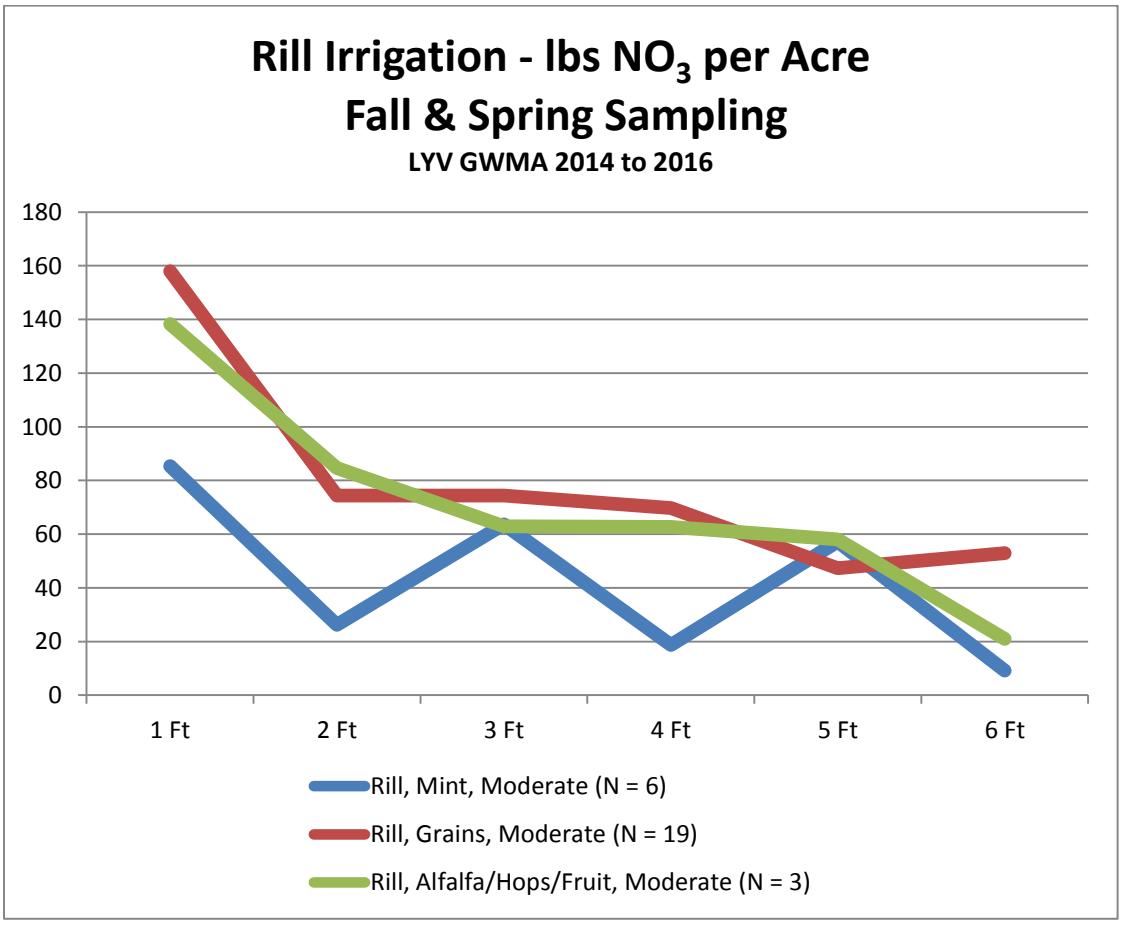
* Field #3141 had extremely high nitrate levels at the 5 ft and 6 ft levels. At this depth the readings cannot be explained by the parameters in the study. This field was excluded from the analysis on this page, but not from later analyses.

Graph 2. Total Nitrogen for Major Sampling Categories LYV GWMA DSS

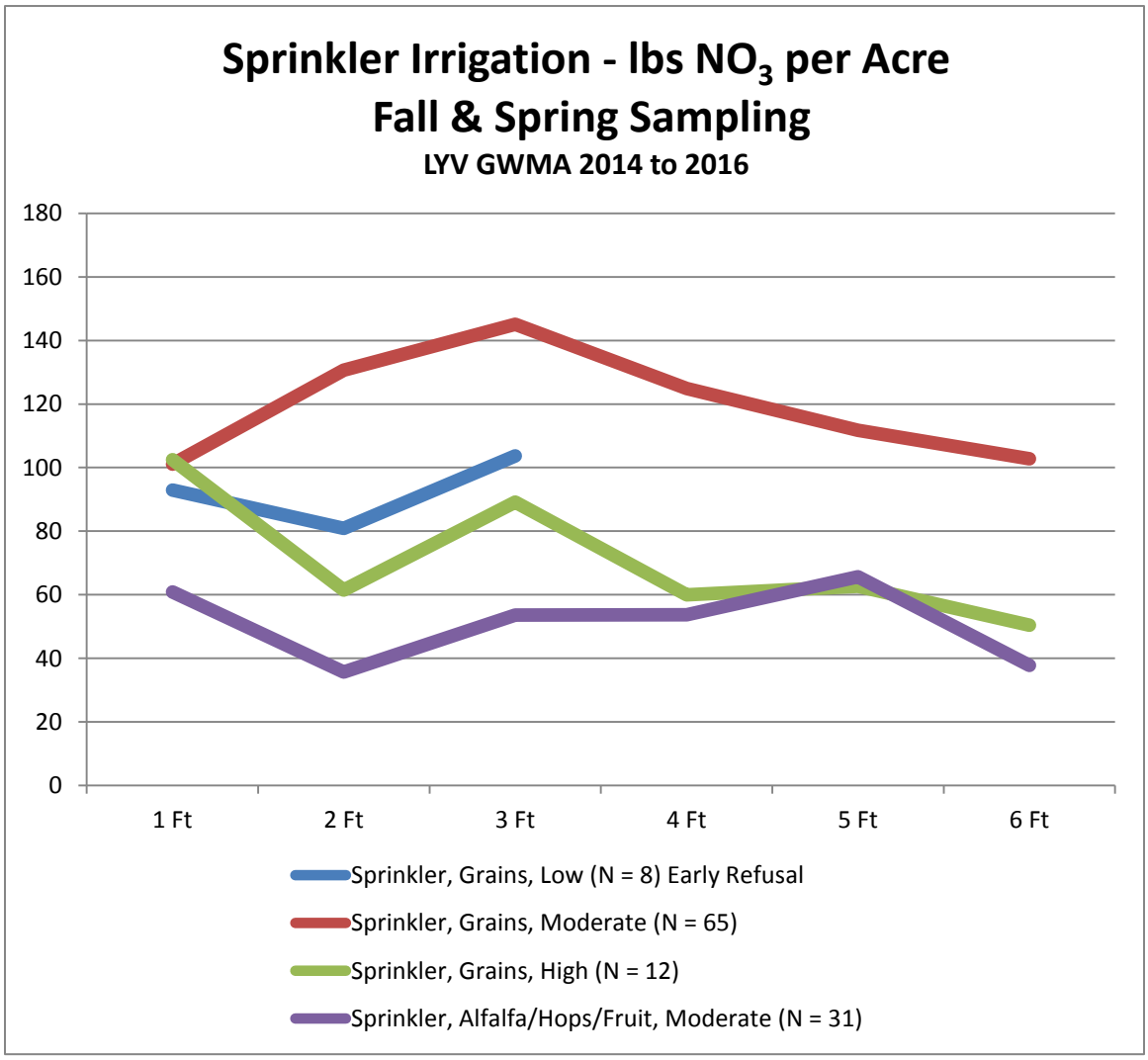


Following are graphs that provide easy viewing of common factors in the 15 groupings.

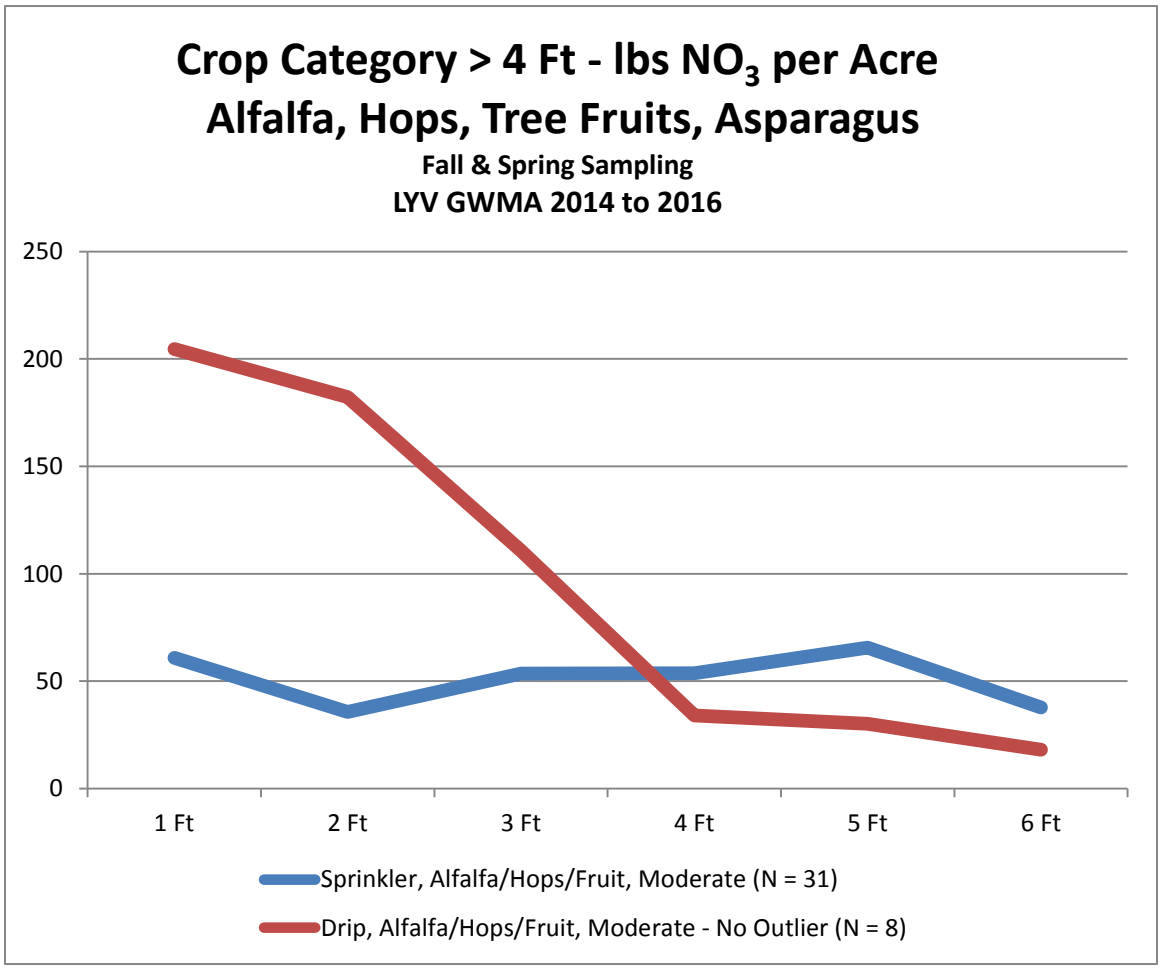
Graph 3.



Graph 4.

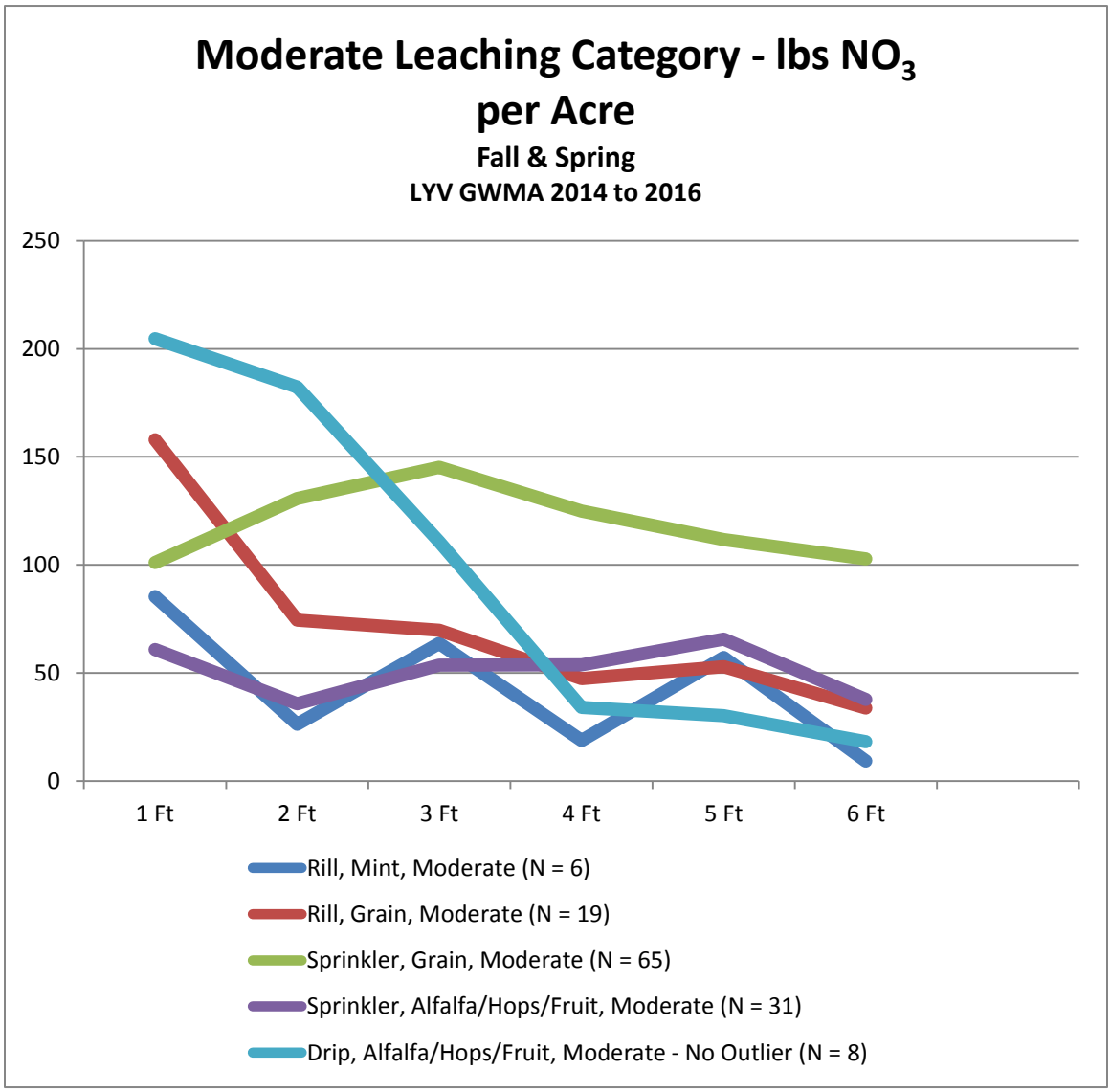

Sprinkler Irrigation - lbs NO_3 per Acre
Fall & Spring Sampling
LYV GWMA 2014 to 2016
180
160
140
120
100
80
60
40
20
0
1 Ft
2 Ft
3 Ft
4 Ft
5 Ft
6 Ft
Sprinkler, Grains, Low (N = 8) Early Refusal
Sprinkler, Grains, Moderate (N = 65)
Sprinkler, Grains, High (N = 12)
Sprinkler, Alfalfa/Hops/Fruit, Moderate (N = 31)

Graph 5.



Note change in scale

Graph 6.



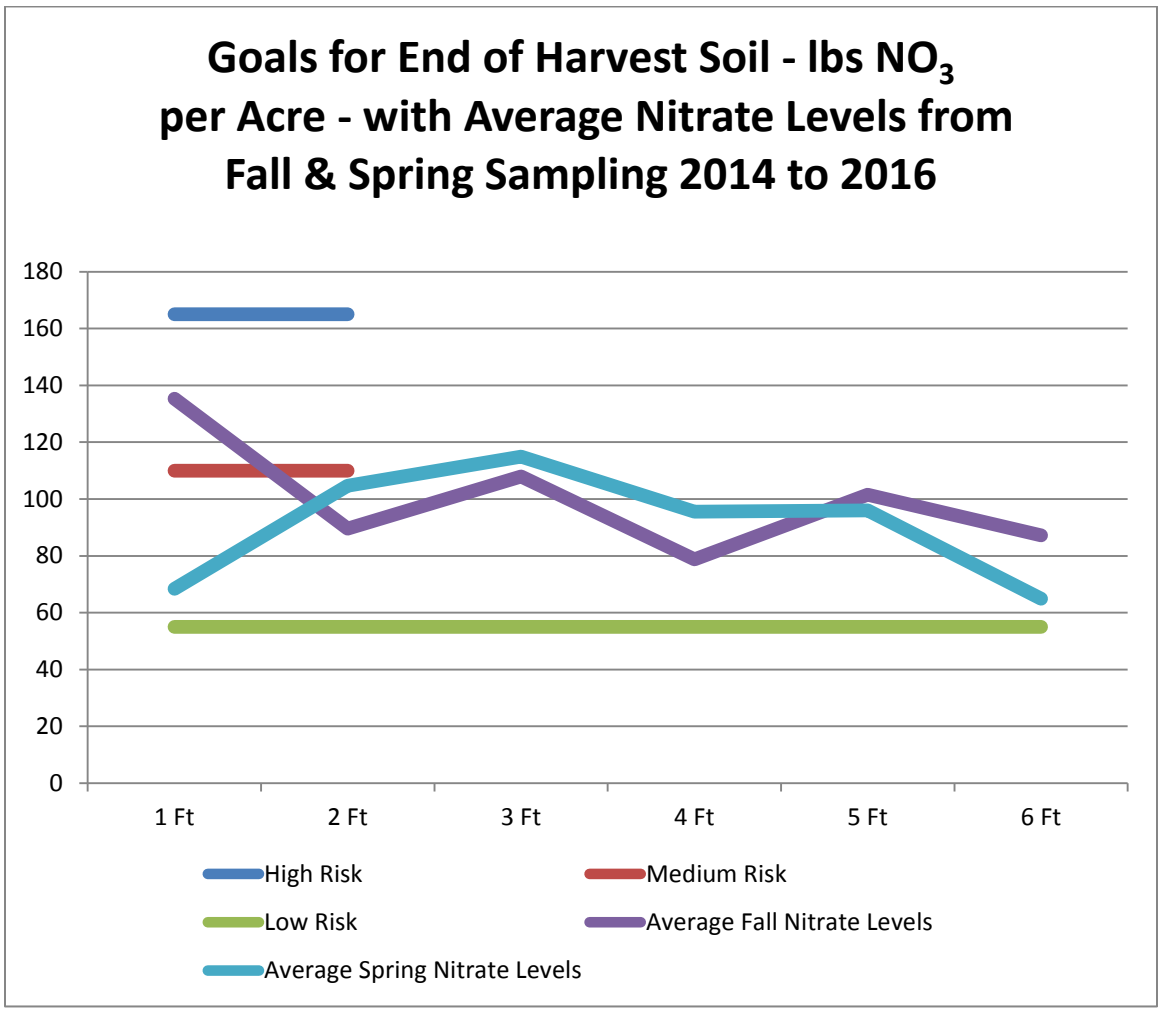
Descriptive Analysis of the DSS Data

Based on the number of samples available certain groupings of data in the DSS lend themselves to limited analysis. In the pages that follow there is discussion of data for the crops: alfalfa, alfalfa + other, triticale & corn silage. There is limited discussion of other crops: grapes, hops, mint, grain corn, & wheat. There is analysis of the impact of double cropping, fertilizer practices and root depth. This study is not sufficiently sophisticated to analyze combinations of factors. The results apply only to the data in the DSS and should only be applied to the entire GWMA target area with caution. Spring and fall data collections are analyzed separately in most of the analyses that follow.

DSS Goals: Suggested goals for end of harvest soil testing at the two foot level in Eastern Washington can be adapted from the WA State General NPDES permit for Concentrated Animal Feeding Operations. (Ecology, 2017). According to this document there is low risk when end of harvest nitrate levels at two feet are < 55 # per acre, medium risk when levels are 55# per acre to 110 # per acre, high risk when levels are 110 # per acre to 165 # per acre and very high risk when levels are > 165 # per acre.

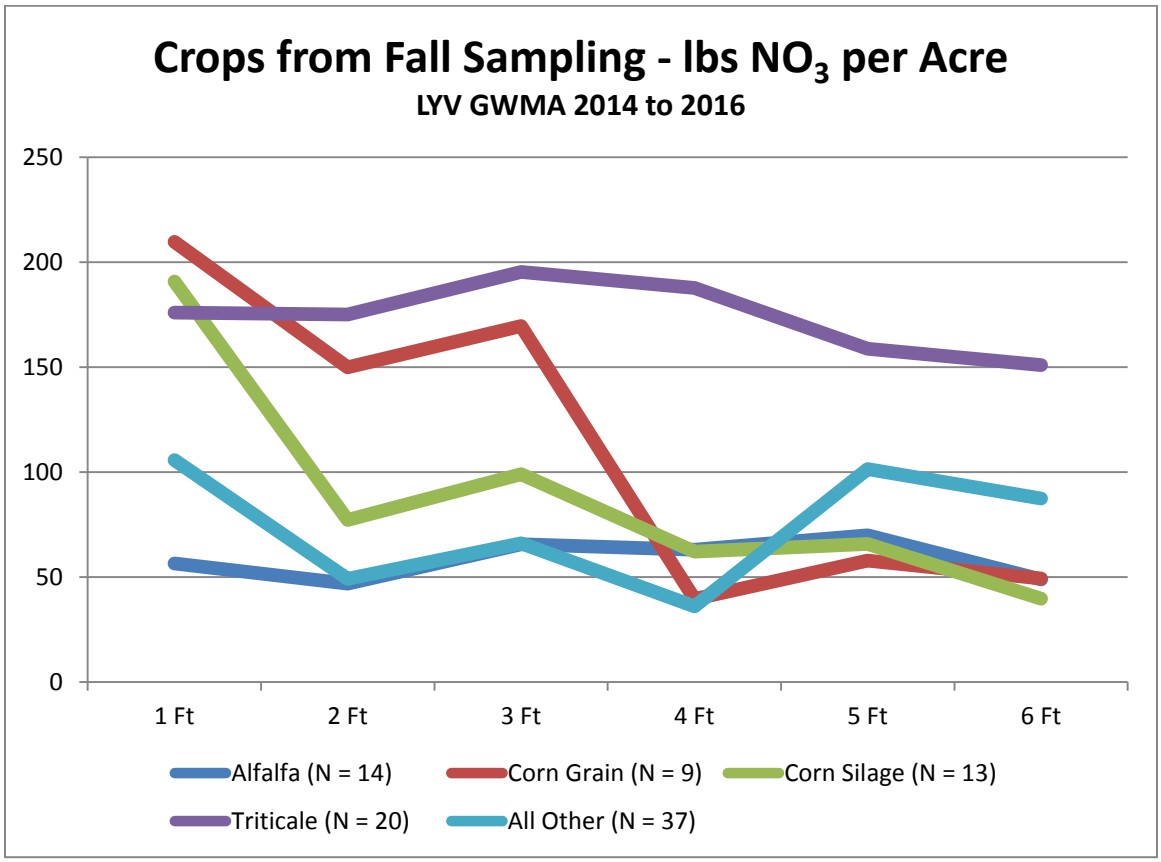
Here is a graphic representation with the average nitrate levels from fall and spring DSS testing in the LYV GWMA target area:

Graph 7.

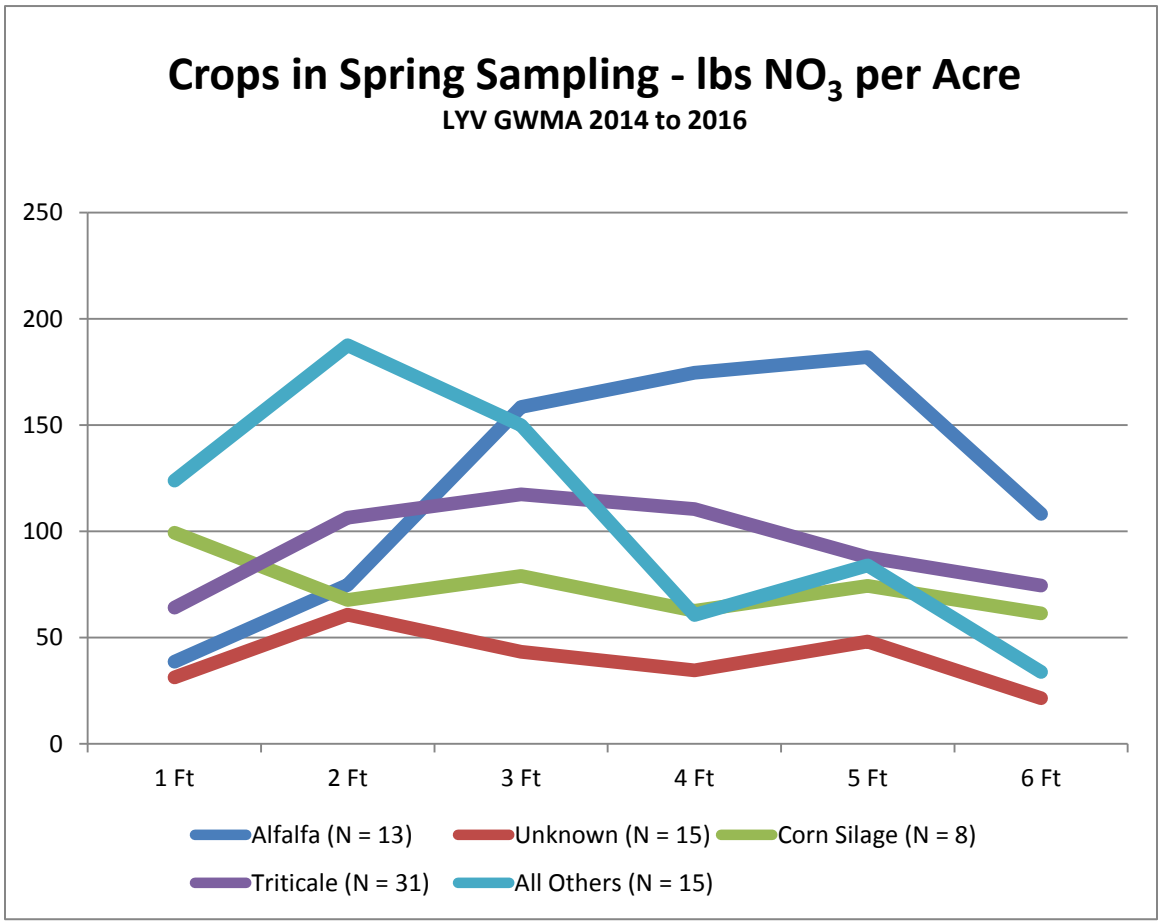


Major Categories: The majority crops in the fall sampling were triticale (n=20), alfalfa (n = 14), corn silage (n=13), corn grain (n=9) and all others (n=37). The majority crops in the spring sampling were triticale (n=31), unknown (n=15), alfalfa (n=13), corn silage (n=8) and all others (n=15).

Graph 8.

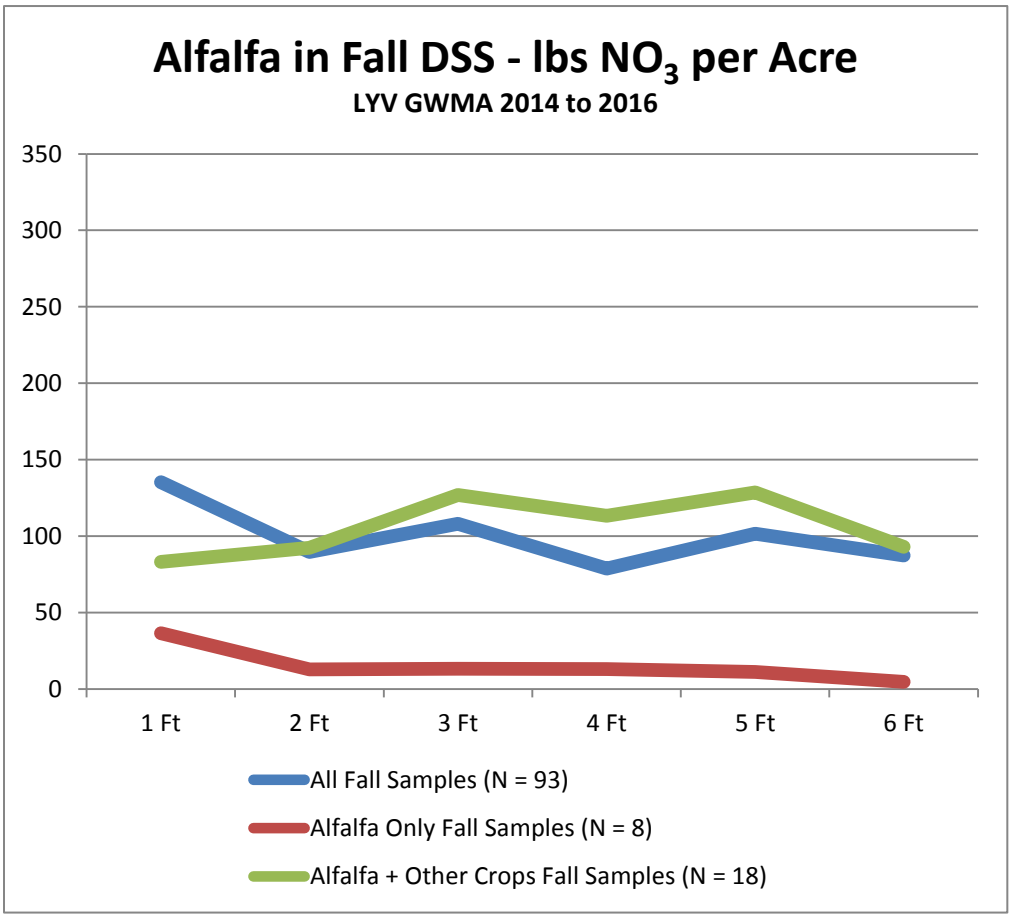


Graph 9.



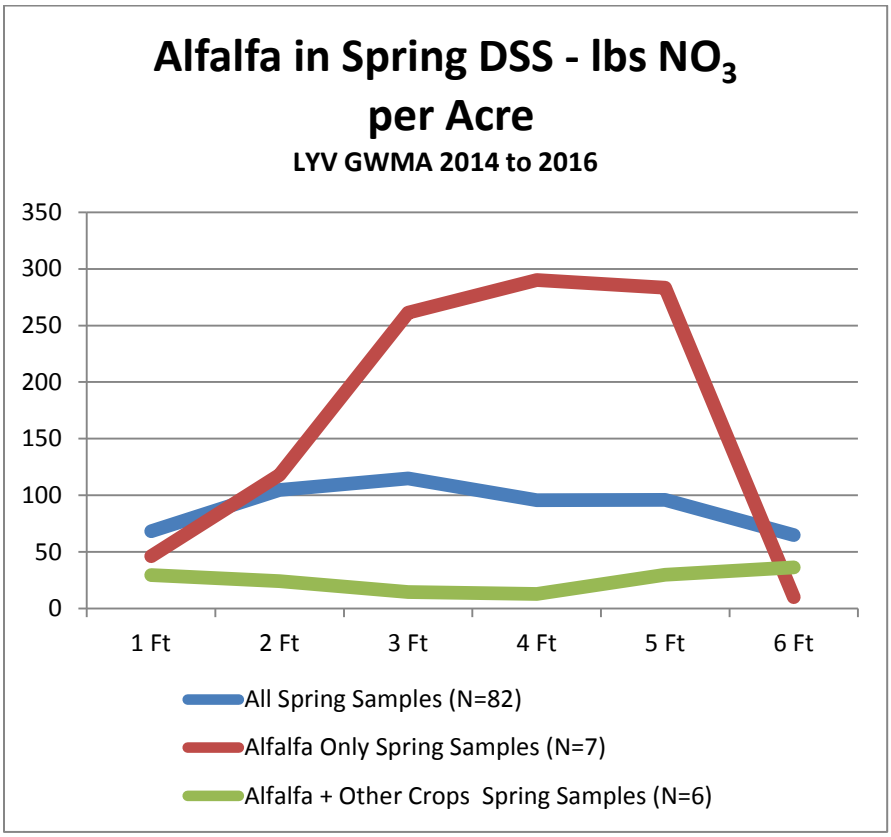
Alfalfa: Analysis of the data for alfalfa from the fall samplings strongly suggests that when alfalfa is the only crop planted on a field for several years, then nitrate levels tend to be low. When other crops are rotated onto the field then nitrate levels tend to be higher. Fertilization practices naturally have a strong influence.

Graph 10.



But when the alfalfa data from spring sampling is analyzed there are surprises. The spring alfalfa fields have much higher nitrate levels than the combined fields for all spring sampling. Alfalfa only fields have higher nitrates than the fields with alfalfa plus multiple other crops in the spring sampling.

Graph 11.



A closer look at the spring "alfalfa only" data provides a clue. There are some extreme values in fields #2044, #2047 and #4152. The range of values for these fields is huge.

Table 5. Spring Sampling: Alfalfa = Only Crop

Field ID	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total	Ammonia	Organic
2045	29	4	20	22	13	31	119	25	2.37
2047	113	466	913	951	626	242	3321	21	3.11
2073	36	35	31	38			140	27	2.42
2074	75	55	68	97	94	26	415	26	2.51
4152	25	106	319	279	256	219	1204	26	2.63
2044	29	152	457	623	706	409	2376	31	3.4
4153	17	9	21	21	5	10	83	17	2.62
Averages	46.29	118.14	261.29	290.14	283.33	10	1094	24.7	2.72

According to the DSS spreadsheets for the fields with high nitrate levels:

- No irrigation type is listed for #2044 but it is likely sprinkler. Soil testing is done annually. “No nutrients have been applied during last four years.” Crop yield is slightly less than average at 7.5 tons per acre. Soil type is Outlook Silt Loam with a moderately high to high Ksat. Rooting depth averages 3.7 ft with a range of 1.5 ft to 5.4 ft
- Irrigation is pivot sprinkler for #2047. Soil testing is done annually. This field received 300#/acre of N from liquid manure in 2012, 2013, & 2014 and 150#/acre of N from liquid manure in 2015. Average crop yield was 8.75 tons per acre. Soil type is Warden Silt Loam 5-8% slopes with moderately high to high Ksat. Average rooting depth is 3.8 ft with a range of 2ft to 5.9 ft.
- Irrigation is pivot sprinkler for #4152 and moisture sensors had been in place for a year. Soil testing is done annually. “No nutrients applied from 2013 thru 2016”. Average crop yield was 8 tons per acre. Soil type is Sinloc Silt Loam 2-5% slopes with a moderately high to high Ksat. Rooting depth averaged 4 ft with a range of 1.5 ft to 6 ft.

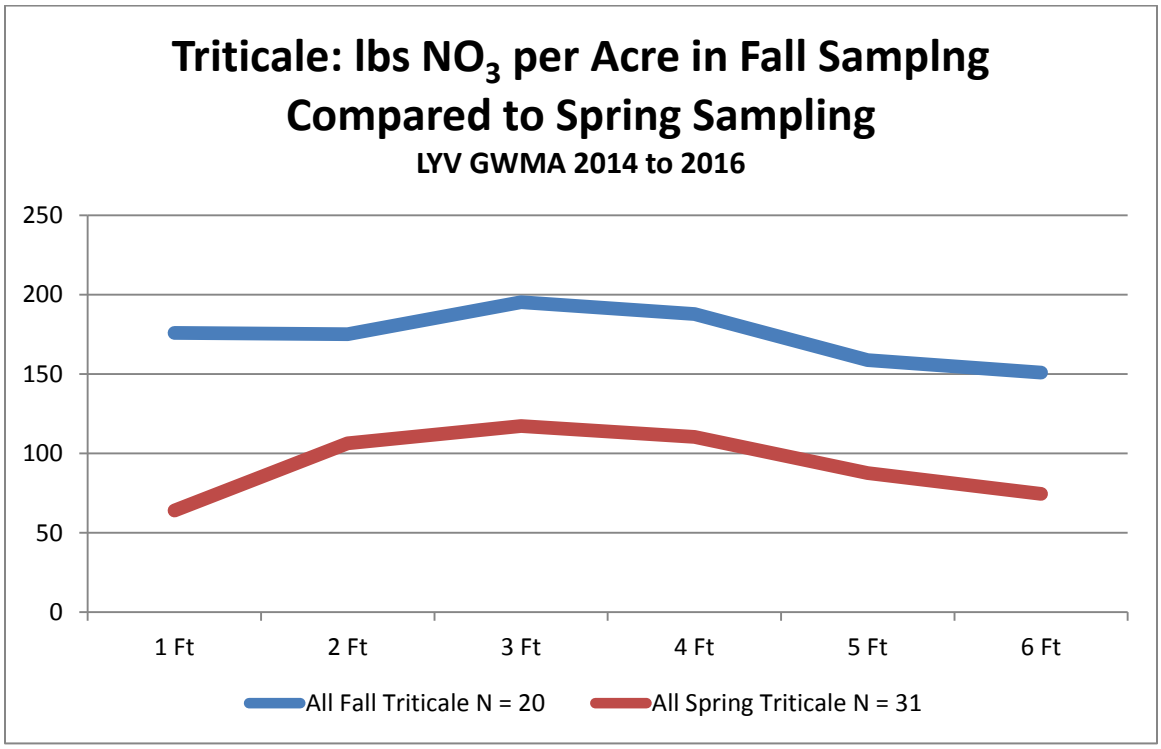
For the fields with low nitrate levels:

- Irrigation is by wheel lines on field #2045. Soil testing is done annually. “No nutrients applied since fall of 2011.” Crop yield is slightly less than average at 7.5 tons per acre. Soil type is Sinloc Fine Sandy Loam 0-2% slopes with moderately high to high Ksat. Rooting depth averaged 3.55 ft with a range of 3 ft to 4.7 ft.
- Irrigation is by pivot sprinkler on field #2073. Soil testing is done twice a year. The field received 150# of N per acre from liquid manure in 2012, 2013, 2014 & 2015. Crop yield was 9.75 tons per acre. Soil type is Warden Silt Loam 8-15% slopes with moderately high to high Ksat. Rooting depth averaged 3 ft with a range of 2.4 ft to 3.3 ft. There was refusal of the auger at < 4 ft at all four bore holes.
- Irrigation is by wheel lines on field #2074. Soil testing is done annually and soil moisture sensors are used. The field received 106 #N per acre in 2012 and 177 #N per acre in 2013 & 2014 from liquid manure. Crop yield averages 8 tons per acre. Soil type is Finley Silt Loam 0-2% slopes with high Ksat. Rooting depth averages 3.9 ft with a range of 2.6 ft to 6 ft.
- Irrigation is by wheel lines on field #4153. Soil testing is done annually. “No nutrients applied 2013 thru 2016.” Crop yield averages 16.7 tons of green chop per year. Soil type is Warden Silt Loam 5-8% slopes with moderately high to high Ksat. Rooting depths average 3.9 ft with a range of 3 ft to 4.8 ft.

This information is insufficient to explain the great differences in nitrate levels.

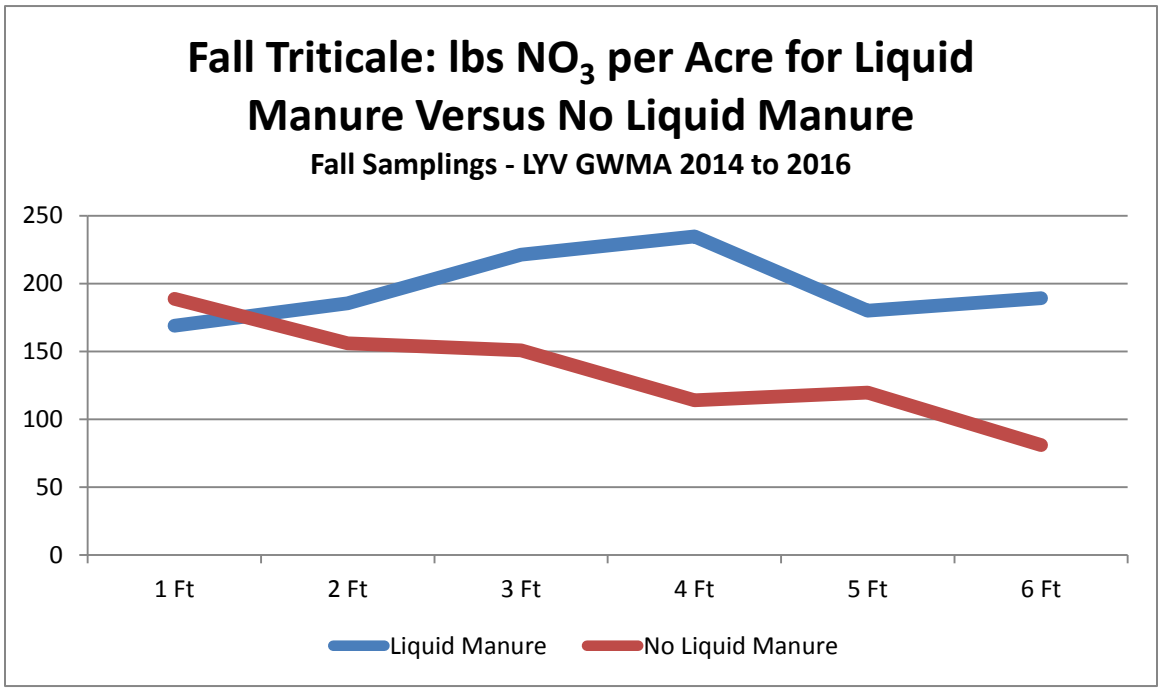
Triticale: Most of the fields planted in triticale are double cropped with corn silage. For purposes of analysis the fields in which triticale is listed as the most recently harvested crop in the *Crop #1* category are considered. Nitrate levels from triticale fields were higher during the fall sampling than during the spring sampling. Overall nitrate levels tended to peak at a depth of 3 ft.

Graph 10.

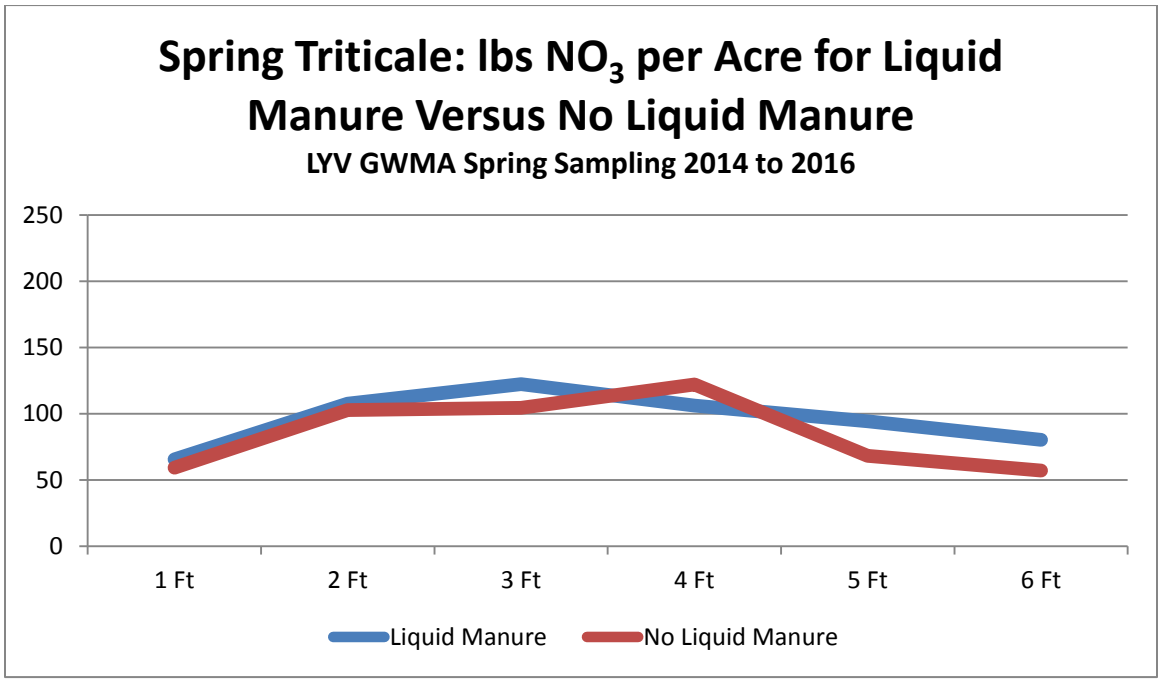


In the fall sampling triticale fields that received liquid manure tended to have higher nitrate levels than those that did not.

Graph 11.

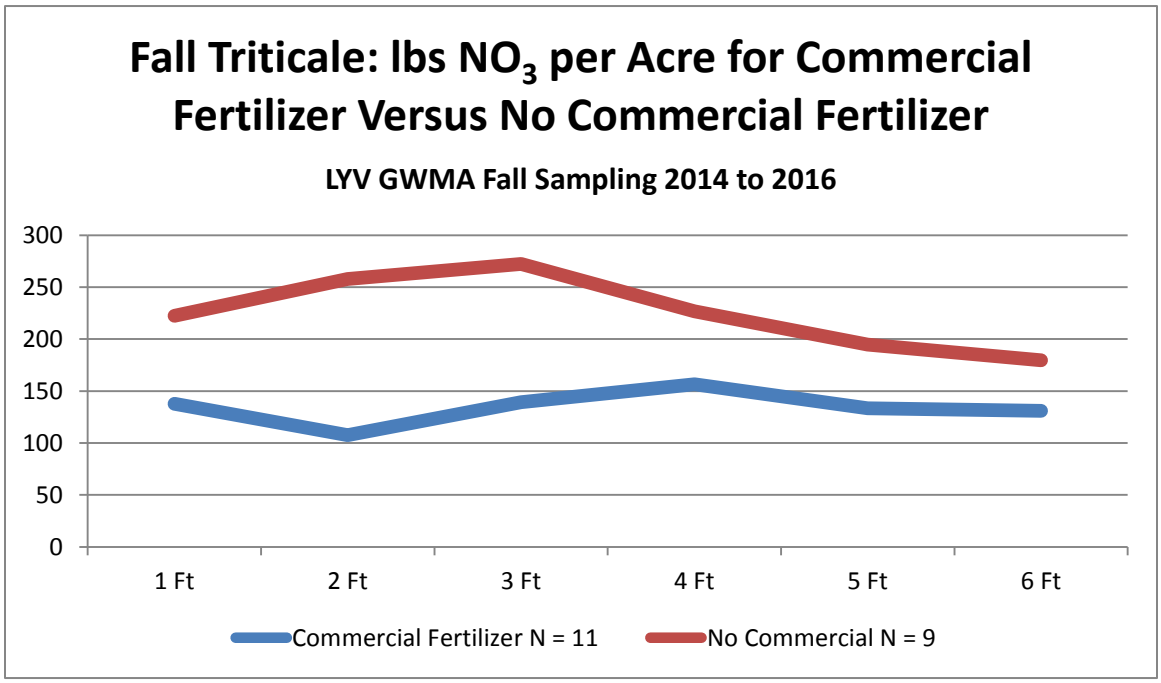


Graph 12.

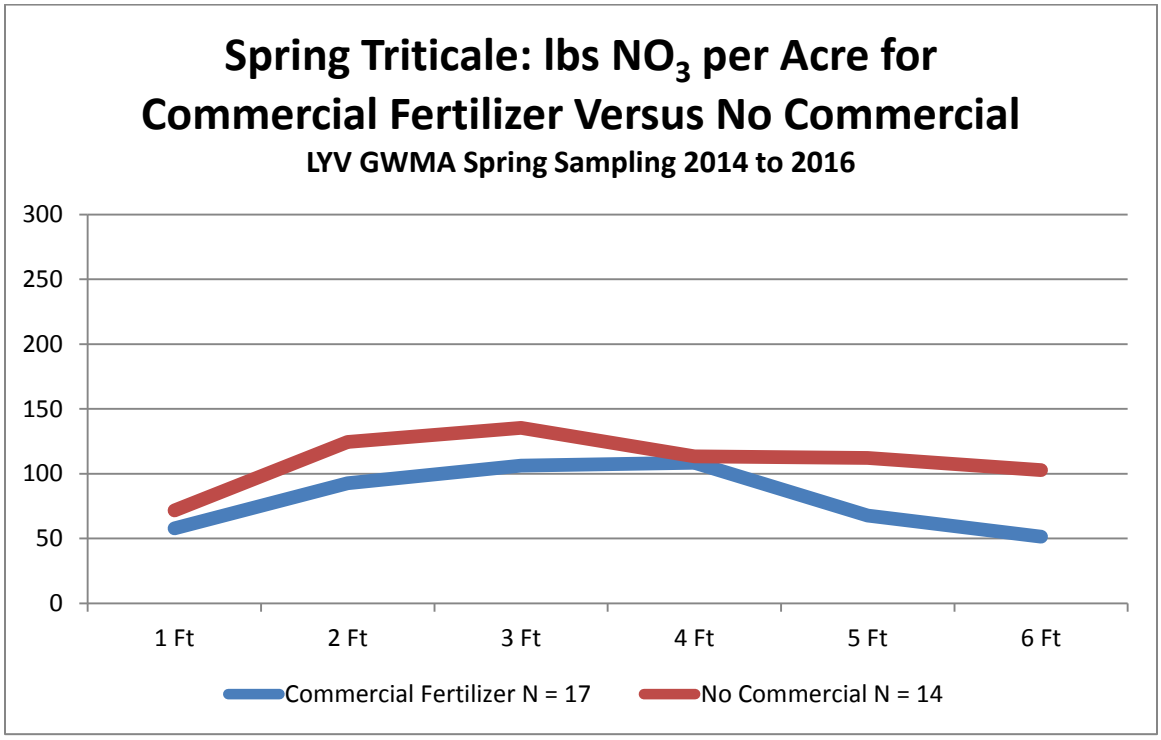


Triticale fields that received commercial fertilizer tended to have lower nitrate levels than those that did not.

Graph 13.

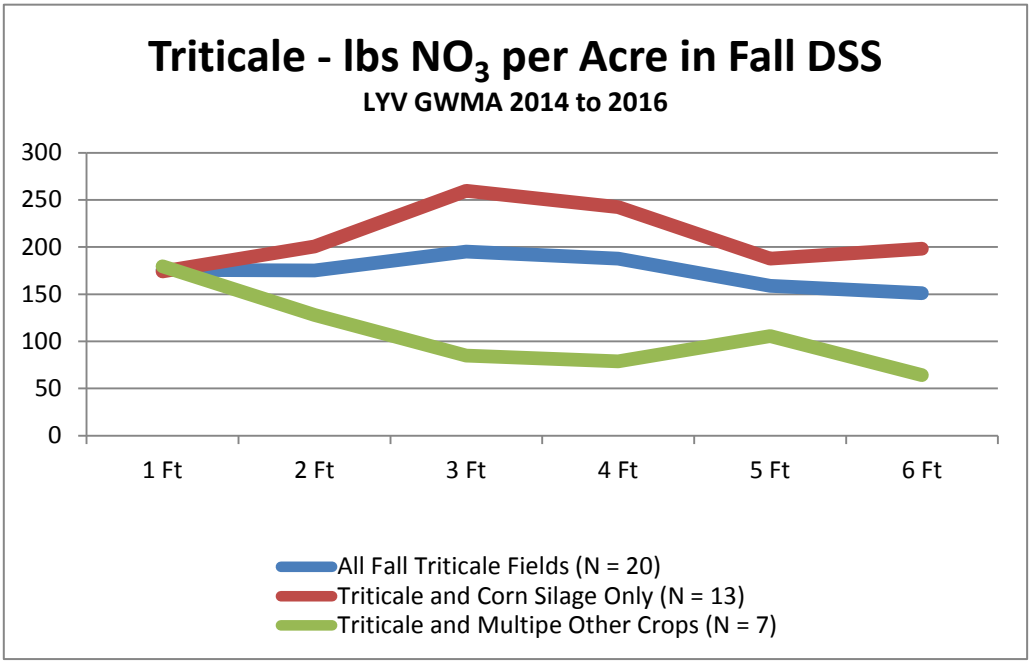


Graph 14.

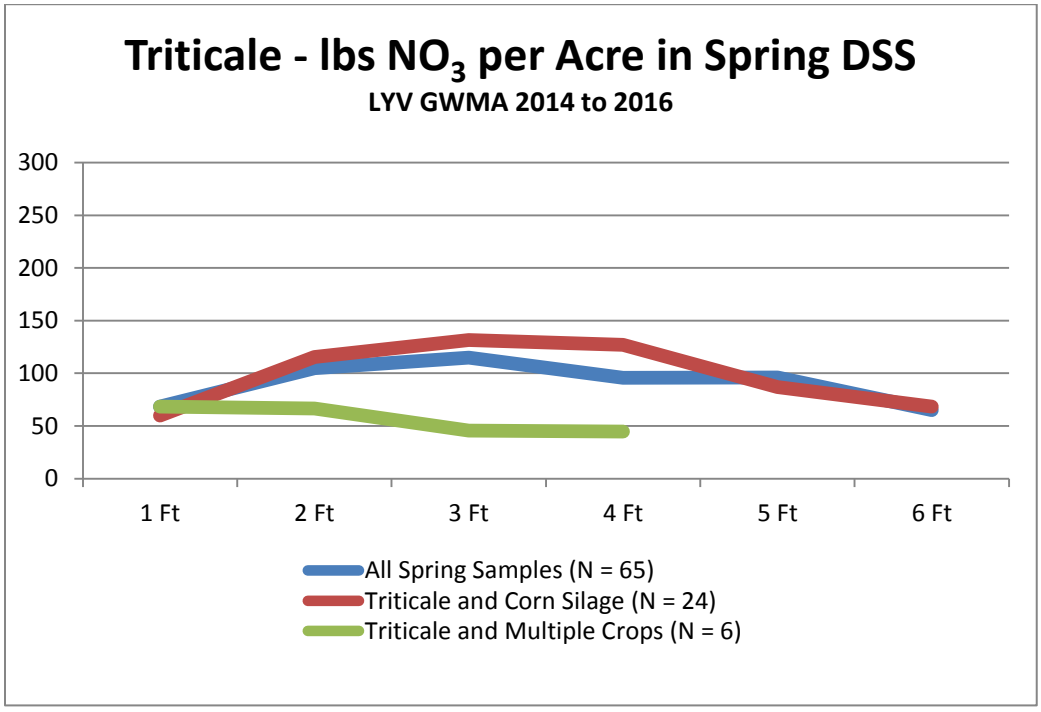


Fields planted only in triticale and corn silage tended to have higher nitrate levels than fields planted in triticale plus multiple other crops.

Graph 15.

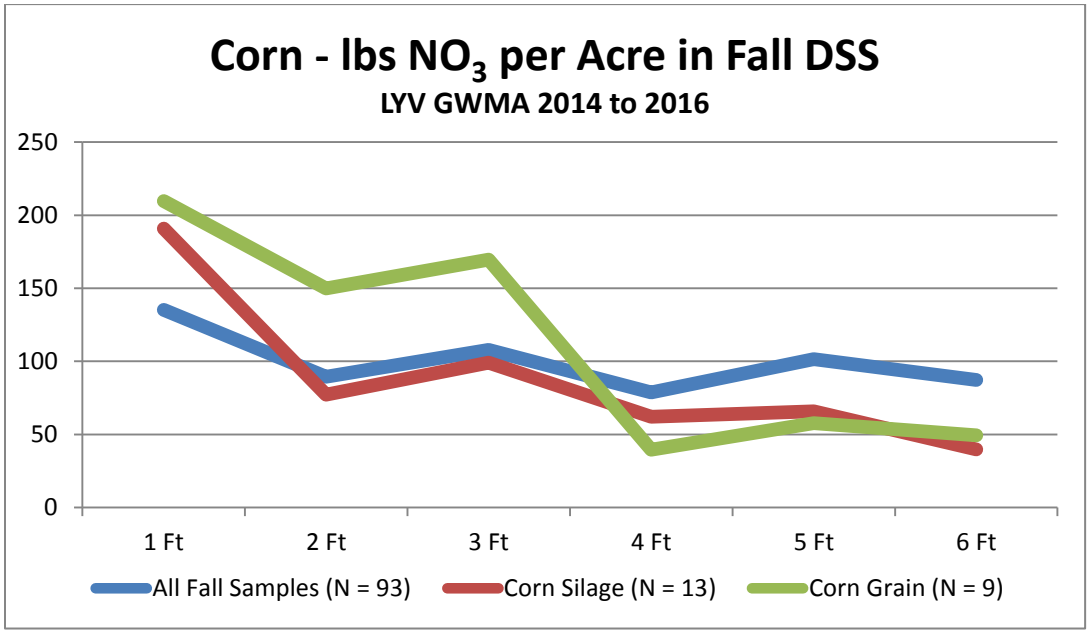


Graph 16.

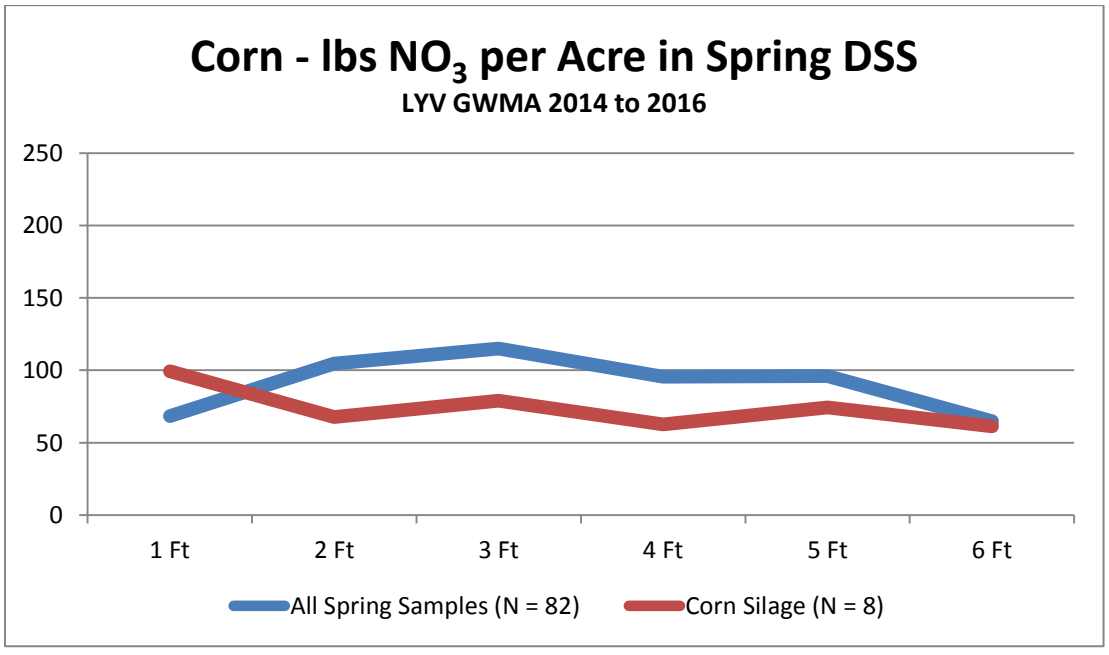


Corn: Both grain corn and silage corn fields were sampled in the fall. Only silage corn was sampled in the spring. Except for the first foot silage corn had lower nitrate levels than the average of all crops in both fall and spring. The fields described below had corn as the most recently harvested crop in the *Crop #1* category of the spreadsheets.

Graph 17.



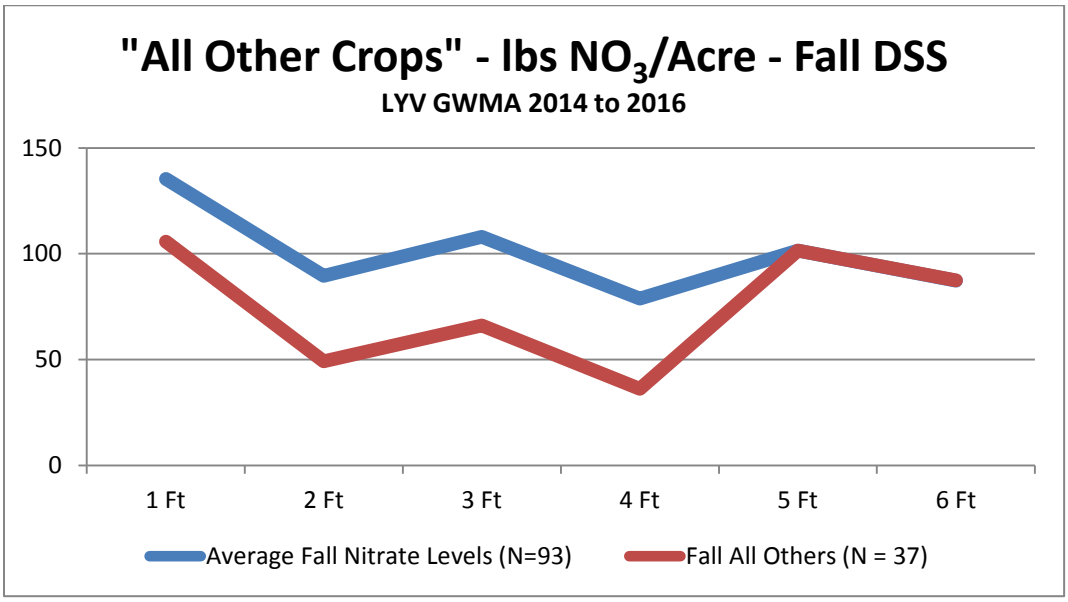
Graph 18.



"All Other Crops": This includes first listed crops other than alfalfa, corn and triticale.

Fall Sampling: There were 37 fields out of 93 for this category in the fall samplings. Crops were: apples (3), barley (1), cherries (2), fallow (1), grapes (6), hay (3), hops (5), mint (5), pasture (5), pears (1), Sudan grass (1), wheat (3), and wine grapes (1)

Graph 19.



Here are the nitrate levels at depths for those fall DSS crops with more than 2 samples. There was refusal before six feet for 17 out of 37 fields so total nitrogen is not included. There were potential outliers.

Table 6. NO_3 Levels for "All Other" Crops for LYV GWMA Fall Sampling

	N	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Ammonia	Organic
"All Other"	37	105.68	49.11	66.03	36.13	101.43	87.43	21.76	1.86
Apples	3	35.33	19	7	3.5	3	3	13.33	1.87
Cherries	2	34	4.5	3	3			6.5	1.26
Grapes *	6	19.33	111.5	182	146	301	292	10.67	1.35
Hay	3	15	5.67	9	7.67	14	18	19.33	1.89
Hops *	5	519.8	27	161	28.2	377.5	304	17.2	1.64
Mint	5	33.8	6.8	21.4	17.8	14.6	13.2	28.8	1.944
Pasture	5	27.8	27	4	4.25	9.25	8	40.4	2.28
Wheat	3	59.33	185	112	45	31	19	27.33	2.02

Possible Outliers are included in the table. These extreme values strongly influence the averages:

The potential outliers are

Grapes:

- Field #3117 is a 37 acre grape field with solid set irrigation. Soil testing is done annually. “This is an organic grape vineyard. No fertilizer is applied. We use vetch legume with triticale as a cover crop and the vetch does nitrogen fixing.” Crop yield averages 6.75 tons per year. Soil type is Warden Silt Loam 2-5% slopes with moderately high to high Ksat.
- Field #3119 is a 15 acre grape field with solid set irrigation. Soil testing is done every two years. No fertilizer is applied. “Previous farmer 40 years ago had a history of excessive nitrogen application according to current farmer.” Crop yield averages 7.5 tons per acre. Soil type is Warden Silt Loam 8-5% slopes with moderately high to high Ksat.

Hops:

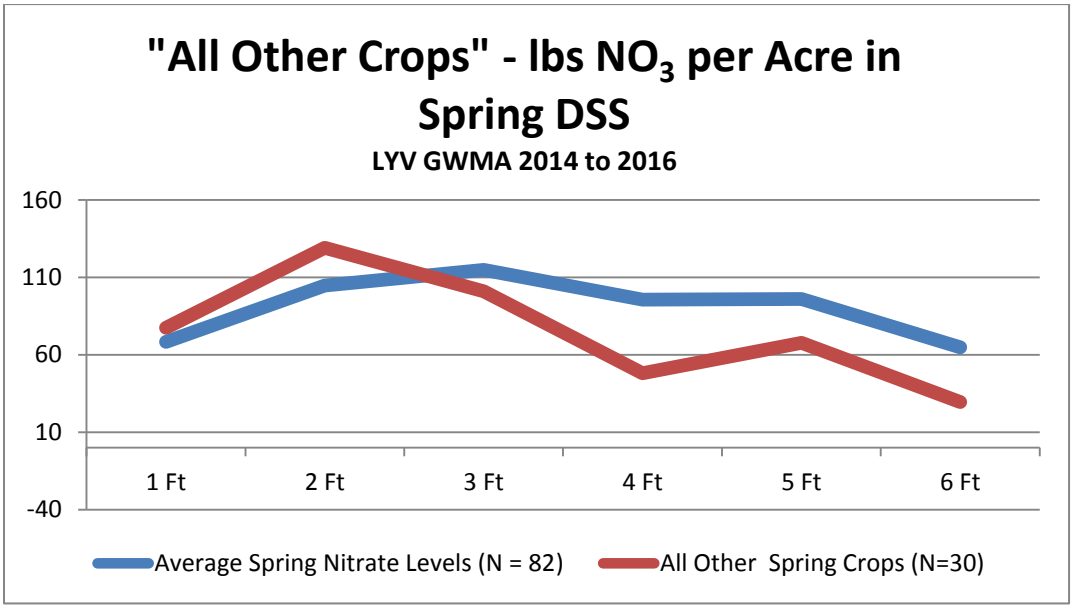
- Field #3141 is a 20 acre hop field with drip irrigation. Soil testing is done annually. 200# N per acre of commercial fertilizer was applied in 2013, 2014 & 2015. Crop yield averages 1.25 tons per acre. Soil type is Esquatzel Silt Loam 0-2% slopes with moderately high to high Ksat.

Table 7. NO_3 Levels: Potential Outliers for “All Other” Crops in LYV GWMA Fall Sampling

Field #	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total	Ammonia	Organic
3117	51	301	573	400			1325	9	1.67
3119	20	213	260	213	559	580	1845	11	1.49
3141	950	59	596	57	1344	1204	4210	22	2.25

Spring Sampling: There were 30 out of 82 fields in this category for the spring samplings. Crops were: apples (1), asparagus (2), cherries (1), hops (5), mint (2), pasture (1), wheat (2), wine grapes (1) and unknown (15)

Graph 20.



Here are the nitrate levels at depths for those spring DSS crops with more than 2 samples. There was refusal before six feet for 14 out of 30 fields so total nitrogen is not included. There were potential outliers.

Table 8. NO_3 Levels for "All Other" Crops for LYV GWMA Spring Sampling

	N	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Ammonia	Organic
All Other Crops	30	77.5	129.04	101.04	48.17	67.85	29.47	16.87	1.75
Asparagus *	2	231.5	499.5	412	207	212	111.5	14	0.91
Hops	5	124	223	111.8	28.8	30.2	20	11.4	1.43
Mint	2	176.5	68.5	175.5	48.5	158	18.5	10	162.63
Wheat	2	104	40					42	3.38
Unknown	15	31.2	60.83	43.27	34.64	48.11	21.5	16.87	1.79

Potential outliers were Fields # 4175 & 4176. These are the only asparagus fields in the DSS and should not be considered typical of asparagus in the area.

- Field # 4175 is a 10 acre asparagus field. The irrigation type is not identified and soil testing is done annually. "No nutrients applied for at least the last three years. No manure applied for over 10 years. Field gets subby when SVID canal fills up in spring and dries out when canal shuts off." No crop yield is recorded. Soil type is Cleman Very Fine Sandy Loam 0-2% slopes with moderately high to high Ksat.
- Field #4176 is a 20 acre asparagus field with rill irrigation. Soil testing is done annually. "No nutrients applied for at least the last three years. No manure applied for over 10 years. Field gets subby when SVID canal fills up in spring and dries out when canal shuts off." No crop yield is recorded. Soil type is Cleman Very Fine Sandy Loam 0-2% slopes with moderately high to high Ksat.

Here are the nitrate levels for the asparagus fields:

Table 9. Asparagus fields in the LYV GWMA Spring DSS

Field #	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total	Ammonia	Organic
4175	427	766	664	242	281	169	2549	12	0.69
4176	36	233	160	172	143	54	798	16	1.12
Average	231.5	499.5	412	207	212	111.5	1673.5	14	0.91

Here are the nitrate levels for the fields in which crops were unknown for the Spring DSS. There was early refusal on 9 out of 15 fields in this group.

Table 10. Fields with Unknown Crop in Spring DSS

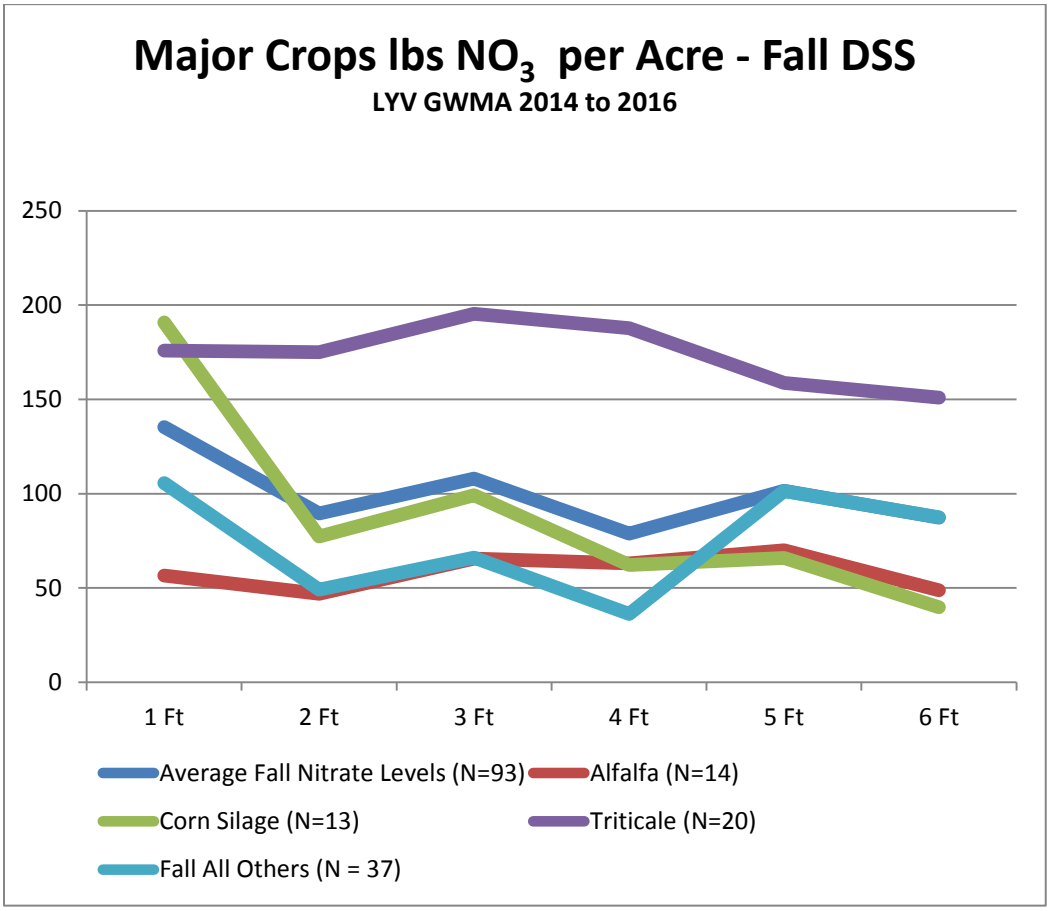
Field #	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total	Ammonia	Organic
2061	5	3	10	4			22	9	1.78
2062	5	6	11	14	10		46	7	0.84
4146	35						35	9	1.64
4147	54	51	96	197	323		721	13	1.82
4148	41	39					80	36	2.95
4151	37	10	6	4	5	3	65	16	1.19
4160	9						9	19	1.79
4162	14	4	3	3	3	63	30	30	1.66
4163	11	5	13	4	38	3	74	19	1
4164	6	3	3	5	16	14	47	12	1.54
4165	4	51	4	4	6		69	10	1.47
4168	52						52	21	3.2

4171	29	6	16	22	29	27	129	13	1.3
4172	25	11	3	3	3	19	64	15	2.02
4173	141	541	311	121			1114	24	2.64
Average	31.2	60.83	43.27	34.64	48.11	21.5	170.47	16.87	1.79

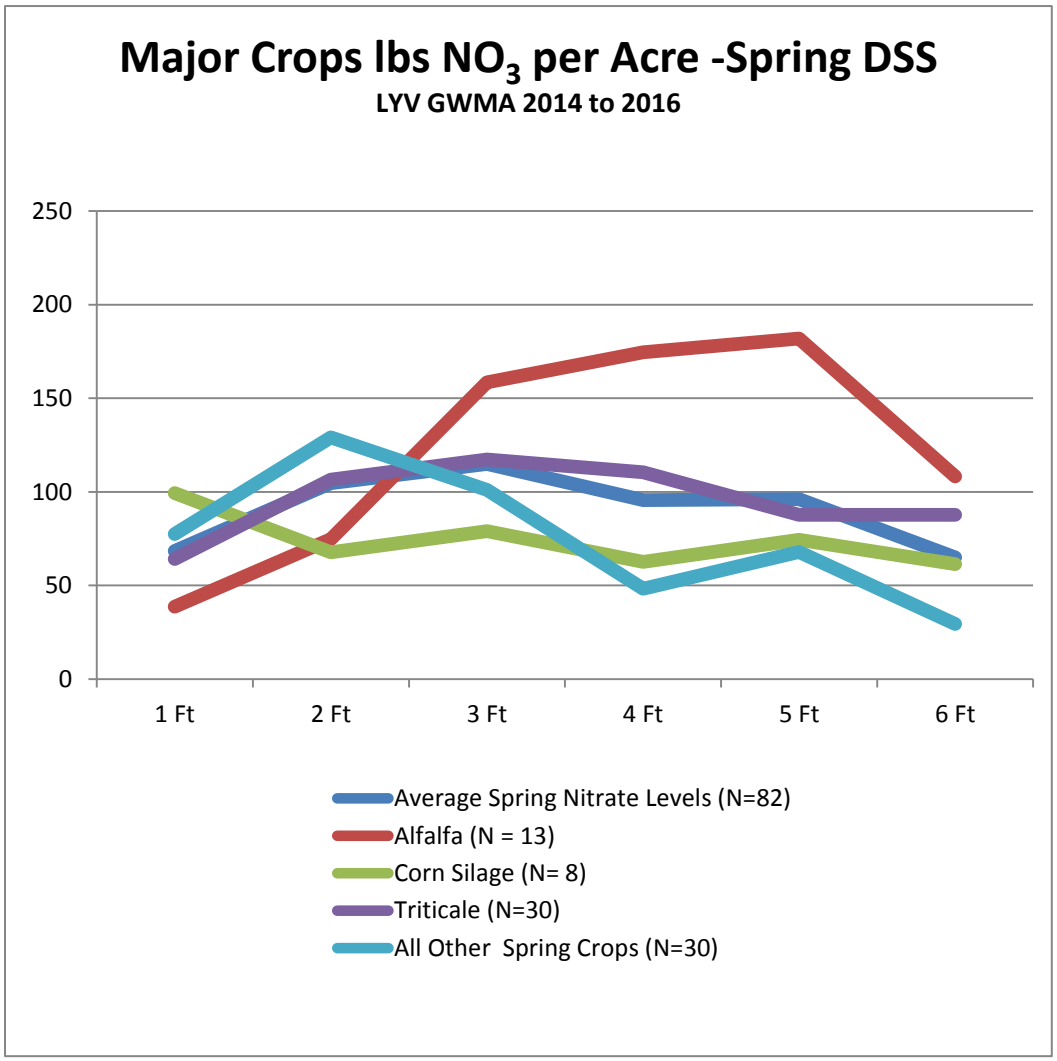
Comparison of Major Crops for Fall & Spring DSS:

Below are graphs that compare average nitrate levels for all crops to nitrate levels for: alfalfa, corn silage, triticale, and all other crops for the fall and spring DSS.

Graph 21.

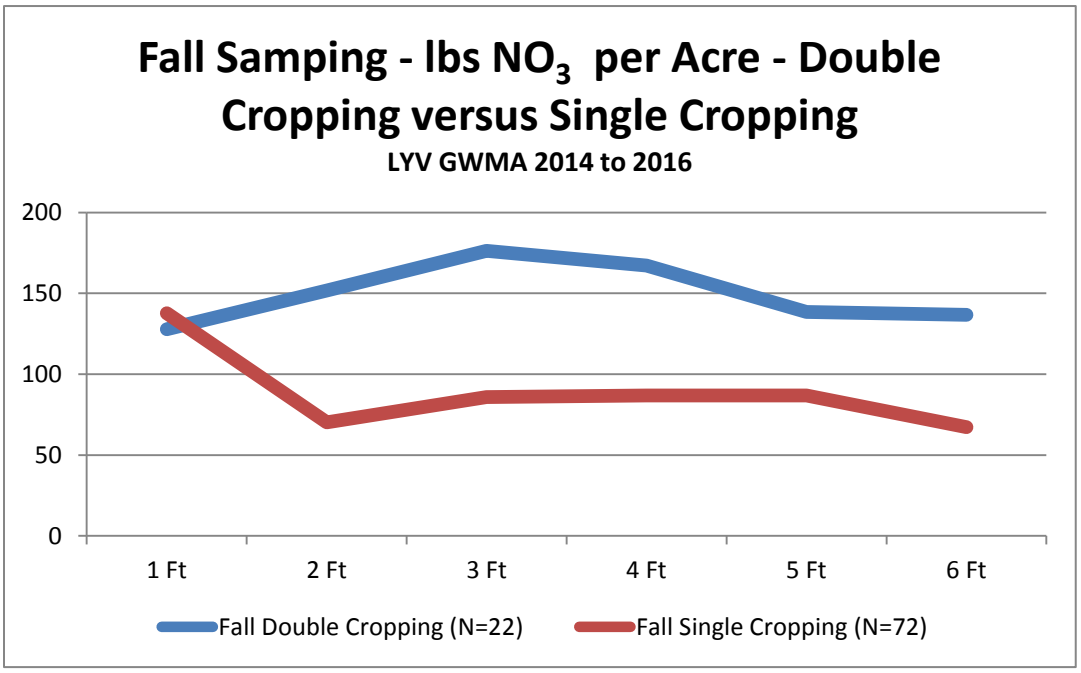


Graph 22.

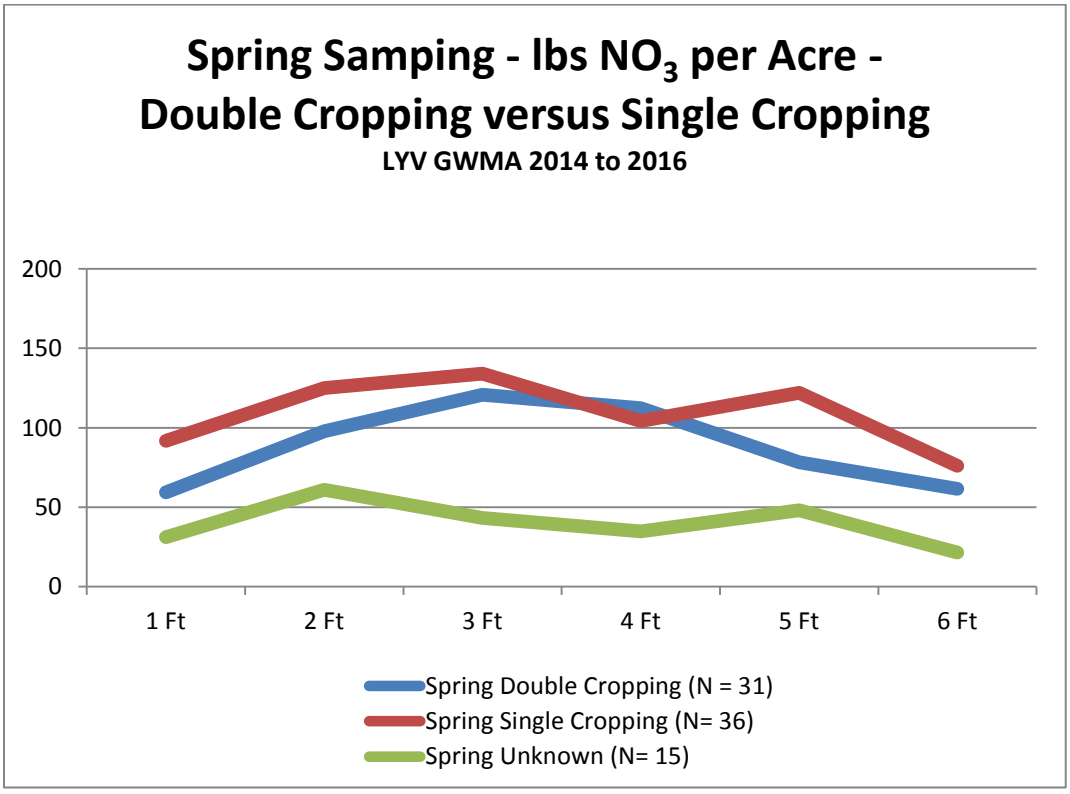


Double Cropping: This practice shows higher nitrate levels than single cropping in the fall sampling and general lower levels in the spring sampling. The 15 samples without cropping information for spring sampling complicate the analysis.

Graph 23.

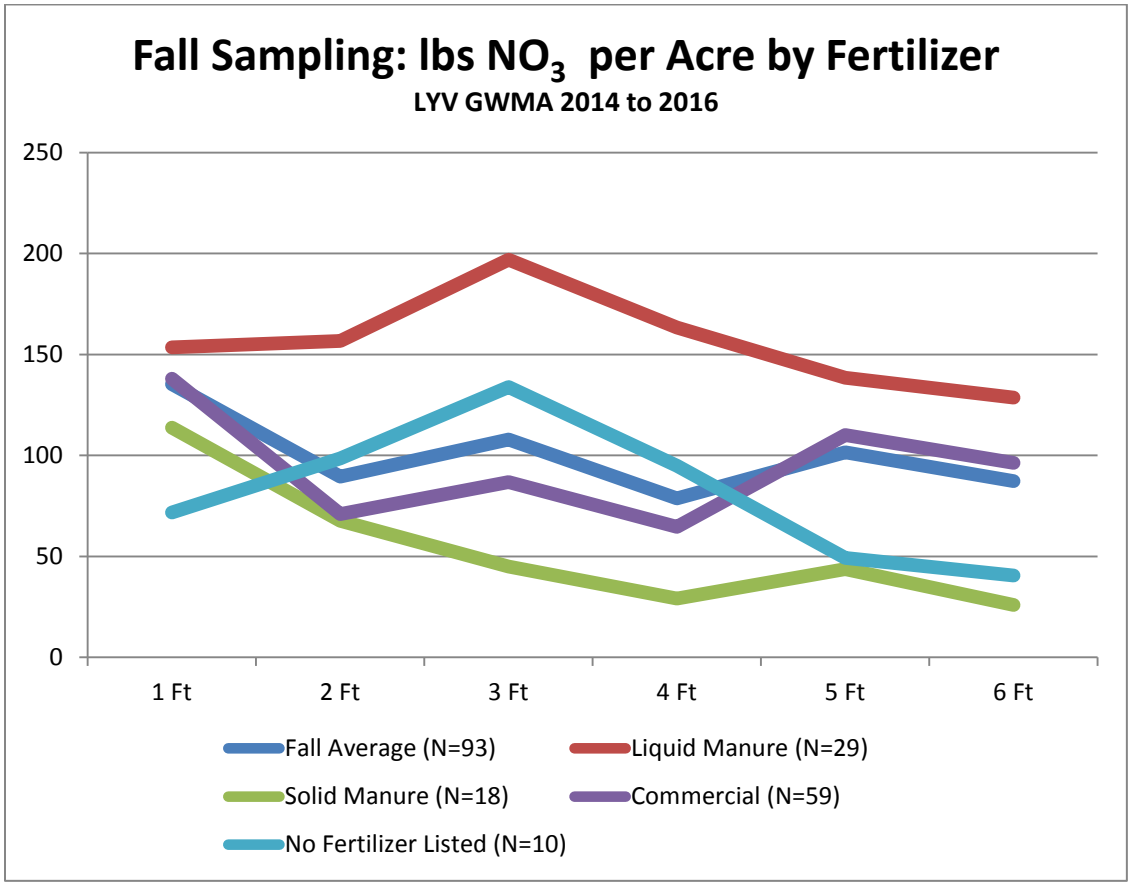


Graph 24.



Type of Fertilizer: For the fall sampling (N=93) there were fairly clear differences in nitrate levels for the various fertilizer types.

Graph 25. Fall Sampling by Fertilizer Type



There were 29 fields (31%) that received liquid manure. These fields had the highest percentage of organic matter. They were most likely to be double cropped and most likely to use sprinkler irrigation. Soil testing was highest for this group.

There were 18 fields (19%) that received solid manure. These fields had the highest ammonia levels and second highest levels of organic matter. They had the most rill irrigation and were least likely to receive sprinkler irrigation.

There were 59 fields (63%) that received commercial fertilizer. These fields had the lowest percentage of organic matter and were least likely to receive more than one type of fertilizer.

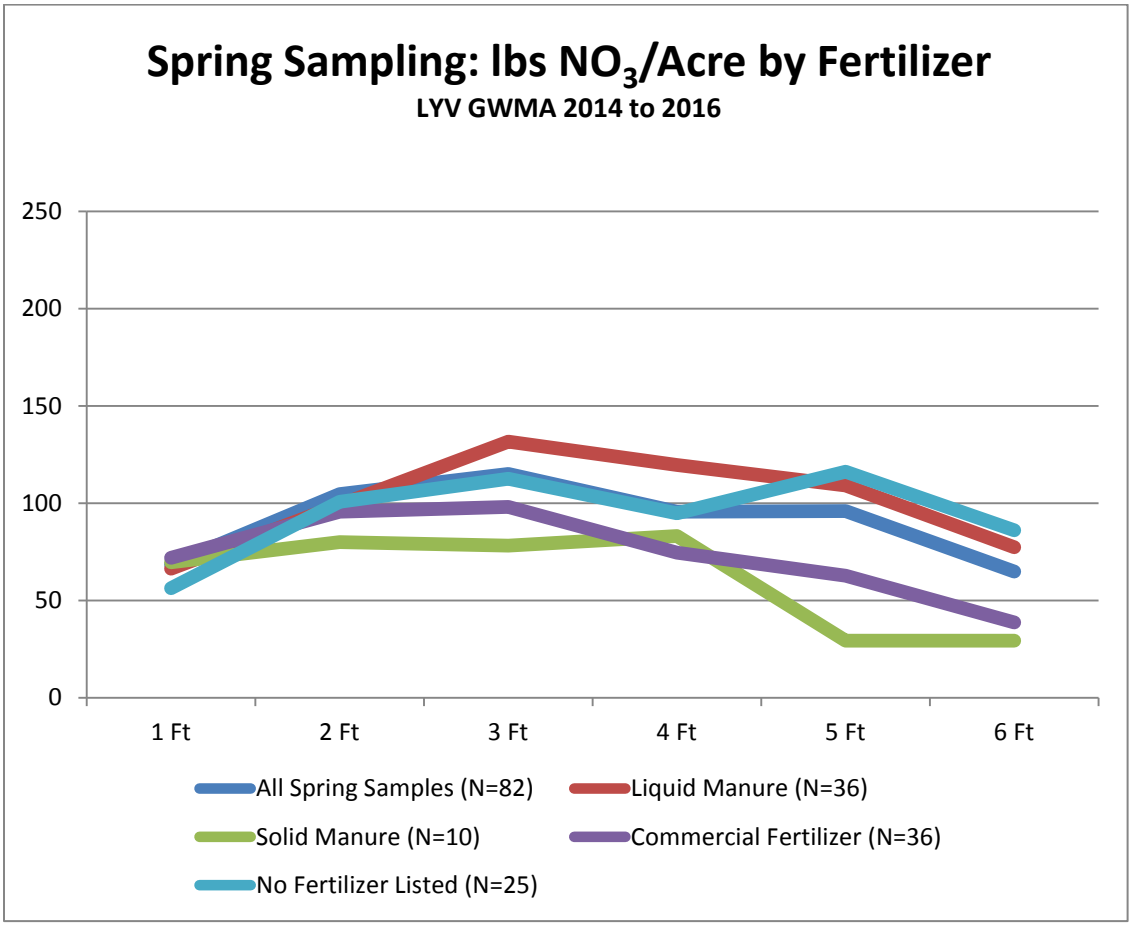
There were 10 fields (11%) with no fertilizer listed. These fields had the lowest ammonia levels and second lowest levels of organic matter. Soil testing was only done on half of these fields, the lowest percentage of all.

Table 11. Analysis of Fertilizer Types for Fall Sampling – LYV GWMA DSS

	NH_3 #/ac Average	Organic Matter	Double Cropped	Rill Irrigation	Sprinkler Irrigation	Soil Testing	> 1 Type Fertilizer
Fall Total N = 93	22.7	2.01%	24%	23%	71%	75%	
Liquid = 29	24.62	2.28%	38%	12%	88%	90%	55%
Solid N = 18	32.33	2.15%	28%	39%	61%	78%	50%
Commercial N = 59	20.27	1.9%	20%	26%	67%	80%	37%
None listed N = 10	15.5	1.94%	20%	10%	80%	50%	

For the spring sampling (N=82) nitrate levels were close together at shallow levels and spread out at deeper levels.

Graph 26. Spring Sampling by Fertilizer Type



There were 36 fields (44%) that received liquid manure. 18 of these fields also received commercial fertilizer. All had soil testing. These fields had the highest ammonia levels and the highest percentage of organic matter. They were most likely to be double cropped and had the highest percentage of sprinkler irrigation.

There were 10 fields (12%) that received solid manure. In contrast to the fall soil sampling these fields with solid manure had the lowest ammonia levels and the lowest levels of organic matter. They were least likely to be double cropped, least likely to receive sprinkler irrigation and most likely to receive drip irrigation. 60% received other additional fertilizers.

There were 36 fields (44%) that received commercial fertilizer. 18 of these fields also received liquid manure. These fields had the second highest ammonia levels and the second highest levels of organic matter.

There were 25 fields with no documented fertilizers. This includes fifteen fields with no survey data returned. These fields had the lowest levels of ammonia and organic matter.

Table 12. Analysis of Fertilizer Types for Spring Sampling – LYV GWMA DSS

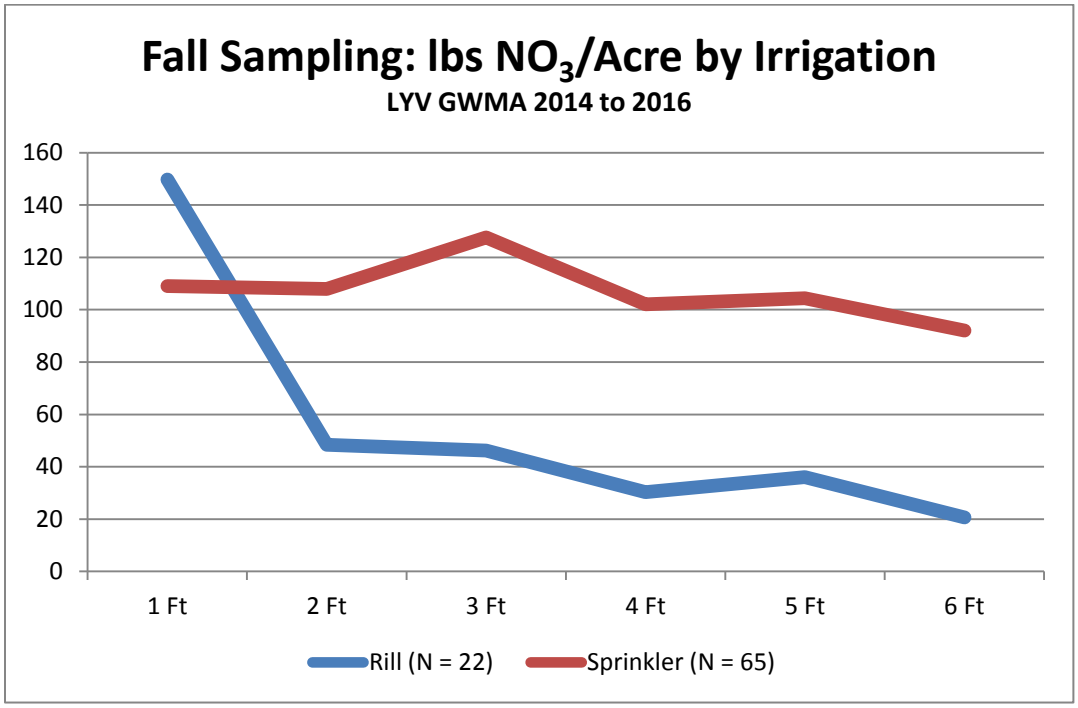
	NH_3 lbs/ac	Organic Matter	Double Cropped	Rill Irrigation	Sprinkler Irrigation	Drip Irrigation	Soil Testing	> 1 Type Fertilizer
Spring Total N = 82	23.8	2.13%	46%	10%	76%	10%	99%	35%
Liquid N = 36	30.86	2.36%	69%	8%	92%	0%	100%	56%
Solid N = 10	20.8	2.07%	50%	10%	70%	20%	100%	60%
Commercial N = 36	26.28	2.21%	56%	8%	78%	14%	97%	58%
None Listed N = 25	18.44	1.85%	4%					

Type of Irrigation: One field in the 93 fall samples received no irrigation. Five fields received drip irrigation and that analysis was complicated by early refusals and the fact that two fields had extremely high and unusual nitrate readings. For this reason drip irrigation is not included in the fall analysis.

Nitrate levels for the 65 fields that received sprinkler irrigation remained around 100 lbs per acre at all levels while the readings for the 22 fields that received rill irrigation rapidly declined after 1 foot.

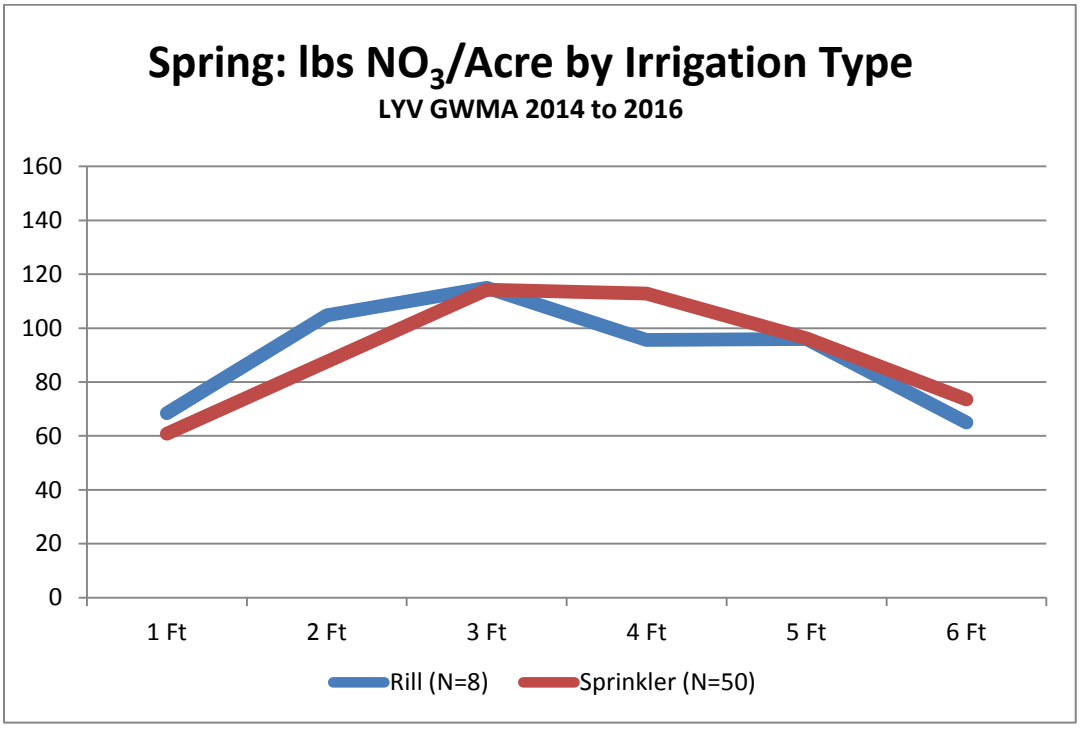
There were 2 fields that had both rill and sprinkler irrigation. They were placed in the rill category according to the DSS plan.

Graph 27.



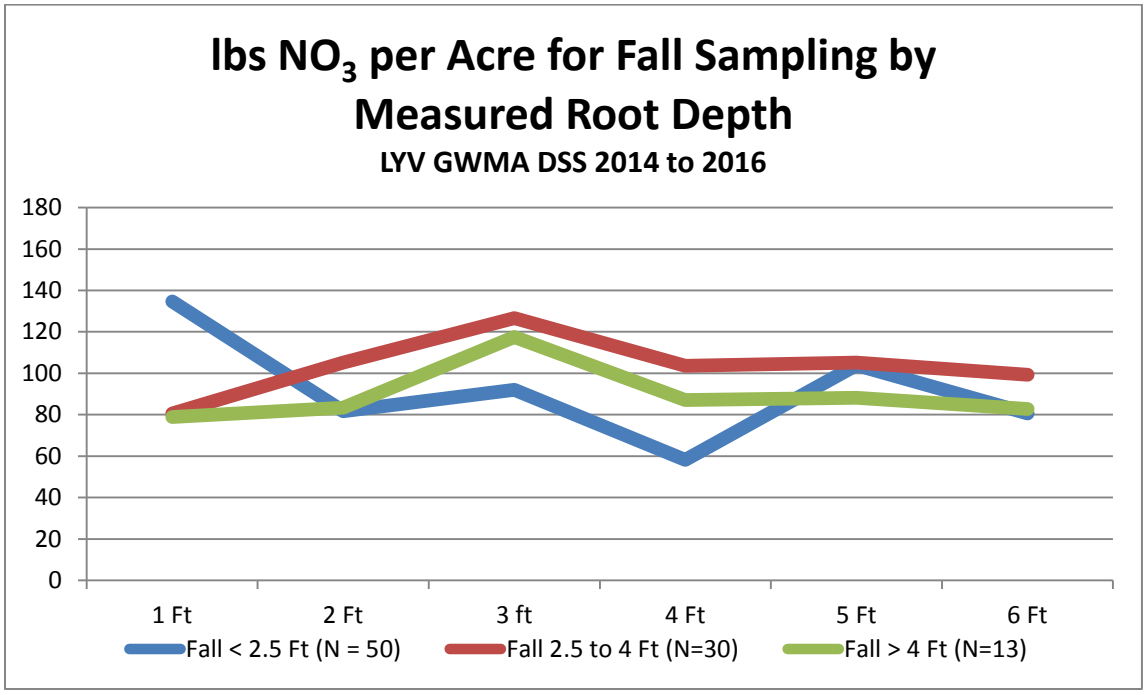
For clarity only rill and sprinkler irrigation for spring sampling are presented here.

Graph 28.



Measured Root Depth: The teams that gathered the soil samples measured root depths on each sampled field. This makes possible a comparison of nitrate levels based on how deep the root of crops penetrated the soil. This is not the same as grouping root depth by crops.

Graph 29.



Graph 30.

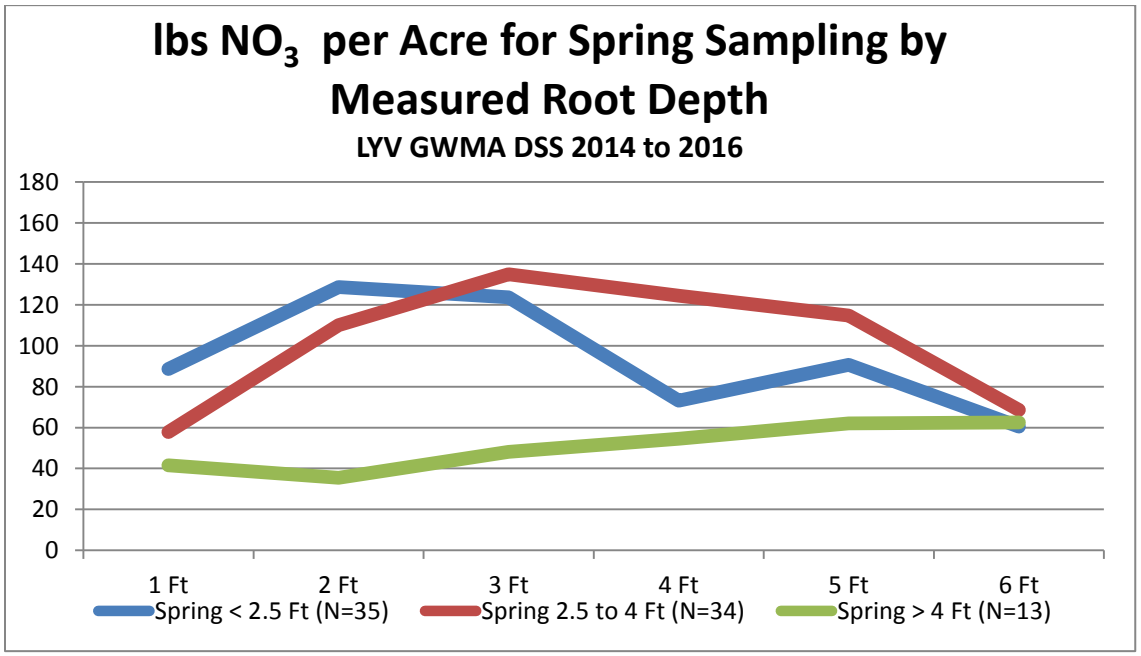


Table 13. NO_3 Levels by Measured Root Depths for Fall & Spring DSS

	Fall 2014 & 2015		Average N by Measured Root Depths						
Group	N	1 FT	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	Ammonia	Organic
< 2.5 Ft	50	134.72	81.76	92.02	58.15	103.91	80.63	35.46	2.06%
2.5 to 4 Ft	30	160.8	105.2	126.63	103.57	105.23	99.32	17.67	1.87%
> 4 Ft	13	78.92	83.38	117.54	87.08	88.17	82.83	23.69	2.12%
	Spring 2015 & 2016		Average N by Measured Root Depths						
Group	N	1 FT	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	Ammonia	Organic
< 2.5 Ft	35	88.6	128.63	123.64	73.1	90.6	60.5	23.23	2.21%
2.5 to 4 Ft	34	57.85	110.06	134.88	124.47	114.68	68.54	21.79	2.1%
> 4 Ft	13	41.54	35.46	48.08	54.54	62	62.46	30.62	2.03%

The measured root depths are different from the classification of root depths according to crop type. There is a full range of crops in each category of measured root depths. For example the category < 2.5 feet in the fall sampling included fields planted in triticale, corn, pasture, alfalfa, grapes, barley, mint, apples, grass hay, hops, and pears.

Note the lower nitrate levels for samples where the roots extend to deeper levels.

Statistical Analysis

Another way to look at the data is to describe the sampling at different soil depths. For the sake of brevity this paper only looks at the 2 Ft and 4 Ft depths. Two feet is the approved level for deep soil testing in Ecology's newly released CAFO General Permit. Four feet is below the root depth for most crops in the DSS and consequently estimates nitrate available for leaching.

The analyses that follow look at the results of soil testing at these levels from a statistical perspective. Previous graphing shows apparent differences in nitrate levels with respect to crops, irrigation, fertilizers and leaching factors. The Student T-test is used here to determine whether those differences have statistical significance. The calculations are

based on whether a factor is present or not present. There is no attempt to measure complex associations.

Two Foot Analysis

Table14. Characteristics of Risk Levels at Two Foot Sampling Depths (Low Risk is < 55 lbs NO_3/Acre, Medium Risk/High Risk is 55 lbs NO_3/Acre to 165 lbs NO_3/Acre, Very High Risk is > 165 lbs NO_3/Acre)

		Low Risk	Medium/High Risk	Very High Risk
N		96	47	27
Irrigation				
	Rill	19 (20%)	6 (13%)	3 (11%)
	Sprinkler	62 (65%)	35 (74%)	18 (67%)
	Drip	4 (4%)	4 (9%)	4 (15%)
	Unknown/None	12 (12%)	2 (4%)	2 (7%)
Crops				
	Alfalfa	19 (20%)	6 (13%)	2 (7%)
	Apples	3 (3%)		1 (4%)
	Asparagus			2 (7%)
	Barley	1 (1%)		
	Cherries	3 (3%)		
	Corn Grain		2 (4%)	2 (7%)
	Fallow		1 (2%)	
	Corn Silage		9 (19%)	2 (7%)
	Grapes	3 (3%)	1 (2%)	2 (7%)
	Hay	3 (3%)		
	Hops	4 (4%)	3 (6%)	3 (11%)
	Mint	6 (6%)	1 (2%)	
	Pasture	5 (5%)	1 (2%)	
	Pears	1 (1%)		
	Sudan Grass		1 (2%)	
	Triticale	19 (20%)	21 (45%)	10 (37%)
	Wheat	2 (2%)		2 (7%)
	Wine Grapes	1 (1%)	1 (2%)	
	Unknown	11 (11%)		1 (4%)
	Double Crop	26 (27%)	15 (32%)	10 (37%)

Fertilizer							
	Liquid Manure		29 (30%)		22 (47%)		12 (44%)
	Solid Manure		17 (18%)		8 (17%)		3 (11%)
	Commercial		54 (56%)		26 (55%)		13 (52%)
	Biosolids						1 (4%)
	Compost		2 (2%)				
	Unknown/None				7 (15%)		5 (19%)
Leaching							
	Low		5 (5%)		4 (9%)		1 (4%)
	Moderate		78 (81%)		39 (83%)		25 (93%)
	High		13 (14%)		4 (9%)		1 (4%)

A. Irrigation Types: Analysis using the Student T-test at the 2 foot soil testing depth finds no statistically significant difference in nitrate levels for different types of irrigation except that rill irrigation is associated with lower nitrate levels at the $p < .10$ level of significance.

Rill Irrigation: The average nitrate level at two feet for fields that received rill irrigation is 61.67 lbs per acre. The average nitrate level at two feet for fields with documented irrigation type that did not receive rill irrigation is 102.66 lbs per acre. *The t-value is -1.41917. The p-value is .078941. The result is not significant at p < .05 but it is significant at p < .10.*

B. Crops by Category from DSS Plan: Analysis using the Student T-test was performed for crops at the < 2.5 ft root depth, 2.5 to 4 ft root depth, > 4 ft root depth, > 4 ft root depth minus alfalfa, for alfalfa, corn silage and triticale. Soil tests for fields with no documented crops were omitted from the calculations. Most results were not statistically significant. Here are the noteworthy results.

< 2.5 Ft Root Depth: The average nitrate level at two feet for this category was 24.43 lbs per acre (N=7). The average nitrate level for all other categories was 102.58 lbs per acre. *The t-value is -1.34184. The p-value is .090799. The result is not significant at p < .05 but it is significant at p < .10.*

Alfalfa: The average nitrate level at two feet for alfalfa was 60.30 lbs per acre. The average nitrate level for all other crops was 107.11 lbs per acre. *The t-value is -1.47226. The p-value is .071482. The result is not significant at p < .05 but it is significant at p < .10.*

Triticale: The average nitrate level at two feet for triticale was 133.90 lbs per acre. The average nitrate level for all other crops was 83.01 lbs per acre. *The t-value is 1.98851. The p-value is .024252. The result is significant at p < .05.*

C. Fertilizer: It appears that the type of fertilizer impacts nitrate levels at two feet.

a. Looking at all 170 samples with results at two feet the Student T-test tells us that the higher levels of nitrates seen with application of liquid manure are significant.

Liquid M: The average nitrate level at two feet for fields that received liquid manure is 125.57 lbs per acre. The average level for fields that did not receive liquid manure is 79.24 lbs per acre. *The t-value is 1.94819. The p-value is .026529. The result is significant at p < .05.*

Commercial: The average nitrate level for fields that received commercial fertilizer is 80.18 lbs per acre. The average nitrate level for fields that did not receive commercial fertilizer is 116.49 lbs per acre. *The t-value is -1.56554. The p-value is .059669. The result is not significant at p < .05 but it is significant at p < 0.10.*

Differences in nitrate levels for other fertilizer types are not significant for this data set.

b. If we leave out the fields with no documented fertilizer applications and look only at the 135 samples known to receive fertilizer the Student T-test tells us that, at two feet, the higher levels of nitrates seen with application of liquid manures and the lower levels seen with application of commercial fertilizer are significant.

Liquid M: The average nitrate level at two feet for fields that received liquid manure is 125.57 lbs per acre. The average nitrate level for fertilized fields that did not receive liquid manure is 67 lbs per acre. *The t-value is 2.39048. The p-value is .009114. The result is significant at p < .05.*

Commercial: The average nitrate level at two feet for fields that received commercial fertilizer is 80.18 lbs per acre. The average nitrate level for fertilized fields that did not receive commercial fertilizer is 126.78 lbs per acre. *The t-value is -1.73592. The p-value is .042447. The result is significant at p < .05.*

D. Leaching Categories: 142 out of the 170 fields (84%) with data at two feet had soils in the moderate to moderately high Ksat category. This makes analysis of leaching less certain. This data showed no significant differences in nitrate levels for the three leaching categories except for a possible mild effect at the p < .10 level of significance.

Moderate: The average nitrate value at the two foot level for fields with moderately high to high Ksat soils was 103.93 lbs per acre. The average nitrate level for fields not in that category was 58.29 lbs per acre. *The t-value is 1.46704. The p-value is .072118. The result is not significant at p < .05 but it is significant at p < .10.* Note that both low to moderately low and high to very high fields had lower nitrate levels than moderately high to high. The graph is dome shaped and not a straight line.

Four Foot Analysis

Table15. Characteristics of Risk Levels at Four Foot Sampling Depths (Low Risk is < 55 lbs NO_3/Acre, Medium Risk/High Risk is 55 lbs NO_3/Acre to 165 lbs NO_3/Acre, Very High Risk is > 165 lbs NO_3/Acre)

		Low Risk	Medium/High Risk	Very High Risk
N		89	34	24
Irrigation				
	Rill	21 (23%)	6 (18%)	2 (8%)
	Sprinkler	52 (59%)	23 (68%)	19 (79%)
	Drip	7 (8%)	4 (12%)	
	Unknown/None			3 (13%)
Crops				
	Alfalfa	16 (18%)	3 (9%)	4 (21%)
	Apples	2 (2%)	1 (3%)	
	Asparagus			2 (8%)
	Barley	1 (1%)		
	Cherries	1 (1%)		
	Corn Grain	4 (4%)	2 (6%)	
	Corn Silage	13 (15%)	5 (15%)	2 (8%)
	Grapes	2 (2%)	1 (3%)	2 (8%)
	Hay	3 (3%)		
	Hops	7 (8%)	3 (9%)	
	Mint	5 (6%)	2 (6%)	
	Pasture	5 (6%)		
	Pears	1 (1%)		
	Sudan Grass	1 (1%)		
	Triticale	16 (18%)	15 (44%)	12 (50%)

	Wheat		1 (1%)		1 (3%)		
	Wine Grapes		2 (2%)				
	Unknown		9 (10%)		1 (3%)		1 (4%)
	Double Crop		19 (21%)		13 (38%)		12 (50%)
Fertilizer							
	Liquid Manure		20 (23%)		17 (50%)		11 (46%)
	Solid Manure		20 (23%)		5 (15%)		1 (4%)
	Commercial		47 (53%)		16 (47%)		8 (33%)
	Biosolids		2 (2%)				1 (4%)
	Compost						
	Unknown/None		10 (11%)		1 (3%)		9 (38%)
Leaching							
	Low		2 (2%)				1 (4%)
	Moderate		76 (85%)		30 (88%)		22 (92%)
	High		11 (12%)		4 (12%)		1 (4%)

A. Irrigation Type: Analysis using the Student T-test at the 4 foot level finds a statistically significant association between sprinkler irrigation and higher nitrate levels and a statistically significant association between rill irrigation and lower nitrate levels.

Rill Irrigation: The average nitrate reading at 4 feet for fields that receive rill irrigation was 40.3 lbs per acre. The average reading for fields that did not receive rill irrigation was 98.54 lbs per acre. *The t-value is -1.92605. The p-value is .028124. The result is significant at p < .05.*

Sprinkler Irrigation: The average nitrate reading at 4 feet for fields that receive sprinkler irrigation was 106.59 lbs per acre. The average reading for fields that did not receive sprinkler irrigation was 37.66 lbs per acre. *The t-value is 2.54584. The p-value is .006025. The result is significant at p < .05.*

Drip Irrigation: The average nitrate reading at 4 feet for fields that receive drip irrigation was 30.45 lbs per acre. The average reading for fields that did not receive drip irrigation was 90.42 lbs per acre. *The t-value is -1.29622. The p-value is .098581. The result is not significant at p < .05 but it is significant at p < .10.*

B. Crops: Analysis using the Student T-test was performed for crops at the < 2.5 ft root depth, 2.5 to 4 ft root depth, > 4 ft root depth, > 4 ft root depth minus alfalfa, for alfalfa, corn

silage and triticale. Soil tests for fields with no documented crops were omitted from the calculations. The only statistically significant results were for triticale.

Triticale: The average nitrate level at four feet for triticale was 142.81 lbs per acre. The average nitrate level at four feet for all other crops was 66.46 lbs per acre. The *t*-value is 2.75448. The *p*-value is .003348. The result is significant at $p < .05$.

Unusually high nitrate levels at four feet for a few alfalfa fields complicate the analysis.

C. Fertilizer: The data suggests that the type of fertilizer impacts nitrate levels at four feet.

a. Looking at all 147 samples that had data at 4 feet the Student T-test tells us that the higher levels of nitrates seen with application of liquid manure are significant. There may be a more modest reduction of nitrate levels with solid manure and commercial fertilizer.

Liquid M: The average nitrate level at four feet for fields that received liquid manure is 139.65 lbs per acre. The average for fields that did not receive liquid manure is 60.61 lbs per acre. *The t-value is 3.08855. The p-value is .001206. The result is significant at p < .05.*

Solid M: The average nitrate level at four feet for fields that received solid manure is 47.85 lbs per acre. The average for fields that did not receive solid manure is 94.7 lbs per acre. *The t-value is -1.45353. The p-value is .074119. The result is not significant at p < .05 but it is significant at p < .10.*

Commercial: The average nitrate level at four feet for fields that received commercial fertilizer is 68.19 lbs per acre. The average for fields that did not receive commercial fertilizer is 108.79 lbs per acre. *The t-value is -1.64521. The p-value is .051047. The result is not significant at p < .05 but it is significant at p < .10.*

b. Looking only at the 117 samples that had data at 4 feet and received fertilizer, the Student T-test tells us that the increased nitrate levels associated with liquid manure and the decreased nitrate levels associated with commercial fertilizer are significant.

Liquid M: The average nitrate level at four feet for fields that received liquid manure is 139.65 lbs per acre. The average for fertilized fields that did not receive liquid manure is 45.71 lbs per acre. *The t-value is 3.4706. The p-value is .000366. The result is significant at p < .05.*

Solid M: The average nitrate level at four feet for fields that received solid manure is 47.85 lbs per acre. The average for fertilized fields that did not receive solid manure is 94.65 lbs per acre. *The t-value is -1.40234. The p-value is .081753. The result is not significant at p < .05 but it is significant at p < .10.*

Commercial: The average nitrate level at four feet for fields that received commercial fertilizer is 68.19 lbs per acre. The average for fertilized fields that did not receive commercial fertilizer is 120.39 lbs per acre. *The t-value is -1.74448; p-value is .041874. The result is significant at p < .05.*

D. Leaching: There were no statistically significant differences in the nitrate levels at four feet for the three leaching categories in this study.

Conclusion

This summary of the LYV GWMA DSS concludes that:

- There are differences between spring and fall deep soil testing results
- There was unequal coverage of the various combinations of irrigation practices, crop types and leaching factors.
    - Data was gathered for 15 out of 27 categories.
    - Only 7 categories had six or more samples
    - One category had 3 samples
    - Two categories had 2 samples
    - Five categories had only one sample.
- Sixty five of 175 samples or 37% fell into the category of sprinkler irrigation, 2.5 ft to 4 ft crops and moderately high to high Ksat
- There were fields with extreme values that would ideally be re-tested. Those fields are #'s 3141, 2044, 2047, 4152, 3117, and 3119.
- The two asparagus samples, #'s 4175 and 4176 may not be representative of that crop
- The range of values for alfalfa is huge and suggests a need for further study
- The range of values for hops is large and suggests a need for further study
- Over half of the fields planted in triticale are at medium to high risk for leaching nitrate to the groundwater
- Double cropping is associated with higher nitrate levels
- In this data set rill irrigation is more protective of the groundwater than sprinkler irrigation
- Application of liquid manure is significantly more likely to result in high nitrate levels
- There is more soil testing on fields with higher nitrate levels.
- There are wide ranges in values for many of the crops in this data set.
- Some of the project purposes were not achieved in this round of DSS. Baseline data for many of the crops and conditions is still lacking. However there is adequate information to proceed with recommendations regarding triticale and application of liquid manure.

References

Lower Yakima Valley Groundwater Management Area (2014) *Deep Soil Sampling Plan Lower Yakima Valley Groundwater Management Area.* (Attachment 1)

Lower Yakima Valley Groundwater Management Area (2013) *PP Summary of Proposed Allocation Processes.* (Attachment 2)

WA State Dept. of Agriculture (2017*) Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*. Available in draft form only.

WA State Dept. of Ecology (2017) *Concentrated Animal Feeding Operation General National Pollutant Discharge Elimination System and State Waste Discharge General Permit.* Available at http://www.ecy.wa.gov/programs/wq/permits/cafo/docs/01182017CombinedPermit.pdf

WA State Dept. of Ecology (2017) *Concentrated Animal Feeding Operation State Waste Discharge General Permit.* Available at http://www.ecy.wa.gov/programs/wq/permits/cafo/docs/01182017StatePermit.pdf

Lower Yakima Valley Groundwater Management Area Deep Soil Sampling Analysis of Fields Planted in Triticale/Corn Silage

By Jean Mendoza

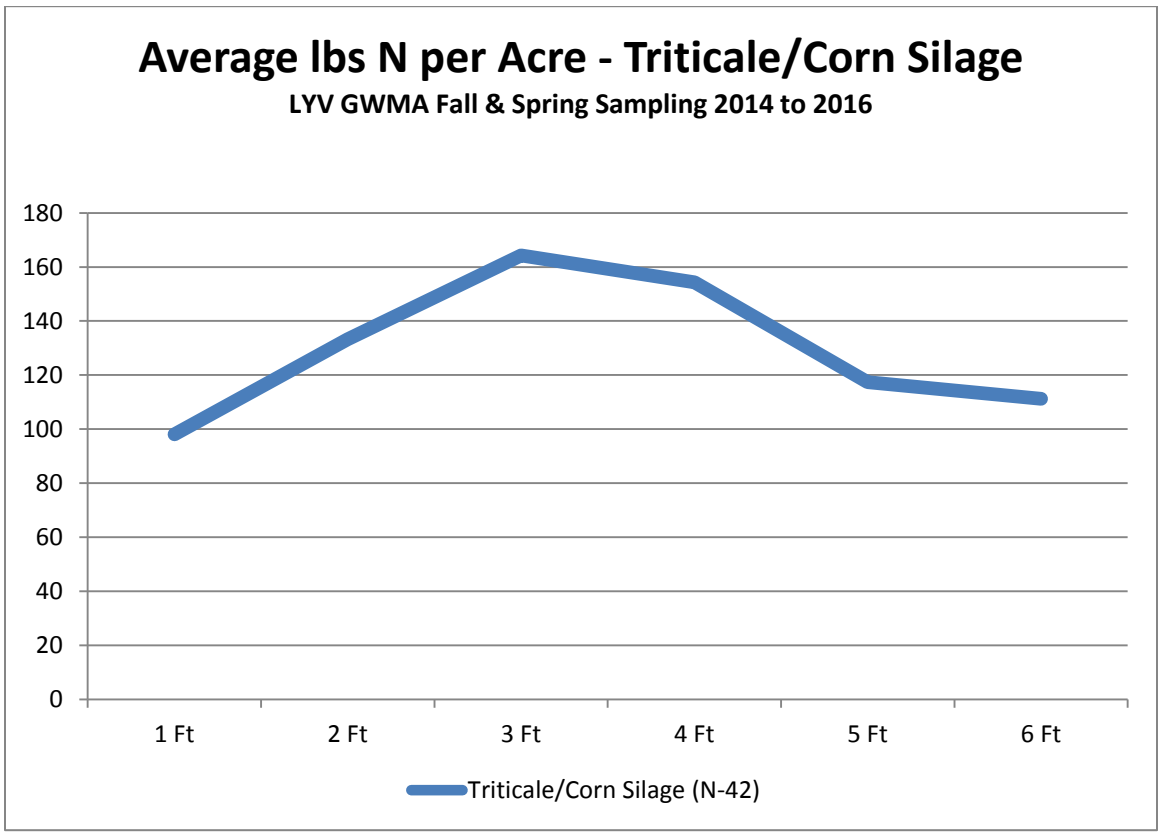
July 2017

Between the fall of 2014 and the spring of 2016 the Lower Yakima Valley (LYV) Groundwater Management Area (GWMA) contracted with the South Yakima Conservation District and Landau Associates to perform four rounds of deep soil sampling (DSS) on agricultural land in the GWMA target area. All fields were voluntarily submitted and anonymously recorded. 24% of the fields (42 out of 175) were double cropped in Triticale/Corn Silage (40) or Triticale/Sudan Grass (2). This is the largest number for any crop in the DSS and lends itself to a more detailed study.

Overview of the Data

Below is a graph that depicts the nitrate levels in lbs of nitrate (NO_3) per acre at depths by one foot increments.

Graph 1.



The average field was 55.5 acres. Soil testing was done on all fields. Testing was done twice a year for 27 of the fields (64%) and annually for 15 of the fields (36%). There was rill irrigation on one field, rill & sprinkler irrigation on two fields and sprinkler irrigation only on thirty nine fields.

Liquid manure was applied to 31 of the fields (74%), solid manure to 5 of the fields (12%), commercial fertilizer to 26 (of the fields 62%) and bio-solids to 1 of the fields (2%). More than one type of fertilizer was used on 22 of the fields (52%).

The capacity of the most limiting layer to transmit water (Ksat) classifications were "very low to moderately low" on 4 of fields (10%), "moderately high to high" on 34 of fields (81%), and "high to very high" on 4 of fields (9%).

There was early refusal of the soil drilling equipment on one field at 2 feet, four more at 3 feet, one more at 4 feet and six more at 5 feet. Early refusal was more likely in the soils classified as very low to moderately low leaching.

Average root depth was 2.87 feet and the median was 2.85. The range for root depths was 1 ft to 5.8 ft.

Data Analysis for Triticale/Corn Silage

Table 1. Nitrate in lbs per Acre for Triticale/Corn Silage

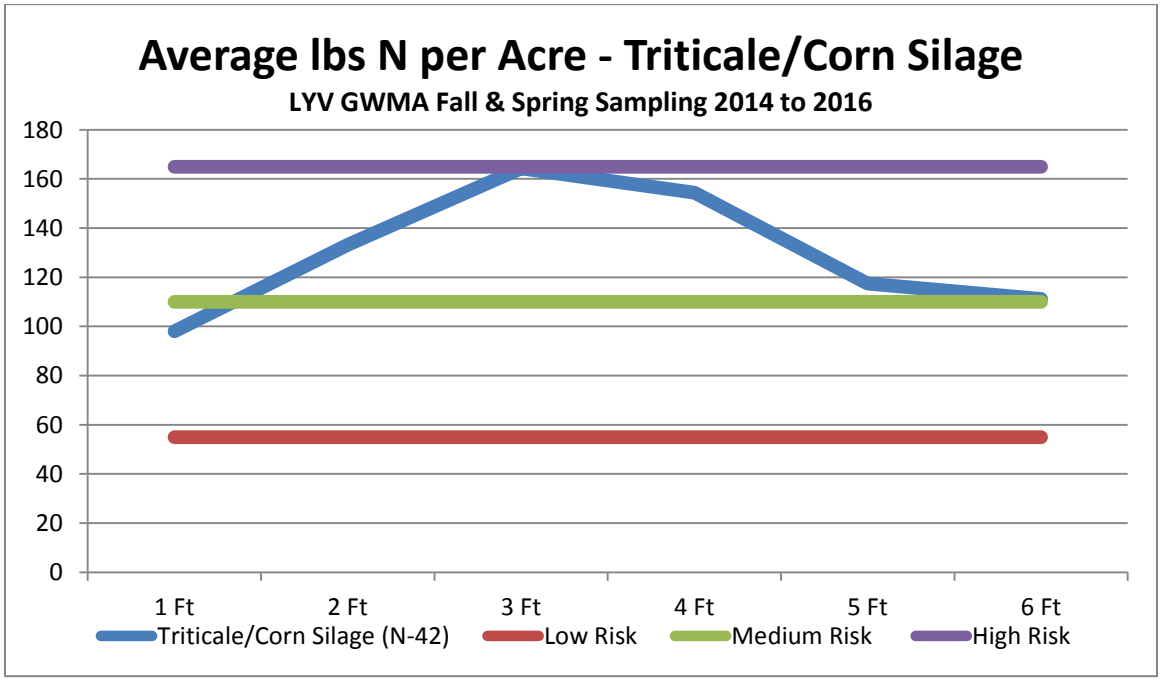
	1 FT	2Ft	3 Ft	4 Ft	5 Ft	6 Ft	Total	NH_3	Organic
Average (lbs/acre)	98.07	133.24	164.3	154.36	117.43	111.2	668.5	29	2.25
Median (lbs/acre)	57	60	87	89	60	66	356.5	24	2.18
Range (lbs/acre)	4 to 467	3 to 986	3 to 892	3 to 726	6 to 576	4 to 565	17 to 3754	9 to 108	0.95 to 3.94
Early Refusal (ft)	0	1	5	6	12	12			

The median is much less than the average at all depths. The data has a positive skew.

The sampling shows that there are high nitrate levels at depths where the crops no longer take up the nitrate for plant use. In other words, there is significant leaching to the aquifer from fields planted in triticale/corn silage.

One way to look at the data is to determine how many fields have nitrate levels above the risk levels that were defined by Ecology (2017) for the CAFO General Permits. According to that document there is low risk when nitrate levels at two feet are < 55 lbs per acre, medium risk when levels are 55lbs per acre to 110 lbs per acre, high risk when levels are 110 lbs per acre to 165 lbs per acre and very high risk when levels are > 165 lbs per acre. The average level of nitrate in this study was in the high risk range for all levels except one foot.

Graph 2.



Analysis at the Two Foot Level

Another way to analyze the material is to look at the two foot level where most nutrient management plan decision making is done for Eastern Washington. Numbers in the table below were sorted by size for the two foot level. There were 19 samples in the low risk category (< 55 lbs/acre), 14 samples in the medium risk category (55lbs/acre to 110 lbs/acre), none in the high risk category (110 lbs/acre to 165 lbs/acre) and 9 samples in the very high risk category (>165lbs/acre).

Table 2.

Field ID #	1 FT lbs/ac	2Ft lbs/ac	3 Ft lbs/ac	4 Ft lbs/ac	5 Ft lbs/ac	6 Ft lbs/ac	Total lbs/ac	Ammonia lbs/ac	Organic Matter
Very High Risk		N = 9 (21%)							
2058	119	986	892	694	407	287	3385	16	1.92%
3094	467	644	776	726	576	565	3754	50	2.85%
3108	311	465	612	684	247	264	2583	27	2.66%
3106	316	445	465	248	256	222	1952	15	0.95%
3097	336	363	335	263	113	64	1474	28	2.18%
2063	227	337	424	528			1516	24	3.94%
2065	213	304					517	15	2.59%
3121	275	193	162	137	202	272	1241	32	2.91%
2066	44	182	193				419	24	3.23%
Medium Risk		N = 14 (33%)							
2037	50	106	226	183	149	72	786	93	1.9%
3110	93	100	125	154	283	413	1168	34	2.19%
2067	19	97	197	115	40	27	495	18	1.56%
3115	82	90	149	111	192	195	819	14	1.67%
3095	60	90	140	178			468	17	1.92%
2078	49	89	86	156	172	111	663	27	2.62%
2046	36	88	95	70	65	72	426	33	2.67%
4167	97	81	88	13			279	68	1.39%
1004	177	79	63	69	42	50	480	16	2.06%
3112	39	73	87	95	47	38	379	22	1.87%
2079	9	66	127	173	98	108	581	17	2.62%
3109	82	60	223	238	56	100	759	12	1.48%
2053	84	58					142	11	1.59%
2035	55	56	56	103	110	93	473	108	3.04%
Low Risk		N = 19 (45%)							
2081	75	48	40	42	32	24	261	35	2.45%
2036	90	47	31	23	12	6	209	65	2.37%
3111	35	45					80	24	1.59%
2068	7	35	137	115			294	13	1.71%
3086	139	30	33	56	47	29	334	14	1.76%
2070	37	26	63	83	51	38	298	9	0.98%
2064	52	26	43	26			147	19	3.21%
2040	41	25	13	36	88	68	271	26	3.09%
2082	41	22	55	70	58	74	320	25	3.36%

2077	26	22	26	25	35	41	175	16	1.81%
3122	101	20	14	3	16	4	158	23	2.07%
4159	34	16	36	27	7	9	129	40	2.41%
2080	15	15	27	44			101	17	2.63%
2050	18	9	21	43	61	51	203	25	2.95%
4161	66	9	6	5	8	8	102	39	2.59%
3096	27	8	10	17	47	19	128	44	2.06%
4158	12	5					17	38	2.18%
2041	4	3	3	4	6	12	32	9	1.46%
2052	59						59	16	2.16%

These nitrate values do not conform to a normal curve but statistical analyses can be done by plotting log values for the nitrate levels. This normalizes the data and tells us that 95% of the nitrate levels at 2 feet for the fields in this study will lie between 4.2 lbs per acre and 815.2 lbs per acre. This is a very large range. There are 2 out of 41 values in the study that lie outside the 95 percentile range. They are 3 lbs per acre at the low end and 986 lbs per acre at the high end.

Analysis of Irrigation Practices found that most samples (89% to 100%) used sprinkler. There is a small trend for lower risk fields to use rill irrigation but the numbers are not large enough to prove statistical significance. :

Table 3. Irrigation Practices and Risk Levels for Triticale/Corn Silage

	Low Risk	Medium/High Risk	Very High Risk	All Samples
Rill	2 (11%)	1 (7%)	0 (0%)	3 (7%)
Sprinkler	17 (89%)	13 (93%)	9 (100%)	39 (93%)
Drip	0 (0%)	0 (0%)	0 (0%)	0 (0%)

There were no dose dependent relationships for ammonia or organic matter and risk

Table 4. Average Ammonia & Organic Matter Levels for Triticale/Corn Silage

	Low Risk	Medium/High Risk	Very High Risk	All Samples
Ammonia	26.16	35.00	25.67	28.27
Organic Matter	2.25	2.04	2.58	2.32

Note: Field #2035 in the Medium Risk category had an unusually high ammonia level of 108 #/acre

There were no clear trends regarding crop yields and risk categories:

Table 5. Crop Yield for Triticale & Corn Silage in Different Risk Levels

	Low Risk	Medium Risk	Very High	All Samples
Average of Most Recent Crop Yields for Triticale in Tons	8.14 T	8 T	8.22 T	8.11 T
Average of Most Recent Crop Yields for Corn Silage in Tons	29.39 T	31.25 T	30.22 T	30.15 T

There were no clear trends regarding impact of fertilizer type for these crops:

Table 6. Percentage of Fields that Received Major Types of Fertilizer for Triticale/Corn

	Low Risk	Medium Risk	Very High Risk	All Samples
Liquid Manure	15 (79%)	10 (71%)	6 (86%)	31 (74%)
Solid Manure	3 (16%)	1 (7%)	1 (14%)	5 (12%)
Commercial Fertilizer	12 (63%)	10 (71%)	4 (57%)	26(62%)
Biosolids	0 (0%)	0 (0%)	1 (14%)	1(2%)
Unknown	0 (0%)	1 (7%)	0 (0%)	1 (2%)
More Than One Type	10 (53%)	8 (57%)	4 (44%)	22 (52%)

There were no clear trends regarding soil type and leaching potential for these crops:

Table 7. Soil Categories and Risk Levels for Triticale/Corn Silage

	Low Risk	Medium Risk	Very High Risk	All Samples
Low to Moderately Low	2 (11%0	1 (7%)	1 (11%)	4 (10%)
Moderate to High Ksat	14 (74%)	13 (93%)	7 (78%)	34 (81%)
High to very High Ksat	3 (16%)	0 (0%)	1 (11%)	4 (10%)

The major conclusion from analysis of data at the two foot level is that over half of the fields in this study are at medium to very high risk for leaching to the groundwater.

Analysis Based on Median Levels at One Foot Intervals

Another way to analyze the data is to look at median levels of nitrate in lbs per acre at each level of testing. Half of all fields in a data set are above the median level and half are below the median level. The data in this study is skewed positively, meaning that median values are lower than average values. In this study half of nitrate levels were above:

a. 57 lbs per acre at one foot

b. 60 lbs per acre at two feet

c. 87 lbs per acre at three feet

d. 89lbs per acre at four feet

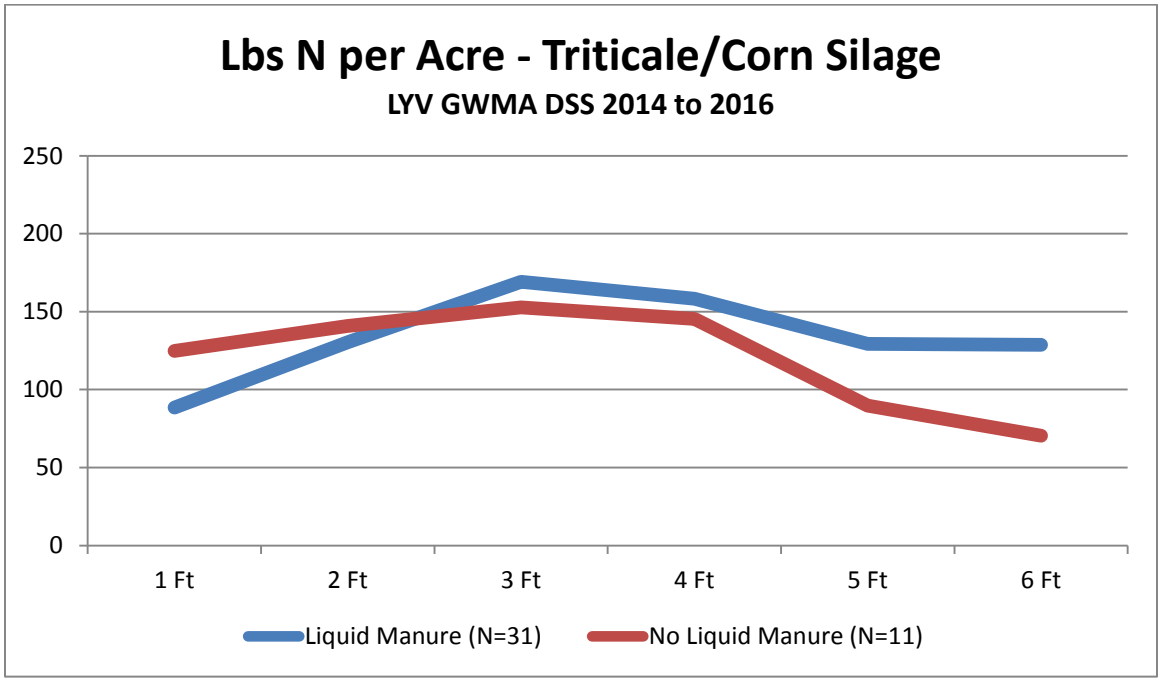
e. 60#lbs per at five feet

f. 66 lbs per acre at six feet.

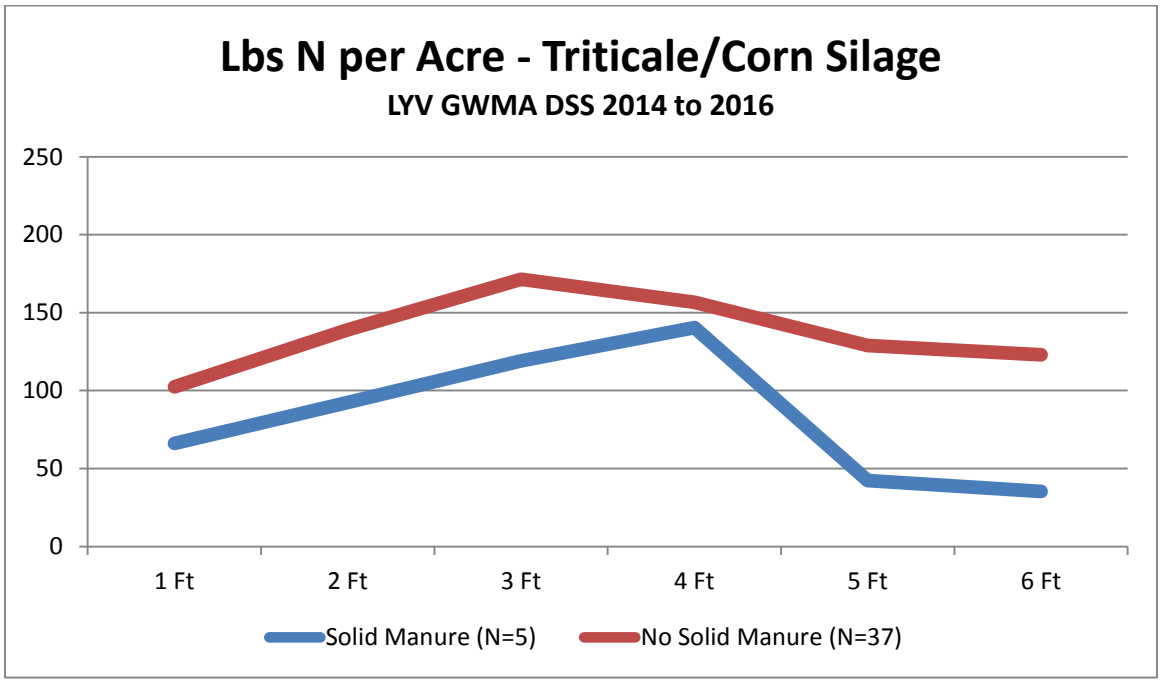
Types of Fertilizers

Analysis of the DSS as a whole indicates that nitrate levels are higher when liquid manure is applied to the fields. Application of solid manure, on the other hand, is associated with lower nitrate levels. The graphs below describe nitrate levels for triticale/corn silage fields based on yes or no for application of each major class of fertilizer. 52% of the fields received more than one type of fertilizer and this practice was associated with a reduction in nitrate levels.

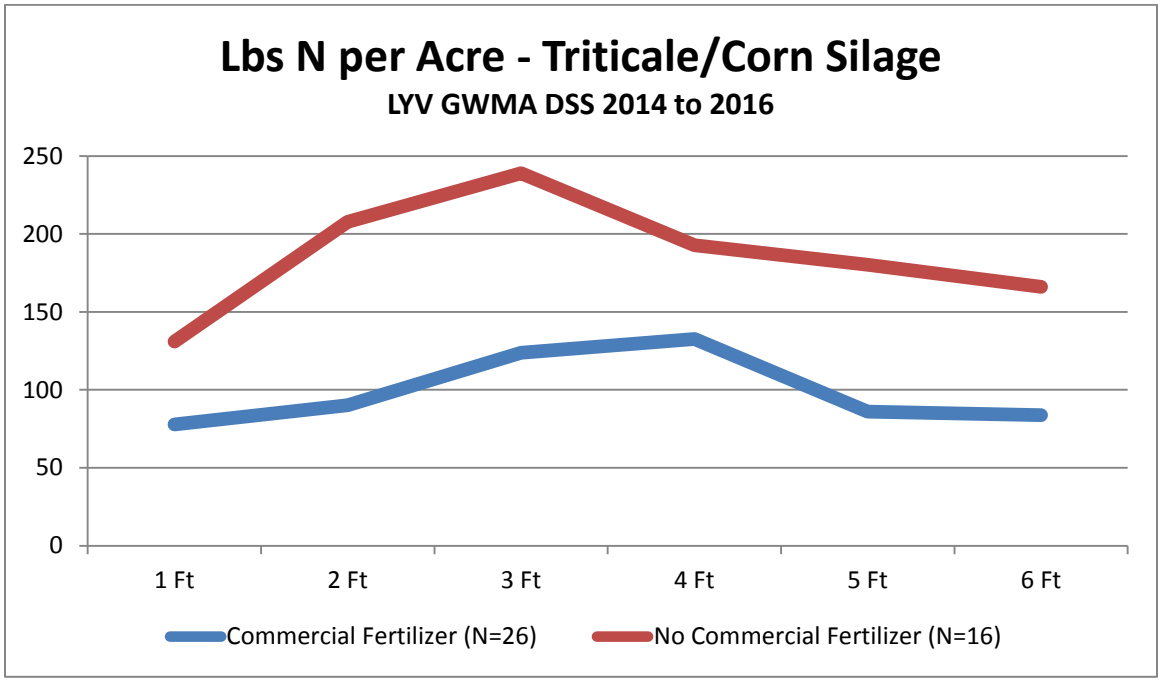
Graph 3. Fields that Received Liquid Manure and Those That Did Not



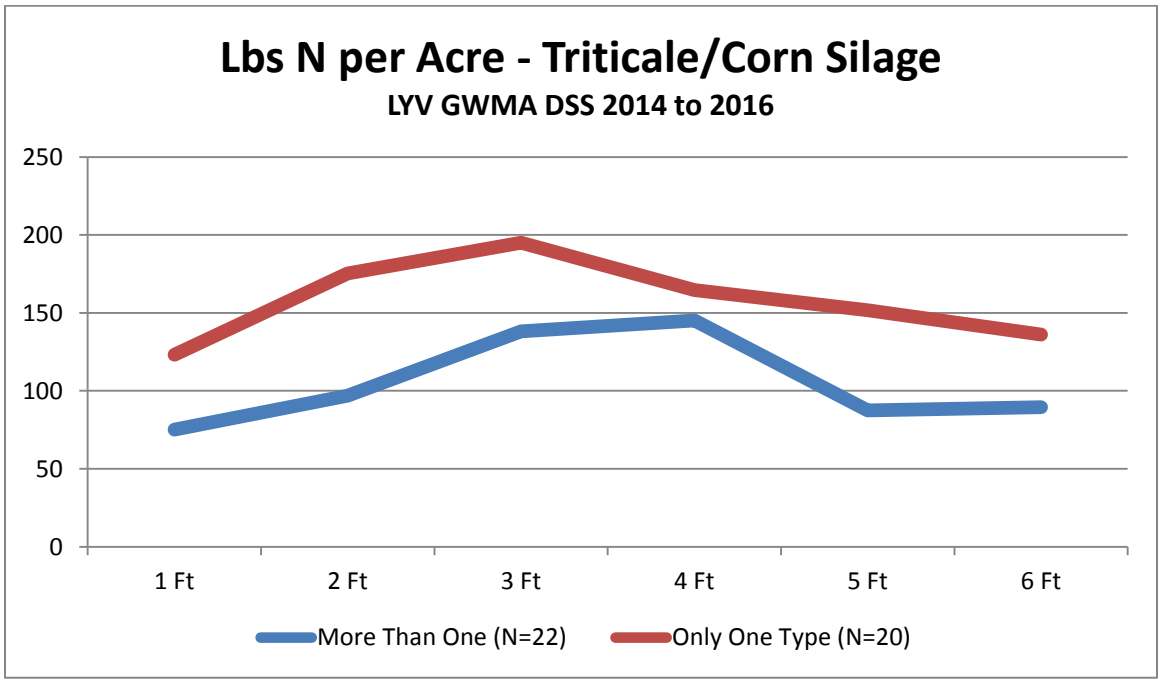
Graph 4. Fields that Received Solid Manure and Those That Did Not



Graph 5. Fields That Received Commercial Fertilizer and Those That Did Not



Graph 6. Fields That Received More Than One Type of Fertilizer or Did Not

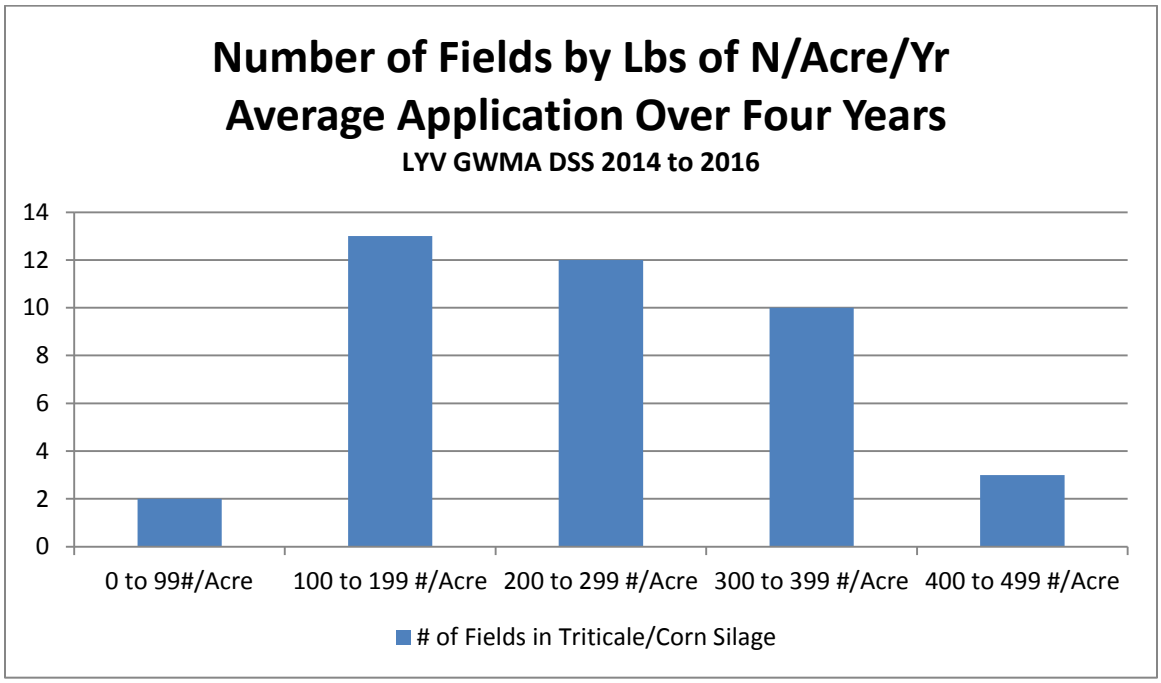


Could this indicate that farmers who apply more than one type are more thoughtful about fertilizer applications?

Amount of Fertilizer

DSS surveys asked farmers how much nitrogen they applied in lbs N per acre to the sampled fields. Average application over four years was calculated for each field and the number of fields with application of 0 to 99lbs, 100 to 199 lbs, 200 to 299 lbs, 300 to 399 lbs and 400 to 499 lbs was counted.

Graph 7. Range of Fertilizer Application Rates to Triticale/Corn Silage Fields in DSS



According to the WSDA Nitrogen Loading Assessment (2017) and the recommendations of members of the GWMA Irrigated Ag Work Group the average uptake of nitrogen for corn silage is 270 #/acre. The uptake by triticale ranges from a low of 190 lbs per acre to a high of 210 lbs per acre. This indicates that most farmers in the DSS apply less than the recommended amounts of nitrogen to triticale/corn silage fields.

Some fields received high amounts of nitrogen fertilizer in single years. For example, Field # 2065 received 575lbs of N per acre in 2013; Fields # 2066 received 500 lbs of N per acre in 2012; Field # 2046 received 500 lbs of N per acre in three out of four years.

There is a clear upward trend in nitrogen application related to level of risk: On average fields in the low risk level received 211 lbs N per acre; those in the medium to high level received 250 lbs N per acre and those in the very high level received 258 lbs per acre.

Table 8. Average Nitrogen Application at Different Risk Levels

	Low Risk	Medium/High Risk	Very High Risk	All Samples
Average N Application in lbs per Acre	211.45	249.92	258.25	237.06
Range of Average N Applications in lbs per Acre	31.25 – 379.75	105 to 436	170 to 391.25	31.25 – 436

Relationships can be examined by looking at the ratio of Total Nitrogen to Average Applied Nitrogen. Calculated Total Nitrogen is the sum of measurements at all six foot levels. Therefore those samples with early refusal were deleted from this analysis. The average ratios of Total Nitrogen to average Applied Nitrogen - were:

Very High Risk: 11.82 (Range = 7.44 to 20.42)

Medium to High Risk: 3.22 (Range = 1.10 to 7.23)

Low Risk: 1.52 (Range = 0.29 to 6.50)

References

WA State Dept. of Agriculture (2017*) Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*. Available in draft form only.

WA State Dept. of Ecology (2017) *Concentrated Animal Feeding Operation General National Pollutant Discharge Elimination System and State Waste Discharge General Permit.* Available at http://www.ecy.wa.gov/programs/wq/permits/cafo/docs/01182017CombinedPermit.pdf

WA State Dept. of Ecology (2017) *Concentrated Animal Feeding Operation State Waste Discharge General Permit.* Available at http://www.ecy.wa.gov/programs/wq/permits/cafo/docs/01182017StatePermit.pdf

Errata

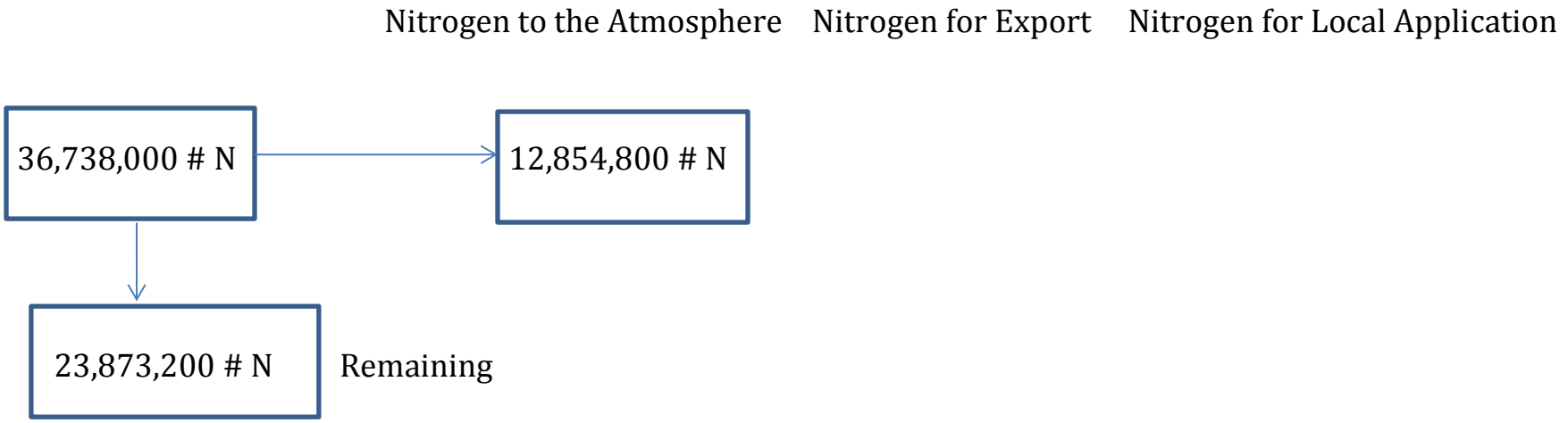
Towards the end of this analysis it was noted that two of the fields were planted in Sudan grass as well as the Triticale/Corn Silage combination. This could impact the data. The fields planted in Sudan grass were # 2046 and # 3096.

A Possible Pathway for Nitrogen Produced by Dairy Cattle in Yakima County

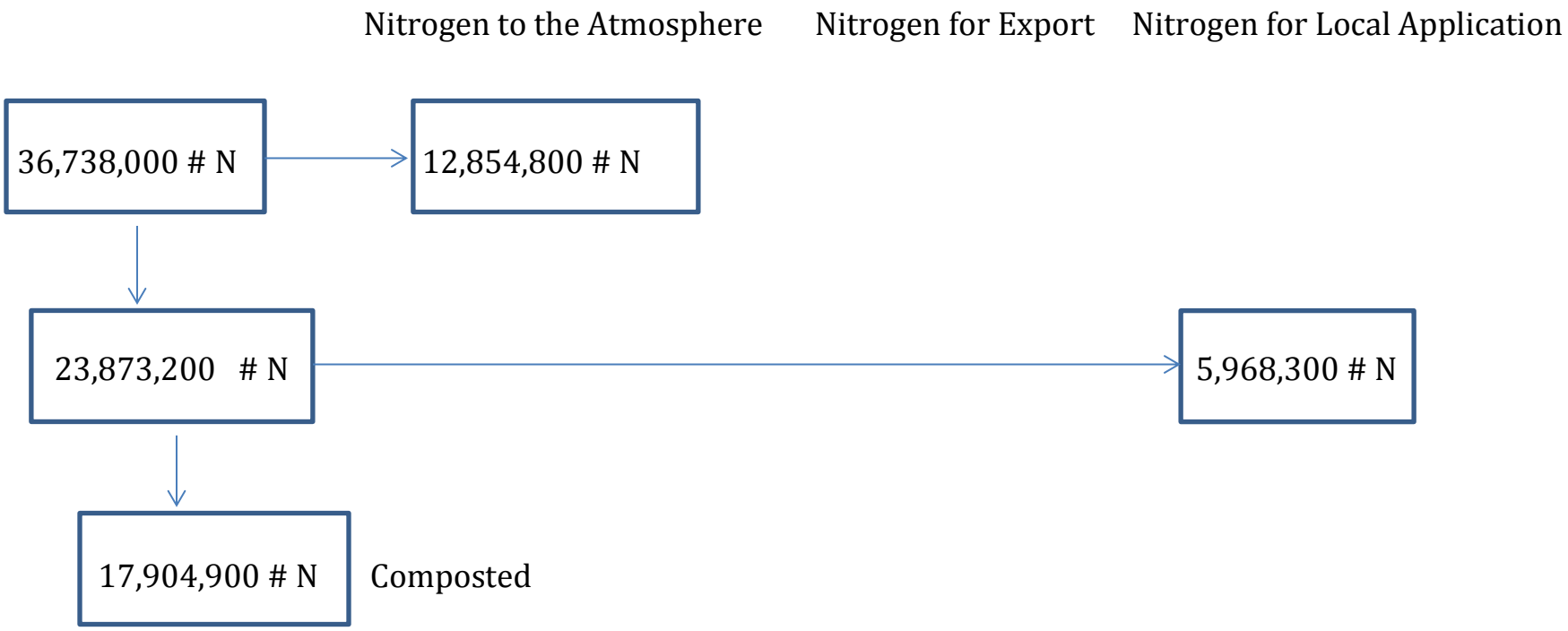
According to the WSDA dairies in Yakima County produce:

18,364 tons of nitrogen per year or 36,738,000 # N per year

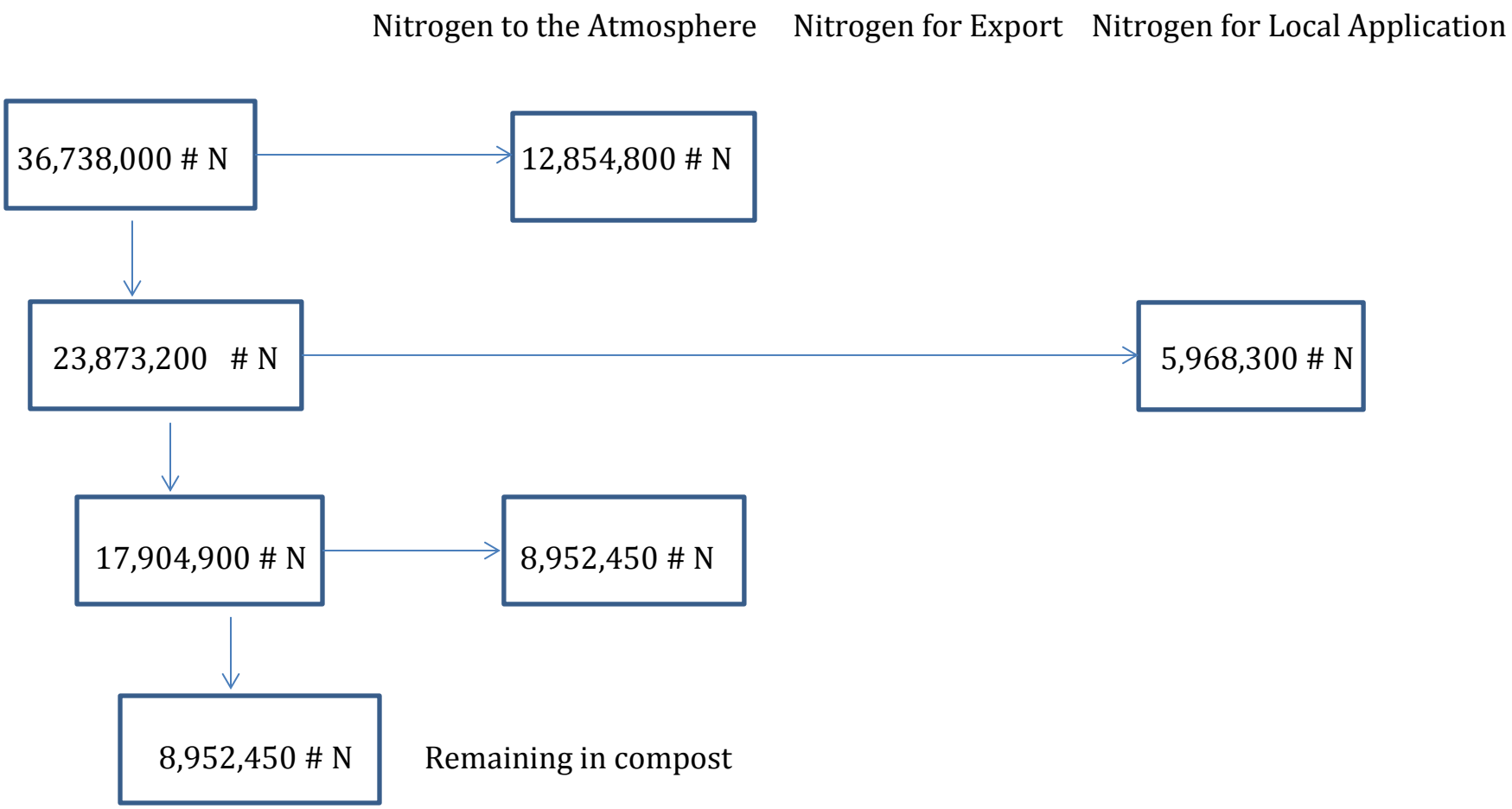
After losses due to volatilization (35%) there is 23,873,200 # N per year available for land application



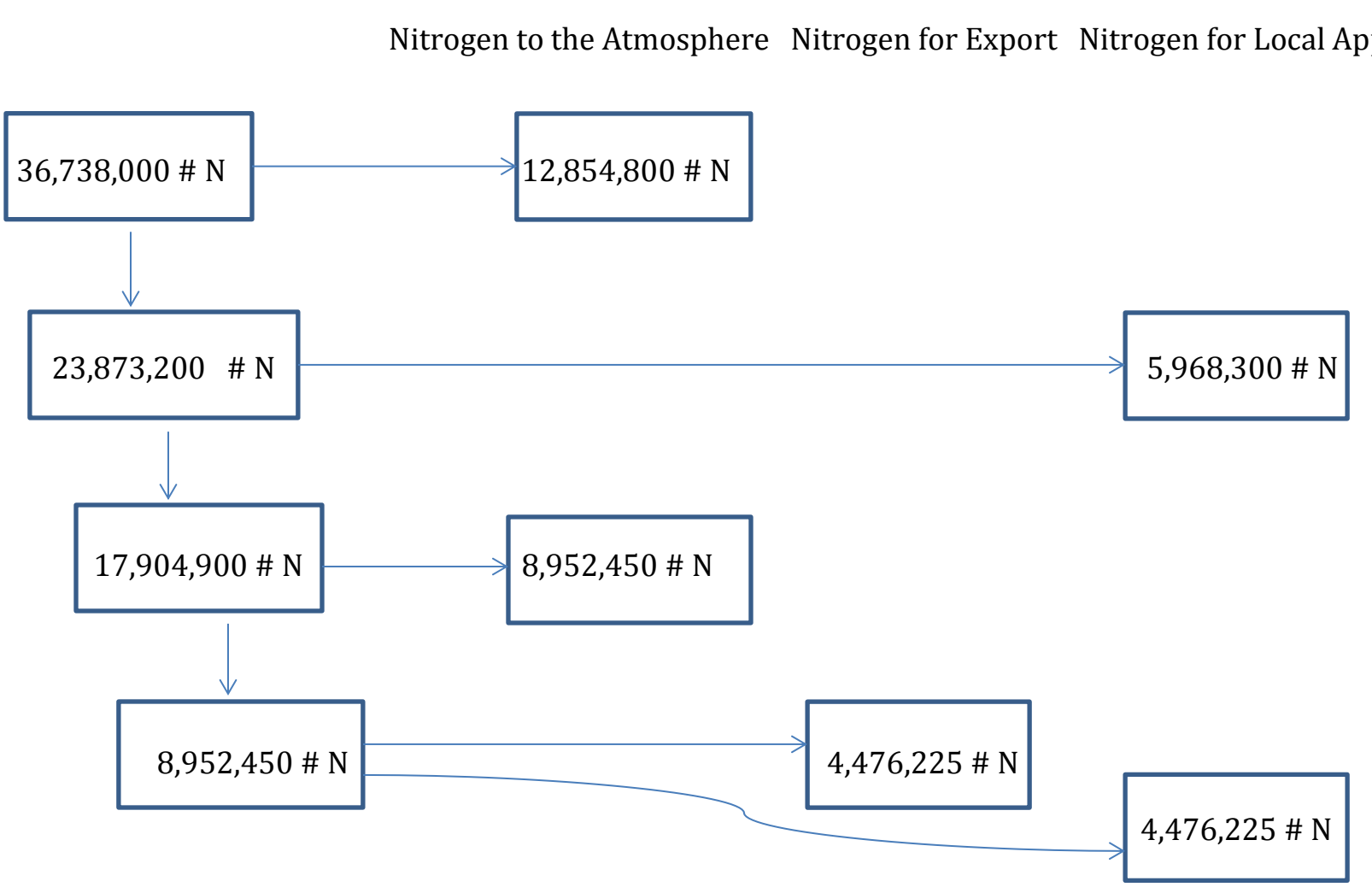
According to Steve George and Laurie Crowe “75% of the manure is composted which reduces the volume by 50%. Over 50% of this compost is exported out of Yakima County” (We need documentation to support this statement)



Assuming that 50% of the N in compost follows the 50% loss by weight:



And accepting the statement that 50% of compost is exported from the county



	Nitrogen to the Atmosphere	Nitrogen for Export	Nitrogen for Local Application
Totals	21,707,250 # N	4,476,225 # N	10,444,525 # N

How much land is needed for agronomic application of 10,444,525# N?

According to WSDA's Nitrogen Availability Analysis major crops in the GWMA area are:

WSDA Crop 2015	GWMA Acreage	N Comm-Avg lbs/ac	Comm N Use % crop ac	N Manure-Avg lbs/ac	N Manure Use % crop ac
		lbs/acre	% crop acres	lbs/acre	% crop acres
Apple	17,333	59.78	86.3%	0.0	0.0%
Corn (Silage)	16,778	214.14	49.6%	203.3	53.9%
Triticale	10,780	107.03	27.2%	104.4	74.8%
Grapes (Juice)	10,257	79.64	91.0%	0.0	0.0%
Alfalfa*	7,989	73.76	91.8%	161.0	8.2%
Pasture	6,731	120.21	97.2%	17.0	2.8%
Cherry	6,336	55.65	80.5%	0.0	0.0%
Hops	5,961	191.80	97.3%	132.0	2.7%
Grapes (Wine)	5,126	25.00	100.0%	0.0	0.0%
Pear	3,331	56.95	76.6%	0.0	0.0%
Mint	1,418	269.23	100.0%	0.0	0.0%
Wheat	1,283	106.09	93.9%	130.9	22.4%
Corn (Grain)	1,166	214.11	71.3%	134.9	62.6%
Asparagus	854	99.40	100.0%	0.0	0.0%
Peach/Nectarine	843	50.59	81.0%	0.0	0.0%
Total	96,186				

(Much of the land planted in triticale is double cropped with corn silage.)

Looking only at crops that apply manure shows 50,688 acres that receive manures:

WSDA Crop 2015	GWMA Acreage	N Comm-Avg lbs/ac	Comm N Use % crop ac	N Manure-Avg lbs/ac	N Manure Use % crop ac
		lbs/acre	% crop acres	lbs/acre	% crop acres
Corn (Silage)	16778	214.14	49.6%	203.3	53.9%
Triticale	10780	107.03	27.2%	104.4	74.8%
Alfalfa*	7989	73.76	91.8%	161.0	8.2%
Pasture	6731	120.21	97.2%	17.0	2.8%
Hops	5961	191.80	97.3%	132.0	2.7%
Wheat	1283	106.09	93.9%	130.9	22.4%
Corn (Grain)	1166	214.11	71.3%	134.9	62.6%
Total	50688				

Multiplying acreage by the average amount of manure currently applied we see that current fertilizing practices utilize 7,049,146 # N per year in the GWMA target area.

WSDA Crop 2015	# N Received from Manures	N Comm-Avg lbs/ac	Comm N Use % crop ac	N Manure-Avg lbs/ac	N Manure Use % crop ac
		lbs/acre	% crop acres	lbs/acre	% crop acres
Corn (Silage)	3,410,967	214.14	49.6%	203.3	53.9%
Triticale	1,125,432	107.03	27.2%	104.4	74.8%
Alfalfa*	1,286,229	73.76	91.8%	161.0	8.2%
Pasture	114,427	120.21	97.2%	17.0	2.8%
Hops	786,852	191.80	97.3%	132.0	2.7%
Wheat	167,944.7	106.09	93.9%	130.9	22.4%
Corn (Grain)	157,293.4	214.11	71.3%	134.9	62.6%
Total	7,049,146				

10,444,525 # N available for land application minus 7,049,146 # N applied to the GWMA target area leaves an excess of 3,395,379 # N per year that must be stored or applied somewhere.

One obvious place for manure application is the Yakama Reservation with 142,000 acres of irrigated land.

If more farmers used manure rather than synthetic fertilizers then more manure could be applied to land in the GWMA target area.

Growers note that it is unwise to rely entirely on manures since there are many other elements involved and testing must be done to balance phosphorous, potassium, calcium, magnesium, sodium, boron, zinc, manganese, iron and copper as well.

Concerns:

This is only one potential model for manure and fertilizer application in the area.

Not all cropland does or should receive the maximum amounts of fertilizer

It would be illegal and unethical to force farmers to choose manure fertilizer

According to this and other models, about 60% of nitrogen that is excreted by cattle is lost and unavailable for land application. Most of this goes up to the atmosphere. In this model over 10,000 tons of nitrogen per year escapes to the atmosphere. This source of atmospheric deposition and the associated problems must be addressed. What goes up must come down.

WSDA estimates that 36,738,000 # N is produced by 101,541 mature dairy cows and 39,625 heifers and calves. According to USDA, in 2012, there were 258,063 head of cattle and calves in Yakima County. This means that manure from approximately 116,897 head of other cattle and calves must also be applied somewhere.

The GWMA needs to address off farm application of manures within the target area.

Apology: Over the past five years I have frequently cited a 2000 report from USDA entitled *Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States.* That report is available at
https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012133.pdf

I stated that the report showed insufficient land in Yakima County for manure application based on nitrogen content. This was incorrect. The report stated that there was insufficient land owned by Yakima County producers for on-farm assimilation of available nitrogen. The report stated that there is sufficient land for manure application if the manures are exported off-farm but remain within the county. That is still true today.

However, this report showed insufficient land within Yakima County for assimilation of manures based on phosphorous content. At the time of that report Yakima County had 192,271 head of cattle and calves according to the National Agricultural Statistics Service.

Respectfully

Jean Mendoza

September 4, 2017

Costs Related to Elevated Nitrates in Groundwater

Reverse Osmosis

One under sink reverse osmosis unit costs between $200 and $600

Whole house purification units cost between $2,300 and $2,800

Commerciale systems are as high as $6,000

Filters must be replaced as often as every month and as infrequently as every year. Filters cost between $9 for a single filter and $180 for a system.

Under sink systems can be rented for as little as $10 per month

Source:

APEC Water – http://www.freedrinkingwater.com/parts/

Yakima Culligan – http://culliganpacific.com/yakima_wa

Well Drilling

Drilling costs begin at $40 per foot for a 6" casing and 6" pipe

$400 for seal and ecology shield

$200 for permit

Other costs may be added depending on soil conditions

An 8" casing with a 6" pipe costs $50 per foot

An 8" casing with an 8" pipe costs $60 to $65 per foot

Depth	6” casing & 6” pipe	8” casing & 8” pipe	8” casing & 8 “ pipe
50	$2,600	$3,100	$3,600
100	$4,600	$5,600	$6,600
200	$8,600	$10,600	$12,600
300	$12,600	$15,600	$18,600
400	$16,600	$20,600	$24,600
500	$20,600	$25,600	$30,000
1,000	$40,600	$50,600	$60,600
2,000	$80,600	$100,600	$120,600

Source:

Apple Valley Well Drilling

Families

Costs include: Purchase of bottled water, purchasing and maintaining reverse osmosis systems, testing well water, drilling new wells, and health related costs.

I. Consider the budget for a family of four with an annual income of $36,000 – a monthly income of $3,000. This equates to both parents working 40 hours per week for $10/hr.

Here is a hypothetical household budget:

Cost of Bottled Water at $1.20 per gallon

Calculate one gallon of water per person per day for drinking & cooking = $4.80 per day or $145 per month

Average property tax including school levies for Lower Yakima Valley cities = 6.797%

Average county property tax including fire protection and state school levy = 7.097%

Estimate an $80,000 mortgage with payments of $400 per month

Monthly Expenses

Income tax $ 0

Sales tax = 8% of non-food purchases

Social Security = 6.2% of gross income	186.00
Car payments	250.00
Car Insurance	125.00
Health Insurance	120.00
Out of Pocket Health Costs	150.00
Gasoline	200.00
Electricity	100.00
Telephone	80.00
Home Heating	200.00
Food at $30 per day	900.00
Clothing	
Car Repairs	
Home Repairs	
Church	
Computer Access	
School Supplies	
Child Care	
Bottled Water	145.00
Total	$3,322.67

This family has to find at least an extra $322.67 every month to meet their budget. Bottled water is 4.4% of their monthly income.

II. Consider the budget for a family of four with an annual income of $24,300 - the federal poverty level, a monthly income of $2,000. This equates to one parent working forty hours a week for $12.50 per hour

Monthly Expenses

Income tax	$ 0
Sales tax = 8% of non-food purchases	
Social Security = 6.2% of gross income	125.00
Rent	700.00
Health Insurance – eligible for low cost or free health insurance under ACA	
Electricity	100.00
Telephone	80.00
Home Heating	200.00
Food at $30 per day	900.00
Clothing	
Home Repairs	
Church	
Computer Access	
School Supplies	
Child Care	
Bottled Water	145.00
Total	$2,250.00

This family, without a car, must find an extra $250 per month to meet their budget. Bottled water is 6.4% of their monthly income.

Costs if 2,500 people in the Lower Yakima Valley buy bottled water due to elevated nitrates in their wells, calculated at $1.20 per person per day = $1,095,000 per year.

Sources:

Families USA (2016) Federal Poverty Guidelines. Available at http://familiesusa.org/product/federal-poverty-guidelines

Yakima County Development Association (2009) Yakima County Profile. Available at http://www.yakimacounty.us/DocumentCenter/View/1579

Yakima County – 2016 Tax Booklet at http://www.yakimacounty.us/DocumentCenter/View/9169

2015 Yakima County Community Indicators report – United Way https://www.uwcw.org/yc-life.

Tax Payers

New wells for Outlook School - $48,000

New well for the City of Mabton - $1.8 million

Since 2001 the City of Grandview has submitted 1040 water samples from their municipal wells in order to adequately monitor elevated nitrates. At a cost of $50 per sample this equates to $52,000 over a fifteen year period or about $3,500 per year. Grandview must blend water from high nitrate wells with safer water from other wells.

Costs for the Lower Yakima Valley GWMA $2.3 million

Costs for the WA State Dairy Nutrient Management Program $0.6 million annually

Statewide training for dairies on how to safely apply manures to crops $575,000 in 2016-2017.

South Yakima Conservation District $240,000 annually for dairy nutrient management

SYCD Grants to individual dairies for technological updates $60,000 per year

Ongoing research to assess the health effects from elevated levels of nitrate in drinking water. For example, *Dose-Response of Nitrate and Other Methemoglobin Inducers on*

Methemoglobin Levels of Infants, a 2009 study conducted in south central Washington at a cost of $594,000

Tax payer contribution to dairy digester construction

Tax payer contribution to construction of natural gas pipeline for dairies in Yakima County $1.5 million

GWMA proposed funding for farmer education regarding nitrate leaching to groundwater - Irrigated Ag Work Group, February 21, 2017

Funding to continue groundwater testing after the GWMA project ends in 2017 – Estimated at roughly $300,000 per year during Data Work Group meeting on February 22, 2017

Costs for the EPA study

Indirect costs to tax payers:

Providing safe drinking water for impacted residents – For example $350,000 for the Yakima Nitrate Treatment Pilot Program

NRCS loans and grants

USDA dairy program payments approximately $1.3 million per year for Yakima County

Ongoing research at approximately $500,000 for each study

Sources:

City of Mabton at http://www.cityofmabton.com/economicdevelopment.html

Environmental Working Group Farm Subsidies data base at https://farm.ewg.org/regionsummary.php?fips=53000&regionname=Washington

WA State Dept. of Health – Office of Drinking Water at https://fortress.wa.gov/doh/eh/portal/odw/si/ListWaterQuality.aspx

WA State Dept. of Health Dose-Response of Nitrate and Other Methemoglobin Inducers on Methemoglobin Levels of Infants at https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.highlight/abstract/5379/report/F

WSDA – Implementation of Nutrient Management Training Program for Farmers, Report to the Legislature at

http://app.leg.wa.gov/ReportsToTheLegislature/Home/GetPDF?fileName=533-DNMPReportToLegJune2016_e9a85fda-7303-4899-a2fb-c30aea1728df.pdf

GWAC Participation

Bureaucracy:

WA State salaries for staff who participate in the GWMA range from $55,000 to $96,000 per year, or $3,500 per month to $8,000 per month, or $175 per day to $400 per day

The average salary for WA State employees who participate in the GWMA is $73,600 or around $6,000 per month, or $300 per day or $37.50 per hour

Costs for a Meeting of the GWAC

Bureaucracy from out of town – approximately 4 people at a full day's pay	$1,200
Local bureaucracy – approximately 9 people at half a day's pay	1,350
Mileage for two cars from Olympia to Sunnyside @ $.54/mi times 380 miles	410
Two meals for 4 people at $15 per meal	120
Citizens and local advocacy groups – approximately 14 at a half day's pay	2,100
Total per meeting	$5,180
Six meetings per year	$31,080

Work Group Meetings

Cost per local participant – half a day = $150

Cost per out of town participant – one day = $300

Mileage for out of town participant = $205

Meals for out of town participant = $30

There are six active work groups with average attendance of five local people and one out of town member

Local participants	$750
Out of town participant	300
Mileage	205
Meals	30
Total per meeting	$1,285
Six groups with an average of 10 meetings per year	$77,100

Time spent by citizens and bureaucrats studying the data – 10 hours per month x 23 GWAC members @ $37.50 per hour = $8,625 per month

Twelve months per year x $8,625	$103,500

Total unbudgeted costs for the GWMA per year	$211,680

Growers & Producers

Costs for Soil Testing – Moisture, Nitrate-N, Ammonium – N, TKN at $40.60 per sample.

Costs for Nitrate Testing					
Lab Tests				$40.60	each sample
Labor, equipment, transportation				$50.00	
Total				$90.60	per sample
Sampling once a year					

Acreage		Every 40 acres		Every 80 acres	
40		$ 90.60		$ 45.30	
80		$ 181.20		$ 90.60	
120		$ 271.80		$ 135.90	
160		$ 362.40		$ 181.20	
200		$ 453.00		$ 226.50	
240		$ 543.60		$ 271.80	
280		$ 634.20		$ 317.10	
320		$ 724.80		$ 362.40	
360		$ 815.40		$ 407.70	
400		$ 906.00		$ 453.00	
440		$ 996.60		$ 498.30	
480		$ 1,087.20		$ 543.60	
520		$ 1,177.80		$ 588.90	
560		$ 1,268.40		$ 634.20	
600		$ 1,359.00		$ 679.50	
640		$ 1,449.60		$ 724.80	
680		$ 1,540.20		$ 770.10	
720		$ 1,630.80		$ 815.40	
760		$ 1,721.40		$ 860.70	
800		$ 1,812.00		$ 906.00	
Sampling Twice a Year					
Acreage		Every 40 acres		Every 80 acres	
40		$ 181.20		$ 90.60	
80		$ 362.40		$ 181.20	
120		$ 543.60		$ 271.80	
160		$ 724.80		$ 362.40	
200		$ 906.00		$ 453.00	
240		$ 1,087.20		$ 543.60	
280		$ 1,268.40		$ 634.20	
320		$ 1,449.60		$ 724.80	
360		$ 1,630.80		$ 815.40	
400		$ 1,812.00		$ 906.00	
440		$ 1,993.20		$ 996.60	
480		$ 2,174.40		$ 1,087.20	

520		$ 2,355.60		$ 1,177.80	
560		$ 2,536.80		$ 1,268.40	
600		$ 2,718.00		$ 1,359.00	
640		$ 2,899.20		$ 1,449.60	
680		$ 3,080.40		$ 1,540.20	
720		$ 3,261.60		$ 1,630.80	
760		$ 3,442.80		$ 1,721.40	
800		$ 3,624.00		$ 1,812.00	

There are about 94,000 irrigated acres in the Lower Yakima Valley. This equates to 1,175 80 acre fields. **At a cost of $90.60 per field this equates to $ 101,925 per year for once a year testing and $ 203,850 for twice a year testing**. Costs are higher if growers test for phosphorous, potassium and other minerals.

Moisture Sensors cost approximately $1,500 each.

Computer software ranges from?

Record keeping?

Time spent learning to use technology?

Costs for lining manure lagoons?

Costs for manure solids separation equipment?

Costs for hiring an agronomist at ___ per hour?

Health

Abstract: Human alteration of the nitrogen cycle has resulted in steadily accumulating nitrate in our water resources. The U.S. maximum contaminant level and World Health Organization guidelines for nitrate in drinking water were promulgated to protect infants from developing methemoglobinemia, an acute condition. Some scientists have recently suggested that the regulatory limit for nitrate is overly conservative; however, they have not thoroughly considered chronic health outcomes. In August 2004, a symposium on drinking-water nitrate and health was held at the International Society for Environmental Epidemiology meeting to evaluate nitrate exposures and associated health effects in relation to the current regulatory limit. The contribution of drinking water nitrate toward

endogenous formation of N-nitroso compounds was evaluated with a focus toward identifying subpopulations with increased rates of nitrosation. Adverse health effects may be the result of a complex interaction of the amount of nitrate ingested, the concomitant ingestion of nitrosation cofactors and precursors, and specific medical conditions that increase nitrosation.

Workshop participants concluded that **more experimental studies are needed** and that a particularly fruitful approach may be to conduct epidemiologic studies among susceptible subgroups with increased endogenous nitrosation. **The few epidemiologic studies that have evaluated intake of nitrosation precursors and/or nitrosation inhibitors have observed elevated risks for colon cancer and neural tube defects associated with drinking-water nitrate concentrations below the regulatory limit. The role of drinking-water nitrate exposure as a risk factor for specific cancers, reproductive outcomes, and other chronic health effects must be studied more thoroughly before changes to the regulatory level for nitrate in drinking water can be considered.**

Ward, M. H., DeKok, T. M., Levallois, P., Brender, J., Gulis, G., Nolan, B. T., & VanDerslice, J. (2005). Workgroup report: Drinking-water nitrate and health-recent findings and research needs. *Environmental health perspectives*, 1607-1614.
https://www.researchgate.net/profile/Jean_Brender2/publication/7502872_Drinking_Water_Nitrate_and_Health_-_Recent_Findings_and_Research_Needs/links/00b7d51acaa782b661000000.pdf

Costs for Nitrogen Loading Assessment

WA Dept. of Health Peer Review – About two weeks of staff time

WA Dept. of Ecology –

WA State Dept. of Agriculture –

Yakima County -

Litigation

Millions of dollars

Revised: February 23, 2017

Comments regarding *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*

Jean Mendoza, April, 2017

I. It appears to me that WSDA and perhaps Yakima County did not comply with the Interlocal Agreement that funded this study. That agreement states in part:

1. PURPOSE The purpose of this Agreement is to provide funds to the WSDA from Ecology's grant to develop a Comprehensive Nitrogen Loading Assessment for the Lower Yakima Valley Groundwater Management Area (PROJECT) to support the development of the Groundwater Management Program as set forth in WAC 173-100.

2. PROJECT. The WSDA agrees to do all work and furnish materials necessary for performing the work in accordance with this Agreement. The WSDA will provide the necessary resources for performing such work as set forth in the Scope of Work and Budget (Attachment "A")

On page 5 the SOW describes an overriding equation for this mass balance model.

NLGW = RL + BL + IACF + IAOF + CAFOPP +AL Where

• NLGW = nitrogen load to groundwater, which assumes that all nitrogen present below the root zone will become nitrate and either be denitrified or leach to groundwater.

• RL = nitrogen loading to groundwater from residential sources including septic tanks, lawn fertilization, and onsite septic systems

.

• BL = nitrogen loading to groundwater from sites with municipal biosolids, and municipal and industrial wastewater (under State Waste Discharge Permits, or NPDES permits)

• IACF = nitrogen loading to groundwater from irrigated agriculture land use where chemical fertilizers are applied and further discussed below

• IAOF = nitrogen loading to groundwater from irrigated agriculture land use where organic fertilizers (e.g., manure) are applied

• CAFOPP = nitrogen loading to groundwater from livestock pond and pen sources this will include such activities as lagoon operations, composting activities, feeding and milking areas

• AL = nitrogen loading to groundwater from atmospheric deposition. Local values from national atmospheric monitoring data sets will be used and applied evenly across the GWMA.

However, the lead agencies have stopped calling this a nitrogen loading assessment. On page 1 the introduction to the study states,

> In 2015, the Yakima County Public Services Department and GWAC partnered with WSDA to conduct a study to provide a scientific baseline estimate of the amount of potential nitrogen available for transport from different nitrogen sources within the GWMA boundaries. Nitrogen available for transport is nitrogen that has the potential to move from the land surface or soil profile into groundwater. The study addressed how much nitrogen could be available, but did not calculate how much is actually transported to groundwater. The processes controlling nitrogen movement through the soil were not evaluated, and loading to groundwater was not estimated.

On page 7 the SOW states:

> WSDA and Yakima County have taken steps toward the development of a GIS linkage structure. This structure will be submitted for review to the County, and the Data, RCIM, IA, and Livestock/CAFO working groups prior to entering source data into it.

To my knowledge this has not been done.

On page 10 the SOW states:

Task 4.2	Identify and analyze N loading from permitted land application sites. This task will be coordinated with the Washington State Department of Ecology.	
	Estimated Budget	*30 hours @ 30.00/hr* *$ 900.00*

In Washington State the laws require Ecology to put sewage sludge and bio-solids to a beneficial use. (RCW 70.95J) With this in mind King County and Kitsap County transport bio-solids to Yakima, Benton, Klickitat, Kittitas and Douglas Counties for application to cropland. Yakima County receives the largest portion of bio-solids and also applies biosolids from the City of Yakima. 40,000 acres, mostly in the lower valley is approved by Ecology for application of bio-solids. (See Attachment B) Yakima County states that they will add this source to the study.

The Port of Sunnyside has a Waste Water Treatment Plant and a National Pollutant Discharge Elimination System (NPDES) permit, No. WA0052426, that permits the facility to spread up to 432 lbs of nitrogen per acre per year on 398 acres. (See Attachment C, page 9) This could potentially add 86 tons of nitrogen to the mass balance for the GWMA target

area. This source was not included in the Nitrogen Balance Assessment. Yakima County states that they will add this source to the study.

On page 10 the SOW states:

Task 4.3	Develop N loading estimates from municipal Underground Injection Control devices. This will include analysis of stormwater management structures, but will not include an assessment of potentially existing UIC's nor will there be an attempt to identify UIC not currently noted in Ecology's UIC database. *Estimated Budget 60 hours @ 30.00/hr $ 1800.00*

Ecology lists 47 underground injection wells at 15 sites in the GWMA target area. These UICs were not addressed in the study. (See Attachment D for a list of the sites)

On page 12 the SOW describes a process for gathering data regarding Irrigated Agriculture

Data for the irrigated agriculture nitrogen loading assessment will be collected using three different methods:

1) County specific crop use, irrigation method, and fertilizer databases

2) Information gathered from a voluntary grower questionnaire that will report site-specific information regarding nitrogen application and removal over several growing cycles and

3) Information collected through a series of group interviews/surveys with local crop consultants and agronomists.

To my knowledge, growers who receive a newsletter from the Sunnyside Irrigation District were informed about the GWMA Deep Soil Sampling study and the survey that accompanied it. To my knowledge the survey was not sent with the newsletter and only those who participated in the DSS study completed the survey. To my knowledge there might have been one or two newspaper articles that described the survey but there was no mailing or direct attempt to reach the thousand plus farmers in the target area.

To my knowledge there were no group interviews/surveys. Crop consultants and agronomists were interviewed by phone. <u>It is very concerning that these sources are anonymous. Readers have no way of verifying the credentials for these experts</u>. My calculations show that, for each of ten major crops, a single consultant spoke for:

- 81% of the surveyed alfalfa acreage
- 56% of apple acreage
- 65% of cherry acreage
- 85% of corn silage acreage
- 78% of juice grape acreage
- 80% of hops acreage
- 90% of mint acreage
- 57% of pear acreage
- 61% of wheat acreage
- 70% of triticale acreage

The study did not tell us whether there were ten different experts for the ten crops or whether one expert spoke for more than one crop. It is possible that the majority of estimates for irrigated agriculture are based on the opinions of just a few people.

On page 13 the SOW states:

> For crops that fix nitrogen (legumes such as alfalfa and peas), either a fixation term will be included in the nitrogen input term or a calculation using a leached concentration and recharge volume will be used to calculate loading (as performed in other studies), depending on data availability.

This was not done. Alfalfa was treated like any other crop and there was no calculation of nitrogen fixation numbers. A brief review of commonly used guides from agricultural universities and extension services gives a range of nitrogen fixation in alfalfa fields. Nitrogen fixation ranges from 20lbs/acre/yr to 500 lbs/acre/yr. (See Attachment E)

In the frequently cited 2012 study, *Nitrate Sources and Loading to Groundwater, Technical Report 2 in: Addressing nitrate in California's drinking water with a focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature*, Viers et al noted on page 10:

> *The mass balance approach is not applied to alfalfa because it does not receive significant amounts of fertilizer, while fixing large amounts of nitrogen from the atmosphere. Little is known about nitrate leaching from alfalfa; we used a reported value of 30 kg N/Ha/Yr (27 lb N/ac/yr) (Letey et al., 1979; Robbins et al., 1980, see Appendix Table 1). In total, 170,000 ha (420,000 ac) of alfalfa fields are estimated to contribute 5 Gg N/yr (5,000 t N/yr) in the study area. Alfalfa harvest exceeds 400 kg N/ha/yr (360 lb N/ac/yr), or 74 Gg N/yr (82,000 t N/yr), in the study area.*

Throughout the California study alfalfa is described separately and is not part of the routine calculations for field crops.

On page 13 the SOW states:

> The following equation will be used to estimate nitrate loading to groundwater from irrigated agricultural fields:
>
> ***Nitrogen load to ground water = (Nitrogen input - Nitrogen removed by cropping)*(1-denitrification fraction)***
>
> Use of the above equation requires the following assumptions and limitations:
>
> All nitrogen not consumed by the crop and removed will become nitrate
>
> Excess nitrate is denitrified in the vadose zone or leaches to groundwater
>
> Input and results are not variable over time and can be approximated with average annual values
>
> Removal of nitrogen from a field via runoff or tile drainage is negligible

The study did not estimate de-nitrification rates. The study did not describe typical pathways in the vadose zone. The study did not assume that "excess nitrate is denitrified in the vadose zone or leaches to groundwater". There was no de-nitrification fraction. (I do understand that there is little de-nitrification in the well aerated soils of the GWMA target area.)

On page 15 the SOW states:

> Additional data that will be obtained through a literature review or data collection include:
>
> • Manure produced per dairy cow and per beef cow and manure nitrogen content
>
> • A range of lagoon seepage and nitrogen leaching rates
>
> • Ammonia volatilization rates from stored and applied manure
>
> • Typical nitrogen loads generated in unpaved animal yards
>
> • Typical manure management practices for animal yards
>
> • Amount of solids/compost or other nitrogen-containing material that is exported from the GWMA

Much, even most of this data was not collected. There is no estimate of the manure produced per dairy cow or beef cow, no estimate of manure nitrogen content, no ammonia volatilization rates, no statement of typical manure management practices and no statement about the amount of solids/compost exported from the area.

On page 16 the SOW says:

> The following equation will be used as a basis for calculating a livestock N loading mass balance:
>
> *(Number of cows x Manure generated per cow x Nitrogen content of manure) = Nitrogen leached from storage ponds + Nitrogen leached from unpaved animal yards + Nitrogen removed for local land application + Nitrogen exported from the GWMA as compost or in other forms + Nitrogen lost to volatilization + Nitrogen lost to denitrification*

This equation was not used. Several components of the equation were never evaluated, including manure generated per cow, nitrogen content of manure, nitrogen removed for land application, nitrogen exported as compost, and nitrogen lost to volatilization or denitrification. There is no estimate of the excess nitrogen available from manure in the GWMA target area.

On page 16 the SOW says the study will complete several tasks:

Task 6.1	Conduct literature review to assemble peer reviewed data on lagoon leakage rates, regional nitrogen content of manure from dairy and beef cattle, required manure handling activities on facility sites. Coordinate with EPA regarding "lagoon" data collected from "Dairy Cluster".		
	Estimated Budget	*30 hours @ 26.00/hr*	*$ 780.00*
Task 6.2	Conduct evaluation of manure generation using latest livestock population data, evaluate 3rd party application, develop lagoon leakage rates, evaluate soil testing results and evaluate manure export activities.		
	Estimated Budget	*90 hours @ 45.00/hr*	*$ 4050.00*

Most of the activities in these tasks were not done.

On page 17 the SOW states:

Quality Assurance/Quality Control evaluations are proposed to check assumptions and parameters used in the Nitrogen Loading Assessment. These activities include:

- Compare livestock mass balance results with grower survey results to verify assumptions used related to manure application. If the total nitrogen applied across the GWMA as organic fertilizer based on grower survey data differs significantly from the mass expected based on the number of livestock in the GWMA and other identified organic nitrogen sinks, input parameters for the nitrogen loading assessment will be reevaluated. This activity will be addressed through periodic revisions to the document as is warranted as new information become available.
- Conduct an assessment on synthetic fertilizer use using the mass applied to fields (based on grower surveys and WSU rates) compared to nitrogen fertilizer mass sold by fertilizer distributors (assuming data are available). This will provide a check on amounts claimed on grower surveys.

Because there was no livestock mass balance calculation it was not possible to verify assumptions related to manure applications. To my knowledge there was no attempt to determine the amount of fertilizer sold in the area. This was discussed within the Irrigated Ag work group but WSDA rarely attended these meetings.

Because there was no attempt to estimate manure generation based on the number of cows; because there was no attempt to quantify the amount of fertilization from organic fertilizer and compare to synthetic fertilizer; because manure export was not quantified, it is almost impossible to draw conclusions regarding the source of nitrates in lower valley groundwater.

On pages 17 & 18 the SOW states:

(These activities include) Upon completion of the Deep Soil Sampling analysis, compare and contrast Nitrogen Loading Assessment with DSS findings. Existing shallow groundwater nitrate data may also be used for this purpose.

and

Task 7.2	Evaluate DSS results with N Assessment results and determine relative gaps in assessment.		
	Estimated Budget	*80 hours @ 55.00/hr*	*$ 4400.00*

The last round of Deep Soil Sampling was completed almost a year ago. To my knowledge there has been no effort to analyze the data. We are proceeding with the Nitrogen Loading Assessment, moving toward development of a plan to address nitrates in groundwater and we will apparently ignore this $350,000 study. Task 7.2 says that WSDA will evaluate the DSS results and will compare those results to the Nitrogen Loading Assessment. This was certainly not done in the first draft.

II. I have concerns regarding the Methodology and Data Collection in the Nitrogen Loading Assessment.

Executive Summary

On page 1 the summary states that the study will evaluate inputs from CAFOs. It appears that input from animals on pasture was omitted. In 2012 there were 258,663 head of cattle and calves in Yakima County, most in the lower valley and many on pasture. During the five years between the 2007 and 2012 the number of milk cows in Yakima County increased from 89,575 to 99,532 and the number of beef cattle decreased from 28,594 to 15,414. (USDA NASS, 2014).

On page 2 the summary states that the study will evaluate both wet and dry deposition of nitrogen. This was not done.

On page 2 the report states, "Atmospheric calculations included adjustments to avoid double counting with other categories that already included atmospheric nitrogen." As a result over half of the atmospheric deposition was classified under other sources. This gives the reader a faulty understanding of the amount of atmospheric deposition.

Tables 1 & 2 on page 3 leave out composting areas, dairy ponds, application of bio-solids and other permitted land applications. The Irrigated Agriculture row is not broken down into organic fertilizer and inorganic fertilizer. The numbers for Atmospheric Deposition apply to less than half of the GWMA area and are not broken down into wet and dry.

On page 4 the summary states, "The irrigated agriculture mass balance estimates could be compared to current and future deep soil sampling results to improve the accuracy of the analysis." Comparing to current deep soil sampling was part of the SOW for this project.

Introduction & Study Area

Suggestion: The introduction states on page 5, "The current population of Yakima County is just over 240,000 people, and the major metropolitan area is the city of Yakima (Census 2010)." It would be useful to state the population for the GWMA target area as well.

Question: The introduction states on page 5, “The lower valley agricultural landscape includes more than 50 active dairy farms and approximately 100,000 acres of irrigated farmland (WSDA 2016).” It is nearly impossible for readers to access the WSDA data source for these numbers. Steve George from the Yakima Farm Bureau states that there are 94,000 acres of irrigated agriculture in the area. Does the 100,000 acres include double counting for land that is double cropped in corn and triticale? According my reading this was done in the UC Davis study. (Viers et al, 2012, pages 71 & 115)

Methodology & Limitations

On page 8 the study describes the treatment zone for each source. For “residential fertilizer” and “small commercial and hobby farms” the treatment zone is the land surface. This means that the total amount of fertilizer applied is assumed to be available for leaching to the groundwater. There is no assumption that this fertilizer is taken up by plants. The result is an over-estimate of nitrate from this source. An estimate that even half of this fertilizer is utilized by plants would be more accurate.

On page 9 the study states, “In order to allow readers to evaluate data sources on a case-by-case basis each data source used, the calculation it was used for, the source, and potential concerns with the data source have been collected in a table (Appendix A: Data Sources, Uses, and Potential Concerns).” However, the only way for readers to access the following listed sources and verify data is through public records requests:

2014 dairy registration locations
WSDA DNMP
WSDA Animal Services
DNMP lagoon assessment project
Nutrient management plans
DNMP staff onsite data collection using ArcGIS Collector
DNMP lagoon assessment
Self-reported data to SYCD
Telephone survey
Dr Ranil Dhammapala
Virginia Prest, WSDA DNMP
GWMA Survey "Well Assessment Survey"
ESD 2015
Scott’s Turf Builder

1. Concentrated Animal Feeding Operations

a. Background and Literature Review

The SOW states:

Task 6.1	Conduct literature review to assemble peer reviewed data on lagoon leakage rates, regional nitrogen content of manure from dairy and beef cattle, required manure handling activities on facility sites. Coordinate with EPA regarding "lagoon" data collected from "Dairy Cluster".		
	Estimated Budget	*30 hours @ 26.00/hr*	*$ 780.00*

It appears that WSDA relied almost exclusively on the work performed by UC Davis in their study of the Tulare Lake Basin in California for a review of the literature. Please note that, in 2014, I shared a listing of relevant sources with the GWMA CAFO/Livestock work group. (See Attachment F) This was not a literature review but it is more extensive than the work done by WSDA in the Nitrogen Loading Assessment. This listing provides a broader look at leakage from dairy lagoons.

b. Pens and Compost Areas

Under "Pens" the study cites research by Mielke from 1974. This was a limited study conducted on beef feedlots in Nebraska during a time when the Clean Water Act was first being developed. It has been replaced by more current, more accurate and more relevant research. It should not be part of this review.

I disagree with the numbers stated on page 12. The study says:

> *As of 2014 DNMP dairy registration, dairies in Yakima County had just over 100,000 milking and dry cows (the vast majority of which were within the GWMA boundary), making for a stocking rate of around 50 cattle/acre, based on the NRAS estimate of pen acreage, similar to that of dairies in the UC Davis study.*

Assuming that 89% of the milk cows in Yakima County are within the GWMA target area (there are about 5,000 milk cows on the Yakama Reservation and about 6,000 in the Moxee Valley) then the stocking rate in the GWMA area is 55 to 57 cows per pen-acre. (See Attachments I & J). This puts the stocking rate for the GWMA area at a higher concentration than the Tulare Lake Basin as a whole and most closely aligned with Tulare County.

On page 14 the study states,

> *NRAS did not have the amount of facility-specific on-site information that would be needed to generate rates for dairy and nondairy CAFOs.*

If WSDA does not have this information who does? Most of us believe that it is WSDA's job to understand agriculture and to know what is happening on Washington farms. What is wrong with calling the two beef feed lots and asking for their average stocking rates?

On page 14 the study states,

> *With no information available in scientific literature about potential loading from compost areas, NRAS did not attempt a calculation for these areas.*

I have found considerable research from both academic and USDA sources regarding the environmental impacts from compost areas. In addition, WSDA's own research shows significant leaching from Yakima Valley composting operations. See the table below with data from Attachments K, L & M. This source is too important to be ignored.

Compost Yards	**Nitrate in mg/kg**							
Soil Testing								
Site	Surface	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft
1C1	364.0	116.3	95.6	82.6	31.1	15.4	15.6	8.3
1C2	292.7	49.8	24.5	28.6	27.1	21.0	19.8	
5C1	159.0	118.8	133.8	225.0	153.9	116.7	28.0	8.5
2Cl	139.0	1.3	6.3	1.0	3.2	1.9	8.5	
2Cu	649.4	30.0	2.2	36.9	150.0	175.1	151.5	
4C1	48.3	164.5	226.1	216.9	222.5	132.1	59.1	
6C	123.2	73.5	34.7	24.7	17.7	9.1		
Average	253.7	79.2	74.7	88.0	86.5	67.3	47.1	8.4
Range	48.3-649.4	1.3-164.5	2.2-226.1	1-216.9	3.2-222.5	1.9-175.1	8.5-151.5	8.3-8.5

On page 14 the study says,

> *Potential emissions of nitrogen compounds to the atmosphere from pens and corrals have not been estimated in this report. It is unknown what proportion of emissions from GWMA CAFOs may redeposit within the GWMA, as emissions may travel large distances before eventual deposition (Viers et al. 2012)*

Nearby Idaho has studied ammonia emissions on dairies. Leytem et al (2010) found:

> *Average emissions per cow per day from the open lots were 0.13 kg NH_3, 0.49 kg CH_4, 28.1 kg CO_2, and 0.01 kg N_2O. Average emissions from the wastewater pond (g m^{-2} d^{-1}) were 2.0 g NH_3, 103 g CH_4, 637 g CO_2, and 0.49 g N_2). Average emissions from the compost facility (g m^{-2} d^{-1}) were 1.6 g NH_3, 13.5 g CH_4, 516 g CO_2, and 0.90 g N_2O. The combined emissions of NH_3, CH_4, CO_2, and N_2O from the lots, wastewater pond and compost averaged 0.15, 1.4, 30.0 and 0.02 kg cow^{-1} d^{-1}, respectively. The open lot areas*

generated the greatest emissions of NH_3, CO_2, and M_2O, contributing 78, 80, and 57%, respectively, to total farm emissions.

The UC Davis study took volatilization losses seriously. Viers et al (2012, pages 152 & 157) estimated that 38% of all excreted N was lost to the atmosphere before it was applied to the land.

This route of nitrogen loading or unloading is too significant to be ignored. In 2008 the EPA estimated that animal agriculture in Yakima County emitted 6,078 tons of ammonia to the atmosphere. In 2011 that number had increased to 8,054 tons. (Attachments N & O)

c. Lagoons

Here is a comparison of the lagoon capacities for California dairies and for GWMA dairies:

	# milk cows	Acres of Lagoons	Cows/lagoon acre
County	U of C Table 30	U of C Table 29	
Fresno	132,588	325	408.0
Kings	177,696	547	324.9
Tulare	545,689	1,740	313.6
Kern	164,127	514	319.3
Total TLB	1,020,100	3,126	326.3
Yakima NASS	99,532	210	474.0
Yakima DNMP	103,089	210	490.9

Based on surface area we have less lagoon space per cow and this impacts a comparison between the two areas. It is possible that GWMA lagoons are deeper than California lagoons.

On page 22 the study states:

The average capacity used for each lagoon was then itself averaged across all lagoons, resulting in an average percent capacity used for 2015 visited of 43%. The depth used in the Darcy's Law calculations is 43% of the actual or estimated design depth.

This is mathematically incorrect. The only time that volume (capacity) is proportional to depth is when the sides of a container are vertical. This is not the case for lagoons.

If the 43% depth is used to calculate volume for the average square lagoon with a 1:3 slope as described in Appendix C the result is a lagoon about 37% full.

Question: Were the lagoons on the "dairy cluster" included in the calculations?

On page 24 the study states,

> *Lagoon liner permeability options were also discussed with some GWMA workgroups in 2015. The groups agreed that 2 liner permeability scenarios should be considered in lagoon seepage calculations. Based on these discussions and limitations in the data available, liner permeabilities of 1 x 10-7 and 1 x 10-6 cm/s were used to determine a low and high rate seepage estimate, respectively.*

I do not recall the referenced meetings and I find no record for those discussions. I disagree with the assumptions WSDA has made regarding lagoon leakage. For purposes of the Nitrogen Loading Assessment, WSDA assumes that all dairy lagoons in the GWMA target area are adequately lined and uses the ranges for compliance when calculating low and high amounts of lagoon leakage. There is no adjustment for aging, poorly maintained lagoons.

The most intensively studied lagoons in the GWMA target area are the lagoons on the "dairy cluster". There are 41 waste management lagoons that cover 40 acres on these sites. It is a fact that the four dairies involved chose to line their lagoons rather than provide proof of proper lining. (U.S. Environmental Protection Agency 2014; U.S. Environmental Protection Agency, 2016).

WSDA states in the Nitrogen Loading Assessment on page 24,

> *Construction dates for lagoons in the GWMA are unknown. Without information on how many lagoons were constructed before the 2004 standard, it is impossible to say how many lagoons may have permeabilities higher than 1 x 10^{-6}.*

And,

> *Clearly lagoons constructed prior to the current guidance documents are unlikely to meet current NRCS standards. However, no information is available about what*

seepage might be for lagoons constructed before 1990, or between the 1993 guidance and the 2004 guidance

Then, incredibly, WSDA goes on to decide

> *Darcy's law calculations were run using the two different permeabilities discussed above (1x 10-7 and 1x10-6 cm/s) to determine a low and high range estimate. Since this is the only parameter that differed between the two calculation scenarios, the estimated loss for high and low differs by a factor of 10. The medium rate was calculated by averaging the low and high rates. Table 7 displays the results from these calculations. The rate per area was determined by dividing the total loss by the total design surface area of lagoons in the GWMA.*

It is unconscionable to just assume, in the face of contrary evidence, that leakage from GWMA lagoons meets current safety standards.

On page 25 the study states,

> *For lagoons with depths of 16 feet or less, the minimum liner thickness required is 1 foot (USDA NRCS 2016a)*

This is not correct. Here is what the NRCS Practice Standard 520 actually says regarding compacted clay liners.

> ***Liner Thickness**.*
> *The minimum thickness of the finished compacted liner must be <u>the greater of</u>—*
> - *The liner thickness required to achieve a specific discharge (unit seepage) design value, or*
> - *A liner thickness required by State regulations, or*
> - *The minimum liner thickness as shown in table 1.*

Table 1. Minimum liner thickness by design storage depth. Design Storage Depth (ft)	Liner Thickness (in)
≤16	12
16.1–24	18
24.1–30	24

The formulas for liner thickness required to achieve a specific discharge are provided in Chapter 10, Appendix D of the Agricultural Waste Management Field Handbook.

As an example: Use Method A on page 10-D 17 and calculate the liner depth to achieve leakage less than 5,000 gal/acre/day, with a hydraulic permeability of 6.5×10^{-7} cm/s and a lagoon depth of 12 ft. The result is a liner thickness requirement of 1.6 ft.

Darcy's Law says that deeper lagoons require thicker liners.

Soils in the GWMA target area usually have a compacted hydraulic conductivity much greater than $1x10^{-6}$ cm/s; in other words greater permeability. The practice of excavating and compacting native soils is not sufficiently protective of the aquifers. The appropriate hydraulic conductivity must be used when estimating required lagoon thickness and determining leakage using Darcy's Law.

On page 27 the study says,

> *The work involved in correctly identifying and characterizing settling ponds or basins well enough for an accurate calculation makes addressing settling ponds beyond the scope of this report.*

On the other hand, settling ponds are a significant source of nitrogen loading to the groundwater. We cannot just ignore them.

2. Irrigated Agriculture

On page 30 the study states,

> *This study does not include information on the use or benefits of nitrogen-fixing cover crops used within the GWMA boundaries. Although cover crops benefit soil health, reduce erosion, and can provide nutrients for future crops, the behavior and cultivation of different cover crops and/or winter crops used in double cropping systems was beyond the scope of this study.*

There is a big difference in the nitrogen balance when there are cover crops on the 17,333 acres of land planted in apples, the 6,336 acres planted in cherries and the 843 acres planted in peaches/nectarines. This is about 25% of the irrigated land. There should be an estimate of the nitrogen uptake from cover crops and this could have been addressed in the telephone interviews for irrigated agriculture.

There are 10,780 acres in triticale. Is this land double cropped? If so, please note this in the narrative.

On page 31 the study says,

> *Results from this study were not compared to the Yakima county deep soil sampling results: that was beyond the scope of this study.*

This is incorrect. On page 18 the SOW states:

Task 7.2	Evaluate DSS results with N Assessment results and determine relative gaps in assessment.		
	Estimated Budget	*80 hours @ 55.00/hr*	*$ 4400.00*

Beginning on page 31 the study describes data collection. The narrative suggests and promises credible numbers. Friends of Toppenish Creek obtained the written notes and spreadsheets that were recorded during these telephone surveys through a public records request. There is not very much. The documents are in Attachments P, Q & R. This data gathering is completely inadequate for our purposes. This is not science.

Question: Under inputs there is a listing for irrigation water. In the spread sheet this source reportedly adds 0 and 7.41 lbs N/acre. (Asparagus apparently receives no nitrogen from irrigation water.) If irrigation water comes from dairy ponds and lagoons is the higher N content in those waters considered?

a. Data Collection Please look at Attachment C. This document describes the sources for the data regarding manure and fertilizer applications on irrigated crops. In over 70% of the categories one lone "expert" spoke on behalf of an entire class of crops. This expert was frequently not even a farmer; rather he sold fertilizer, packed and processed crops or advised growers. If I participate in a scientific study I want to be acknowledged. Why would these experts want to remain anonymous? Here is a summary table that shows what percentage of the cropland was characterized by one person.

Survey of Yakima Valley Crops for the Lower Yakima Valley GWMA	

Crop	Acres Surveyed	One Consultant	% One Consultant
Alfalfa	6,194	5,000	81%
Apple	14,165	8,000	56%
Cherry	3,826	2,500	65%
Corn Silage	11,480	9,800	85%
Juice Grapes	3,849	3,000	78%
Hops	3,760	3,000	80%
Mint	780	700	90%
Pears	1,741	1,000	57%
Wheat	490	300	61%
Triticale	7,500	5,250	70%
Total	53,785	38,550	72%

Looking at alfalfa it is easy to see how one person can strongly influence the numbers. Here are the nitrogen application estimates from the three commercial consultants who responded regarding alfalfa:

Alfalfa	Acreage		Organic N #/acre	Commercial N #/acre
Comm Consultant	100	acres	0	30
Comm Consultant	200	acres	225.7	0
Comm Consultant	5000	acres	0	80
Average			75	37
Weighted Average			8.5	76

If you just look at the opinions of three men and give each person's opinion equal consideration then the average grower applies 75# of organic N and 37# of commercial N per acre to alfalfa. Because consultant #3 speaks for such a large acreage, the numbers closely match his estimates when the averages are weighted. In this weighted scenario the average grower applies 8.5 #/acre of organic N and 76#/acre of Commercial N. See Attachment T for a more complete look at alfalfa.

b. Irrigation water nitrogen

Dairies own about 29,000 acres of land in the Lower Yakima Valley. (WSDA, 2016) They grow a large amount of silage corn and triticale on this land. Much of their irrigation water does not come directly from the canals. It comes from lagoons and ponds that collect manure and liquids from the milk parlors, pens and corrals. This effluent is high in nitrogen content. Nutrient management plans actually require dairies to test this liquid for nitrogen levels before applying to fields.

It is important to remember that more nitrogen is excreted in urine than in feces. Rotz (2004, page E123) states

> *With all diets balanced to meet the RDP and RUP requirements of lactating dairy cows, urine N excreted from a high-protein diet (18% CP) was 2.3 times greater than that from a low-protein diet (12%CP; Tomlinson et al., 1996). Fecal N excretion was only 25% greater using the high-protein diet, which illustrates that excess protein is primarily excreted in urine.*

Dairy ponds are a source of nitrogen. If we fine tune this study to include 5#/acre from irrigating with surface water, then we certainly should not ignore the much larger contribution from irrigation with pond and lagoon water.

c. Calculated Residual Nitrogen

This study appears to shift responsibility from the crops where fertilizers are over-applied and direct it towards crops that are less likely to contribute to nitrate pollution. Fruits and grapes must take in a significant amount of nitrogen in order to build structure. Only the fruit is harvested but the trees and vines must be maintained.

Here is an abbreviated table taken from the large spreadsheet that WSDA shared at the Nitrogen Loading presentation. These numbers are for inputs and outputs at the medium or average level.

	Comm N	Manure N	Compost N	At. Depos.	Calc. Residual	Irr. Water	Soil Conv.	Crop Uptake	Loss to Atm.	Total #/acre
Apples	52	0	6	2.05	50	5.5	92	100	17	90.5
C Silage	106	110	0	2.05	10	5.23	92	270	30.4	24.7

Juice Grapes	72	0	7.4	2.05	60	4.86	92	90	17	131.3
Triticale	29	78	1	2.05	13	5.23	92	212.5	17	-9.2

At this average level the amount of manure/fertilizer applied is:

- Apples: 58#/acre
- Juice Grapes: 79.4 #/acre
- Triticale: 108 #/acre
- Corn Silage: 216 #/acre

But the excess #N/acre per crop is:

- Triticale: negative 9.2
- Corn Silage: 24.7
- Apples: 90.5
- Juice Grapes: 131.3

Apples and grapes actually end up with more nitrogen than the growers applied. I suggest that the calculated residual and soil conversion contribute to this problem. In addition, there is no quantification of the nitrogen taken up by cover crops in the orchards.

d. Soil Organic Matter Conversion to Nitrate

The study states:

> *This term represents the breakdown of organic matter (containing nitrogen) to nitrate-nitrogen available for both crop uptake and leaching below the crop root zone. This input was the same for every commodity analyzed. The native organic matter content of most lower Yakima Valley soils is around 1% but when these soils have a history of organic inputs such as manure, it can increase by 2 to 3 time..*

The study averaged organic matter readings for the Deep Soil Sampling in 2015 and applied the results to all crops, whether they received manures or not. I re-calculated the numbers and found that cropland with alfalfa, corn, triticale and Sudan grass had an average of 2.28% organic matter while all other crops - grapes, apples, mint, hops - had an average organic matter content of 1.69%. This is a difference of .59 percentage points and I believe it is significant.

e. Alfalfa

Here is a summary table for the GWMA Deep Soil Study – 2014 to 2016. For more analysis see Attachment T.

Deep Soil Sampling for Alfalfa – Levels in #N/Acre							
		1FT	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft
Average for all DSS, N = 26		45.5	54.6	104.8	121.7	106.6	92.6
Average for fields receiving liquid manures, N - 10		53.2	91.6	188.3	205.0	124.7	136.0

It is clear that nitrates leach to the groundwater from these Lower Yakima Valley alfalfa fields. This contradicts the prediction that alfalfa depletes the soil of nitrogen. There is a gap between the theoretical work and the field work.

Various academic institutions and extension services clearly state that alfalfa fixes nitrogen in the soil at rates of 20 to 500 #/acre/year. See Attachment E.

Pacific Northwest Extension (WSU, OSU & U of I) states.

> *Fertilizer N rates should be reduced 60 to 100 pounds per acre when field corn follows alfalfa grown for forage or seed. Shorter growing seasons likely will not mineralize as much N from alfalfa residues as longer growing seasons. Also, poor alfalfa stands won't release as much N the following year as good stands. Reduce the alfalfa N credit by 20 to 30 lb N per acre if the alfalfa stand is less than two plants per square foot.*

The role of alfalfa in the GWMA nitrogen balance should be revisited.

f. Results and Discussion

Can someone explain how only 2.8% of the pasture land received manure?

3. Atmospheric Deposition

"Atmospheric deposition and nitrate-nitrogen in groundwater used as irrigation water are approximately one-tenth of all nitrogen input."

(Viers et al in the U of C Davis study, *Nitrogen Sources and Loading to Groundwater. Technical Report 2 in: Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater,* page 11)

Consider Tulare County in California, the county that most closely resembles the GWMA target area in concentration of milk cows. Here is a deposition map from that study:

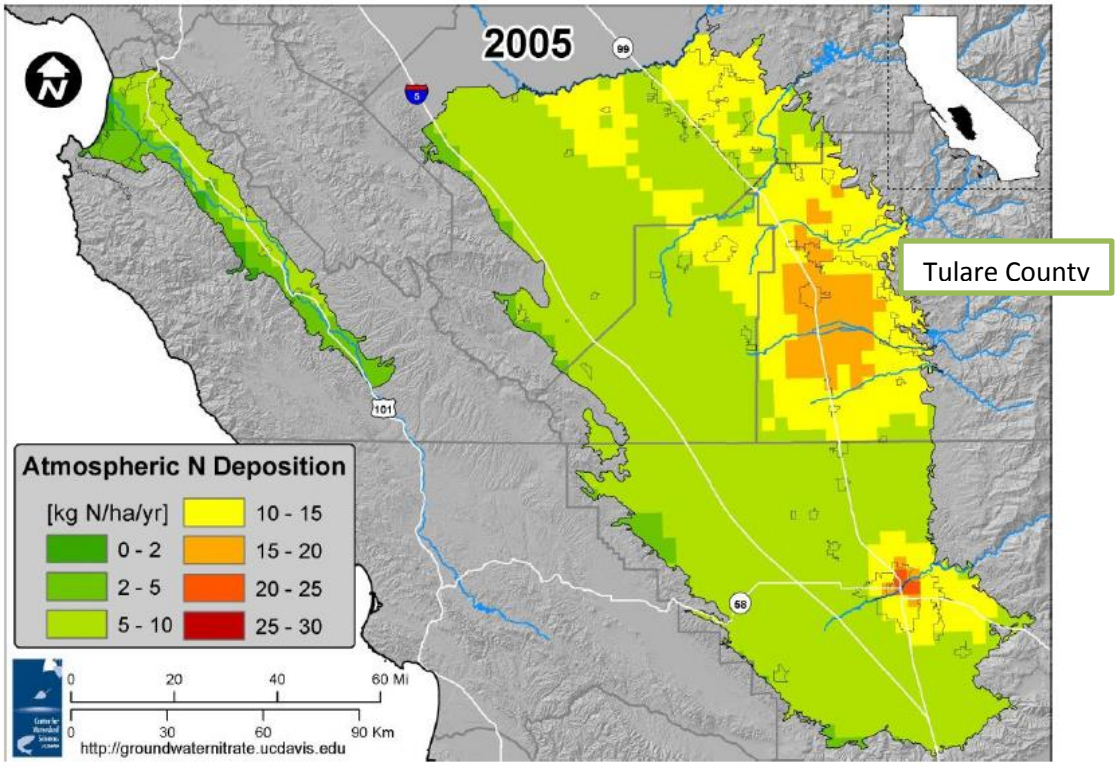


Figure 61. Atmospheric N deposition, spatially distributed across the study area, based on the Community Multiscale Air Quality model developed by U.S. EPA.

While the average atmospheric deposition of nitrogen in the Tulare Lake Basin is 9 lbs/acre (Viers et al, 2012, page 226) the atmospheric deposition in Tulare County target area ranges from 9 to 18 lbs/acre/year (page 228). (Lbs/acre/yr = .89 kg/ha/yr) Between a quarter and a half of the ammonia that goes up comes down in the same area.

Potter et al (2008, page 114) provide an overview of nitrogen inputs for the nation as a whole and for the western states as a whole. They say:

> *Total nitrogen input for the West region averaged 147 pounds per acre (table 34, fig. 14). The largest source was commercial fertilizer at 48 percent, followed by bio-fixation at 40 percent, manure at 11 percent, and atmospheric deposition at 1.6 percent (fig. 15). The West region had the lowest amount of nitrogen from atmospheric deposition, averaging only 2.3 pounds per acre in these model simulations*.

This document estimates that corn fields volatilize 30.4 lbs of nitrogen per acre per year. There are a lot of corn fields in the lower valley. How can we say that all of this reactive nitrogen goes up into the ambient air and only 2.05 lbs per acre comes back down?

Dr. Ranil Dhammapala from the WA State Dept. of Ecology has conducted research in the Sunnyside area regarding wintertime nitrates. He found that 31% of fine particulate matter in the area is ammonium nitrate, a very high percentage compared to most areas. (Attachment U)

WSDA cites Dr. Dhammapala as the expert who recommended 2.05 lbs/acre for average atmospheric deposition and a high level of 6.15. I have read the e-mails leading up to this estimate. I am not sure he intended 6.15 to be the high level. He may have recommended it as a potential average.

Ecology's study of the Upper Yakima Valley documents that we have problems with winter nitrates in the air. There is more than enough ammonia in the air to combine with all available nitrate and sulfate and this leads to increases in fine particulate matter and thus deposition. (Van Reken et al, 2015).

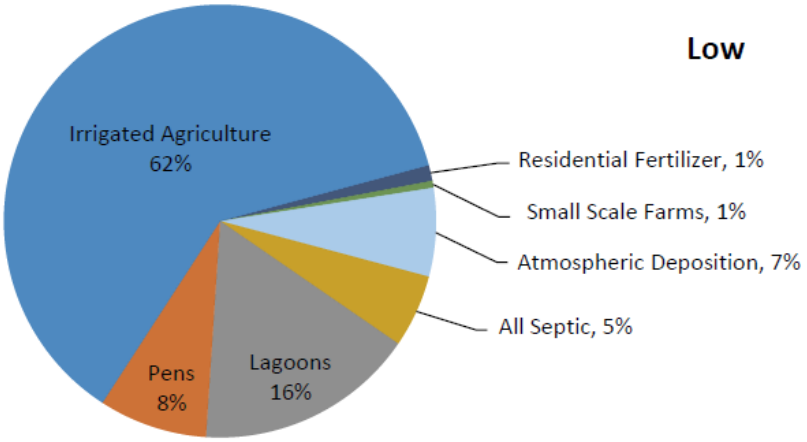
Finally, on page 68 the Nitrogen Loading Assessment states,

> *The lowest number used is the combination of the most recently available annual wet and dry deposition data from the NADP Mt. Rainier station. Deposition reported includes dry nitric acid, dry ammonium, dry nitrate, wet ammonium, and wet nitrate (EPA 2016). This is believed to be a good surrogate for low deposition due to the considerable transportation corridor along I-5 in western Washington mimicking farm-related emissions and deposition seen in eastern Washington.*

<u>The transportation corridor along I-5 mimics farm related emissions and deposition in eastern Washington?</u> Really?. . . . . Really?

Conclusions

The pie charts on Page 72 of the report are based on faulty reasoning. These charts are misleading and just plain wrong, especially with respect to Irrigated Agriculture.



Where did the authors find 62% from IA in the low assessment? Here is how they did it.

Look at the chart on page 71:

Table 32. Estimated nitrogen available per acre from all sources at low, medium, and high range

Source		Area (acres)	Low (lb/acre-year)	Medium (lb/acre-year)	High (lb/acre-year)
Irrigated Agriculture		96,186	11	60	181
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential Fertilizer	4,381	4.7	11.7	18.6
	Small Scale Farms	2,096	4.3	10.7	17.1
Atmospheric Deposition		73,976	1.53	2.05	6.15

Blue shading indicates top 3 contributors in each range (low. medium, high).

Carrying out the calculations for the low range gives the following results. These percentages correlate with the pie chart:

	Acreage		Low Lbs/Acre		Total Lbs	% of the Whole
Irrigated Agriculture	96,186		11		1,058,046	62%

CAFO Pens	2,096		67		140,432	8%
CAFO Lagoons	210		1,354		284,340	17%
ROSS	398		223		88,754	5%
LOSS	3		195		585	0%
COSS	30		163		4,890	0%
Residential Fertilizer	4,381		4.7		20,591	1%
Small Scale Farms	2,096		4.3		9,013	1%
Atmospheric Deposition	73,976		1.53		113,183	7%
Total	179,376				1,719,834	100%

Now ask, where did the authors find 11 lbs/Acre of N application for Irrigated Ag? Look at the chart on page 43.

Table 14. One year's worth of inputs and outputs for the top 15 crops in the GWMA

Commodity	Acreage	Sum of inputs and outputs for one year (lb N/ac-yr)		
		Low	Medium	High
Apple	17,333	-5	91	219
Corn (silage)	16,778	-200	25	242
Triticale	10,780	-135	-9	250
Grapes (juice)	10,257	61	132	197
Alfalfa	7,989	-365	-236	-46
Pasture	6,731	-186	-68	62
Cherry	6,336	27	105	210
Hops	5,961	-84	78	113
Grapes (wine)	5,126	40	94	156
Pear	3,331	-1	92	173
Mint	1,418	-166	73	157
Wheat	1,283	-79	23	113
Corn (grain)	1,166	-48	126	284
Asparagus	854	58	157	210
Peach/Nectarine	843	12	81	158

These calculations yield -92 Lbs/Acre/yr from Irrigated Ag. In everyday terms this tells us that most crops are taking more nitrogen from the soil than farmers are putting back. This means soil depletion.

But this does not fit with the framework of the study and the esthetics of the report. It is impossible to show negative input in a pie chart. The authors solved the problem by only including the positive inputs from juice grapes, cherries, wine grapes, asparagus and peaches/nectarines on the balance sheet. They only looked at the surplus and not the deficit. See the Table on page 44.

Table 15: Sum of inputs and outputs for the top 15 crops in the GWMA (entire acreage)

	Estimated total N surplus in GWMA (ton N/yr)		
Commodity	**Low**	**Medium**	**High**
Apple	-	786	1,897
Corn (silage)	-	208	2,029
Triticale	-	-	1,346
Grapes (juice)	312	677	1,008
Alfalfa	-	-	-
Pasture	-	-	209
Cherry	87	333	666
Hops	-	232	337
Grapes (wine)	103	240	400
Pear	-	153	288
Mint	-	52	111
Wheat	-	14	72
Corn (grain)	-	74	165
Asparagus	25	67	90
Peach/Nectarine	5	34	67
Total	532	2,870	8,685

532 tons equals 1,064,000 lbs and 1,064,000lbs/96,186 acres equals 11 Lbs/Acre. The low assessment of nitrogen input for the study tells us what the input would be if the excess nitrogen that is applied on the 23,453 acres of juice grapes, cherries, wine grapes, asparagus, and peaches/nectarines were evenly distributed over all the cropland in the GWMA target area. What does this mean? It means very little. It has no purpose. It makes no sense.

Thank you for reading my comments. I look forward to further discussions.

Jean Mendoza

Friends of Toppenish Creek

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Draft Analysis of 2017 USGS Survey of Domestic Wells & Drains in the Lower Yakima Valley Groundwater Management Area

Jean Mendoza

April 30, 2018

Executive Summary

This document is a very preliminary effort to make sense of data from 901 well samples and 167 drain samples that were collected in 2017 by the United States Geological Survey for the Lower Yakima Valley Groundwater Management Area.

Data was gathered from the web site https://maps.waterdata.usgs.gov/mapper/index.html Readings were copied onto Excel spreadsheets and analyzed using Excel. The summaries that follow are my impressions from several weeks of study. There is much more work to be done.

At this point in time it appears that nitrate levels are higher in wells near the middle and southern portions of the GWMA. There is no statistical correlation between well depth and nitrate levels or ground surface elevation and nitrate levels. There were wells with low nitrate levels close to wells with high nitrate levels. There were a few wells with wide fluctuations in nitrate levels.

Wells near the Yakima River had much lower nitrate levels than those farther from the river. There is an area east of the Toppenish Wildlife Refuge with surprisingly low nitrate levels.

Drains likewise showed wide ranges in values from zero nitrates to as high as 20 mg/L nitrates. Drains showed major seasonal fluctuations.

This study requires a large time commitment and my knowledge of soils, hydrogeology and local farming practices is limited. I will continue to refine this very rough draft and welcome input from other members of the GWMA.

DRAFT

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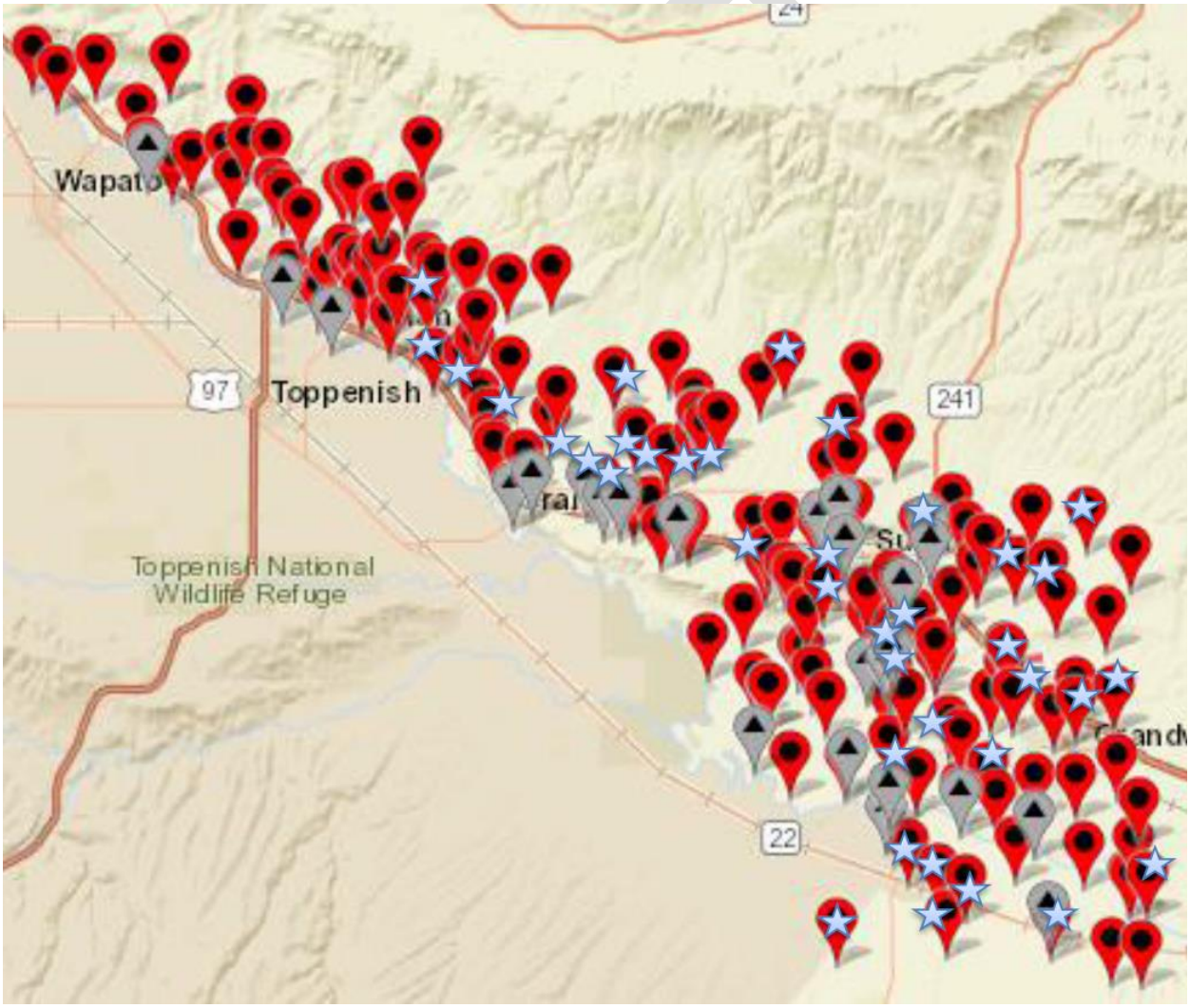
Introduction

Between April 3 and December 8, 2017 the United States Geological Survey (USGS) sampled 156 domestic wells and 24 drains in the Lower Yakima Valley (LYV) on behalf of the LYV Groundwater Management Area (GWMA). USGS sampled over 90% of the wells six times or approximately every two months. The study resulted in 901 well water samples and 167 drain samples. The purpose of the research was to describe nitrate levels across the GWMA target area at this point in time and to look for seasonal trends.

Here is a map that shows locations for the sampled wells and drains with stars next to wells that had nitrate levels > 10 mg/L.



Data was made available to the LYV Groundwater Advisory Committee (GWAC) at their April 5, 2018 meeting but there were no provisions for data analysis. The committee was essentially told, 'Here is the data. If you want to understand, analyze it yourselves.' This

paper is an effort on the part of Friends of Toppenish Creek to begin that analysis and share the results with other members of the GWAC.

Overview of Well Sampling

133 (15%) of the samples had non-detectable levels of nitrate + nitrite that were reported at < 0.040 mg/L. A surprising finding was that 6 of the wells with no detectable nitrate were in the 50 to 100 foot well depth range.

180 (20%) of the samples had readings > 10 mg/L, the EPA designated safety level for drinking water.

The low number of wells at depths greater than 400 feet makes conclusions in this range less reliable.

Well depths ranged from 52 ft to 795 ft. No well depths (ND) were reported for six wells.

Well Depth	# Samples	# Sites	WD Average	WD Median	N Average	N Median	N Range
0 - 100 ft	183	31	83.4 ft	90 ft	7.12 mg/L	7.97 mg/L	0 - 22.3 mg/L
100.1 - 200	434	75	150.33	145	7.34	5.5	0 - 45.2
200.1 - 300	179	31	239.7	238	3.84	3.14	0 - 17.7
300.1 - 400	41	6	357.71	354	3.03	2.51	0.078 - 7.05
400.1 - 500	17	3	415.12	405	0.22	0	0 - 0.773
500.1 - 600	0	0	NA	NA	NA	NA	NA
600.1 - 700	6	1	663	663	0	0	0
> 700 ft	6	1	795	795	2.18	2.18	1.98 – 2.32
ND	35	6			5.51	2.82	0 – 18.9

Land surface elevations ranged from 657 ft to 1241 ft.

Elevation	# Samples	# Sites	Elev. Ave	Elev. Median	Nitrate Ave	N Median	N Range
600 – 700 ft	78	14	679.88	674	1.7	0	0 – 11.3
700.1 – 800 ft	338	58	751-33	750	6.22	4.68	0 – 22.3
800.1 – 900 ft	257	44	848.59	851	7.92	6.57	0.961 – 43.1
900.1 – 1000	107	18	934.06	928	6.35	5.48	0 – 17.7
1000.1 – 1100	80	14	1040.7	1043	5.95	2.32	0 – 45.2
> 1100 ft	41	7	1175.78	1155	2.05	2.27	0 – 5.74

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Most of the samples, 721 out of 901, were under the safe level of 10 mg/L for nitrates.

Grouping	WD Average	Elevation Average	Nitrate Average	Nitrate Median	# Samples
0 – 10 mg/L	192 ft	846 ft	3.72 mg/L	3.21 mg/L	721
10.1 – 20 mg/L	120	803	13.35	12.4	159
20.1 – 30 mg/L	94	801	21.71	21.65	8
30.1 – 40 mg/L	151	850	36.15	NA	2
> 40 mg/L	112	949	43.16	43.1	11

Analysis by Well Depth

With 901 samples it is possible to look for a correlation between well depth and nitrate levels. We did this using calculation of a Pearson r correlation coefficient. The formula is:

$$r = \frac{1}{n-1}\sum_{i=1}^{n}\frac{(x_i-\bar{x})}{s_x}\frac{(y_i-\bar{y})}{s_y}$$

The first step in the calculation is to create a scatter plot in order to visualize a possible relationship. Here is the portion of scatter plot for N values to 25 mg/L. (See Attachment 1)

24.1-25		x						
23.1-24								
22.1-23	x							
21.1-22	xxx							
20.1-21	xx	x						
19.1-20	xx	xxxx						
18.1-19		x						
17.1-18	xxxxxxx	xx	xxxxxx					
16.1-17	xx	xxxx						
15.1-16	xxxxx	Xxxxxxxxx						
14.1-15	xxxx	xxxx						
13.1-14	x	xx						
12.1-13	Xxxxxxxxxxx	xxxxxxxx						
11.1-12	xxxxxx	Xxxxxxxxxxxxxxx						
10.1-11	Xxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx						
9.1-10	XxxxxxxXxxxxxxxx	Xxxxxxxxxxxxxxxxxxx						
8.1-9	Xxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxx					
7.1-8	Xxxxxxxxxx	Xxxxxxxxxxxxxxx	Xxxxxxxxx					
6.1-7		Xxxxxxxxxxxxxxxx	xxxxxx	xxxxxx				
5.1-6		Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxx	xxx				
4.1-5	xxxx	XxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxXxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	x				
3.1-4	Xxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxx	xxxxxx				
2.1-3	Xxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxx				xxxxx
1.1-2	xxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxxxxx	xxxxxxx				x
0.1-1		Xxxxxxxxxx	xxxxxx	xxxxx	xxxxx			
0 mg/L	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	x	Xxxxxxxxxxx		xxxxxx	
	0-100 ft	101-200 ft	201-300	301-400	401-500	501-600	601-700	701-800

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The first impression is that there is little overall correlation between well depth and nitrate levels. This is borne out by calculation of the Pearson r correlation coefficient = negative 0.281. Generally speaking there is poor correlation if |r| < 0.60. (Excel Calculations are available in Attachment 2)

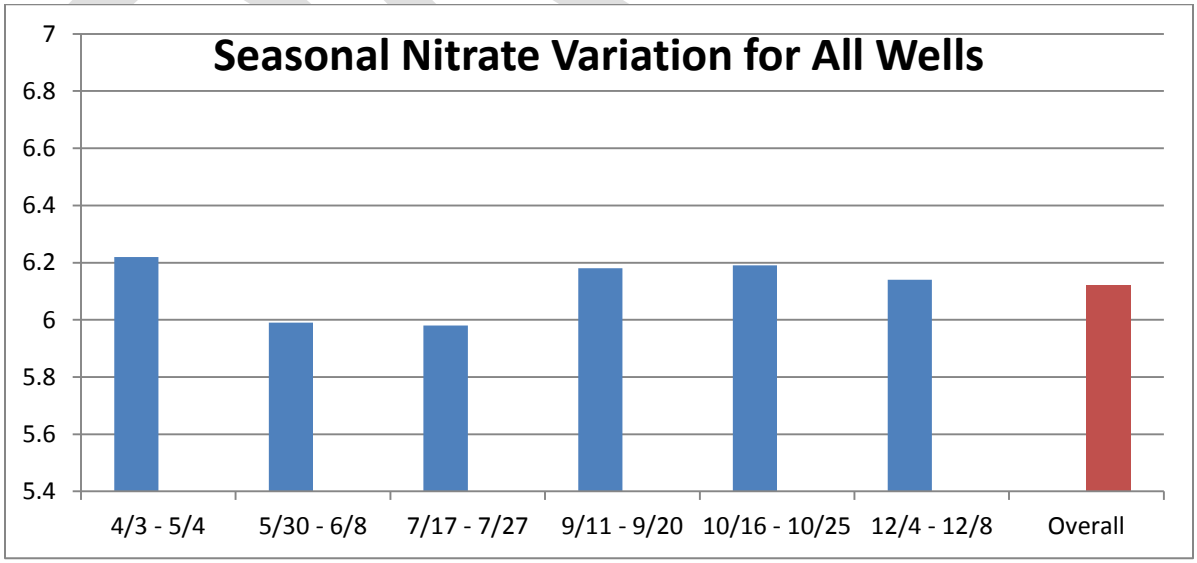
Analysis by Ground Surface Elevation

Based on a similar calculation of the Pearson r correlation coefficient regarding elevation and nitrate levels, r = negative 0.018. There is little relationship between elevation and nitrate levels. (See Attachment 2). This issue will be addressed more completely in the section on nitrate levels and distance from the Yakima River.

Seasonal Analysis

It is well known that nitrate levels in the LYV fluctuate with the seasons. Here are the seasonal results from this study.

Sampling Period	N	WD Ave	El. Ave	Nitrate Ave
4/3 - 5/4	149	175.79	836.66	6.22
5/30 - 6/8	151	178.08	839.04	5.99
7/17 - 7/27	154	178.26	839.83	5.98
9/11 - 9/20	154	178.26	839.83	6.18
10/16 - 10/25	152	178.66	841.36	6.19
12/4 - 12/8	141	177.04	840.87	6.14
Overall	901	177.69	839.59	6.12



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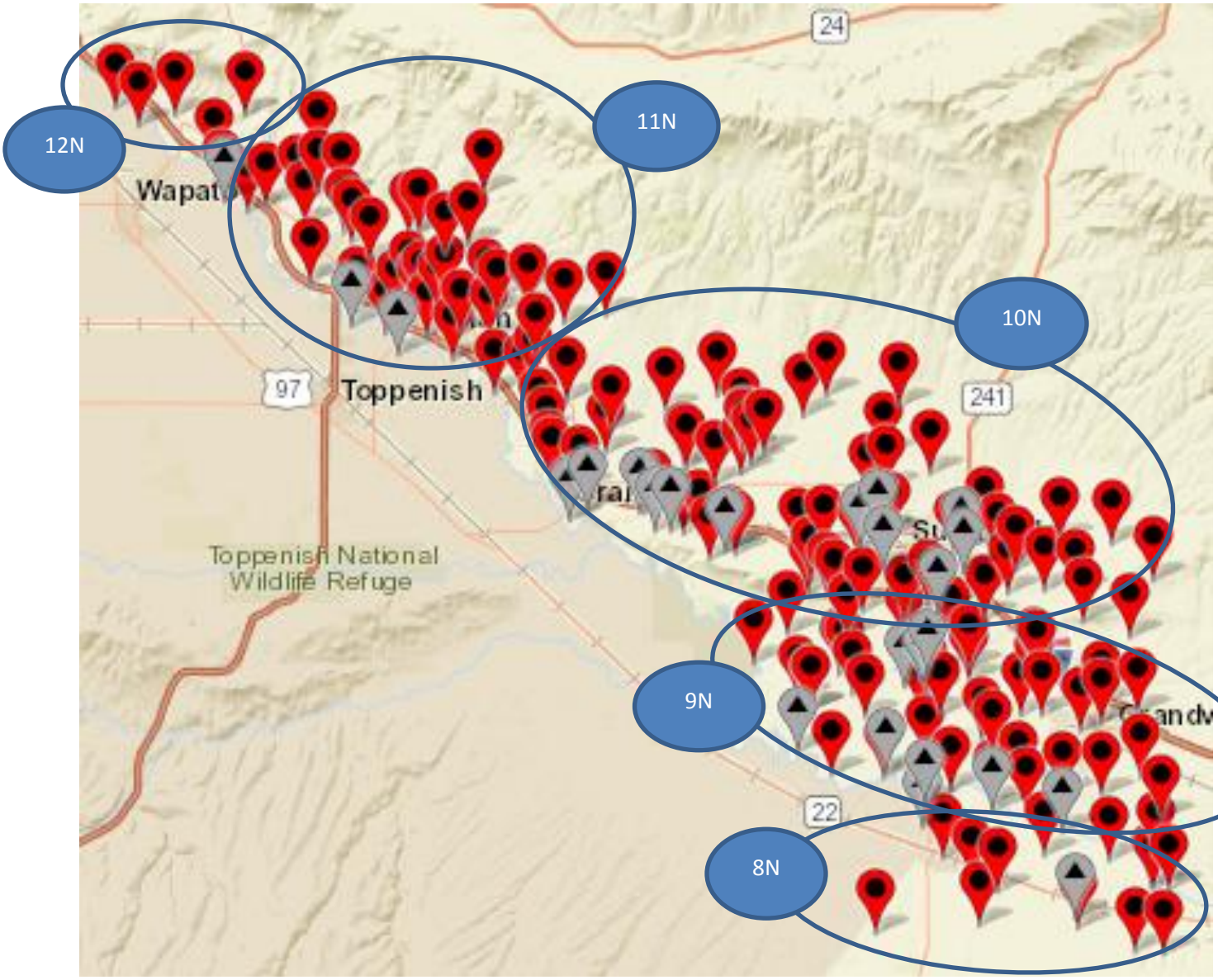
USGS Groupings

USGS uses five major categories for well classification in the GWMA Target Area. The categories begin with 8N, 9N, 10N, 11N, and 12 N.

Here is a map that shows where wells in each grouping are located:



This table describes the number of wells in each grouping with depths and average nitrate levels:

Grouping	N Samples	N Sites	Well Depth Average	Elevation Average	Ave. Nitrate Level
All Sites	901 ft	156 ft	177.79 ft	839.59 ft	6.12 mg/L
N12	29	5	276.48	1013.48	0.50
N11	218	38	243.71	959.66	4.00
N10	344	58	166.30	841.00	8.62
N9	260	45	133.63	739.27	5.11
N8	54	10	130.15	728.15	6.45

The northern wells are at a higher elevation, are deeper and have lower nitrate levels. Within the middle and southern groups a higher elevation and deeper well depth is associated with higher nitrate levels. My conclusion is that there are other factors involved besides well depth.

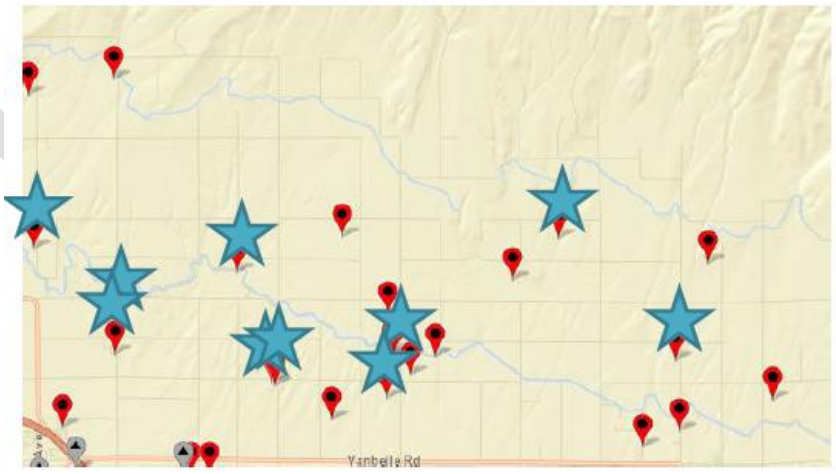
High Risk Wells & Low Risk Wells

Here is a mapping of high and low risk wells

Wells with > 10 mg/L nitrate at least once are covered with a star =

Wells with < 1 mg/L nitrate are covered with a sphere =

Northeast Quadrant – North of Outlook & Sunnyside



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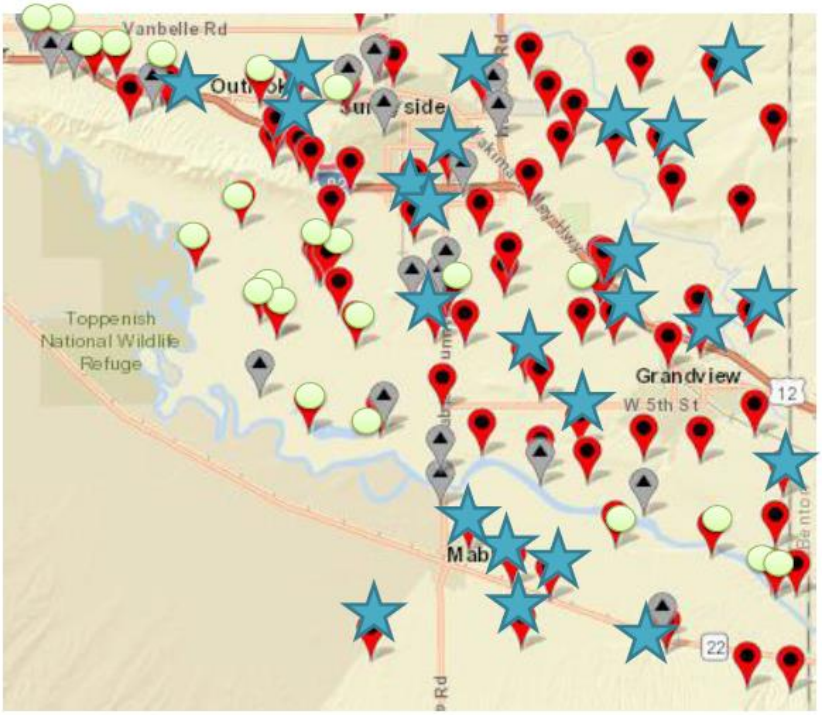
Northwest Quadrant



Southeast Quadrant



There are multiple wells with very low nitrate levels near the Yakima River. There are also interesting pockets of low nitrate wells: 1. the area directly east of the Toppenish Wildlife Refuge, 2. the area north of Snipes Mountain and south of Van Belle Road.

Special Cases

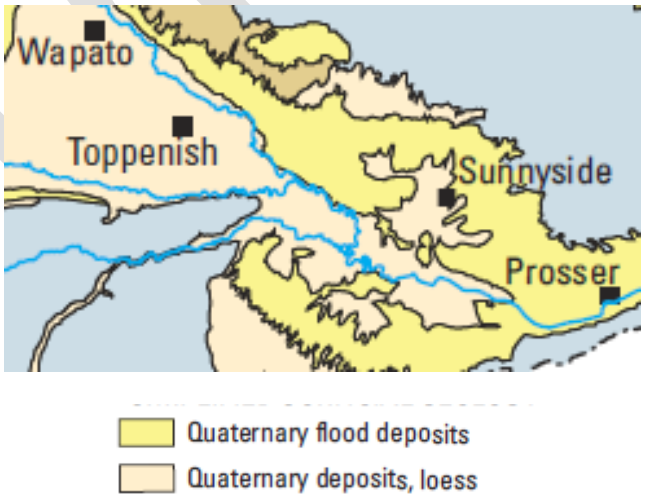
We have assumed that shallower wells are more vulnerable to nitrate pollution. After looking at the data it appears that other important factors are involved.

Near the Yakima River - I divided the data set into wells within 2 miles of the Yakima River and wells > 2 miles from the Yakima River. The results show shallower well depths and lower elevation nearer the river which is no surprise. The results also show lower nitrate levels on parcels within 2 miles of the river. (See Attachment 3)

Distance from the River	Well Depth	Hole Depth	Elevation	Average Nitrate Level
< 2 Miles	159 ft	160 ft	800 ft	4.34 mg/L
> 2 Miles	190 ft	191 ft	867 ft	7.32 mg/L

This deserves analysis by people who know more about hydrogeology than I do.

Let me point out that the 2006 USGS study *Hydrogeologic Framework of Sedimentary Deposits in Six Structural Basins, Yakima River Basin, Washington*, available at https://pubs.usgs.gov/sir/2006/5116/pdf/sir20065116.pdf lists two major soil types for this area. They are quaternary flood deposits and quaternary loess as shown in this excerpt from the map on page 7 of that document.



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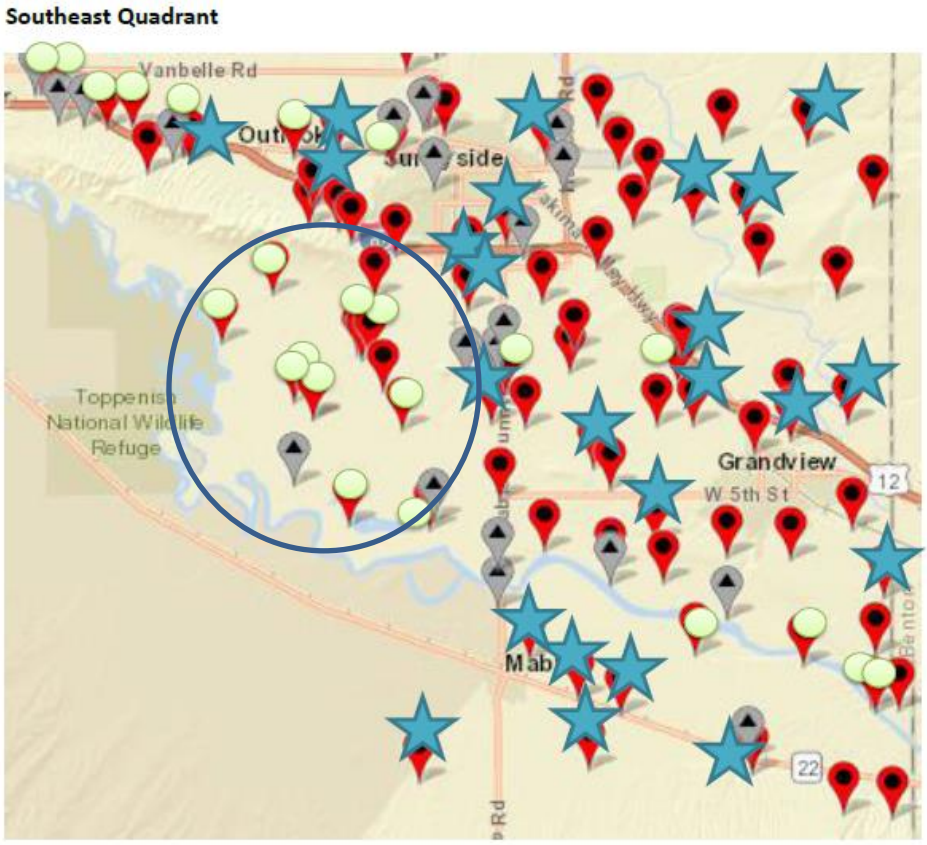
1990 Agricultural Chemicals Pilot Study

In 1990 Ecology released a document entitled the *Washington State Agricultural Chemicals Pilot Study.* Available at https://fortress.wa.gov/ecy/publications/documents/9046.pdf



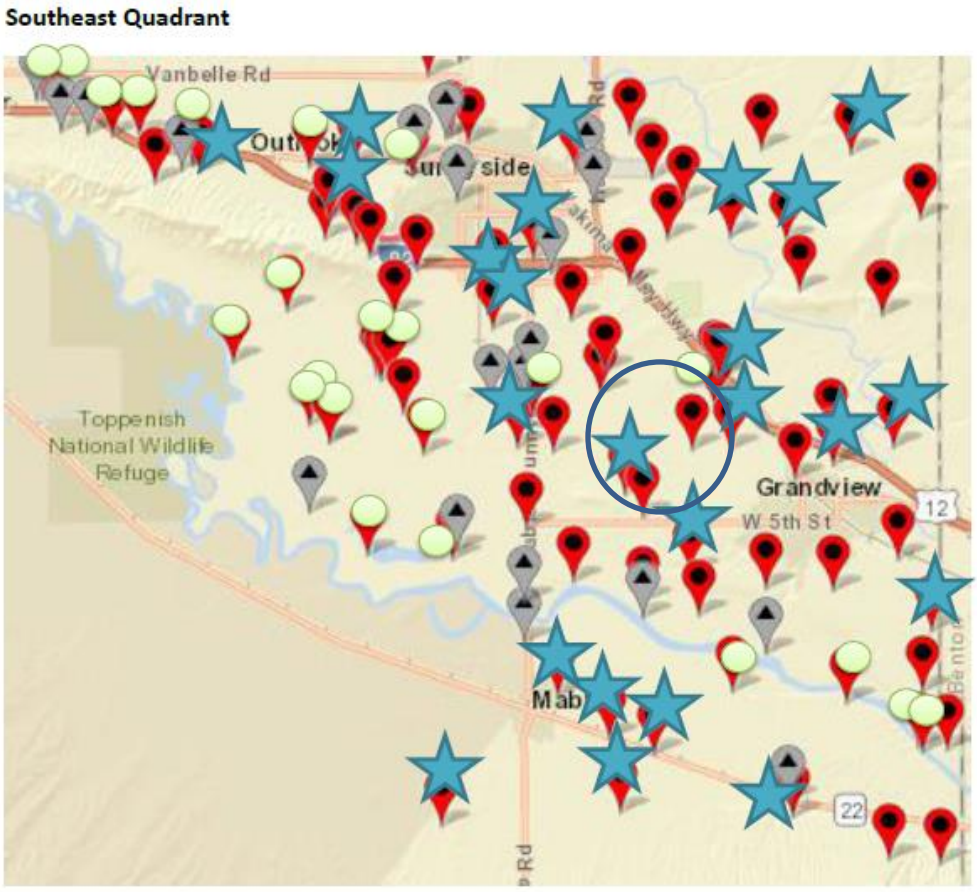
The study found. "Eight wells of the 27 wells (30%) sampled in the Yakima County study area showed detectable concentrations of nitrate/nitrite-N. The concentrations ranged from less than 0.01 to 6.2 mg/L with a mean concentration of 0.7 mg/L. No wells exceeded the MCL of 10 mg1L." This correlates with our 2017 USGS sampling of domestic wells in the area that shows most wells with < 1 mg/L nitrate.

This suggests different patterns of groundwater flow compared to other parts of the GWMA.

1992 Hornby Lagoon Study

In 1992 Ecology published the *Groundwater Quality Assessment, Hornby Dairy Lagoon, Sunnyside Washington.* https://fortress.wa.gov/ecy/publications/documents/92e23.pdf

The purpose was to study water quality down gradient from a new two stage dairy lagoon. After one year only chloride was elevated in the monitoring wells and Ecology recommended further observations for long term effects. It appears that long term monitoring was not done.

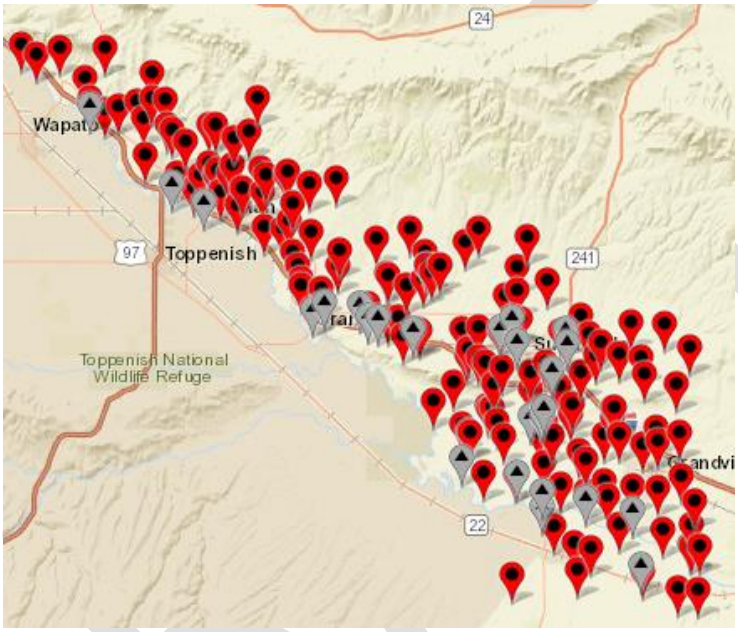


There are two wells in our study that are 0.8 miles and 1.5 miles downgradient from the Hornby Lagoon study. The nearest well had nitrate levels that ranged from 19.2 to 20.7 mg/L. The other had nitrate levels that ranged from 1.69 to 1.89 mg/L.

Lower Valley Drains

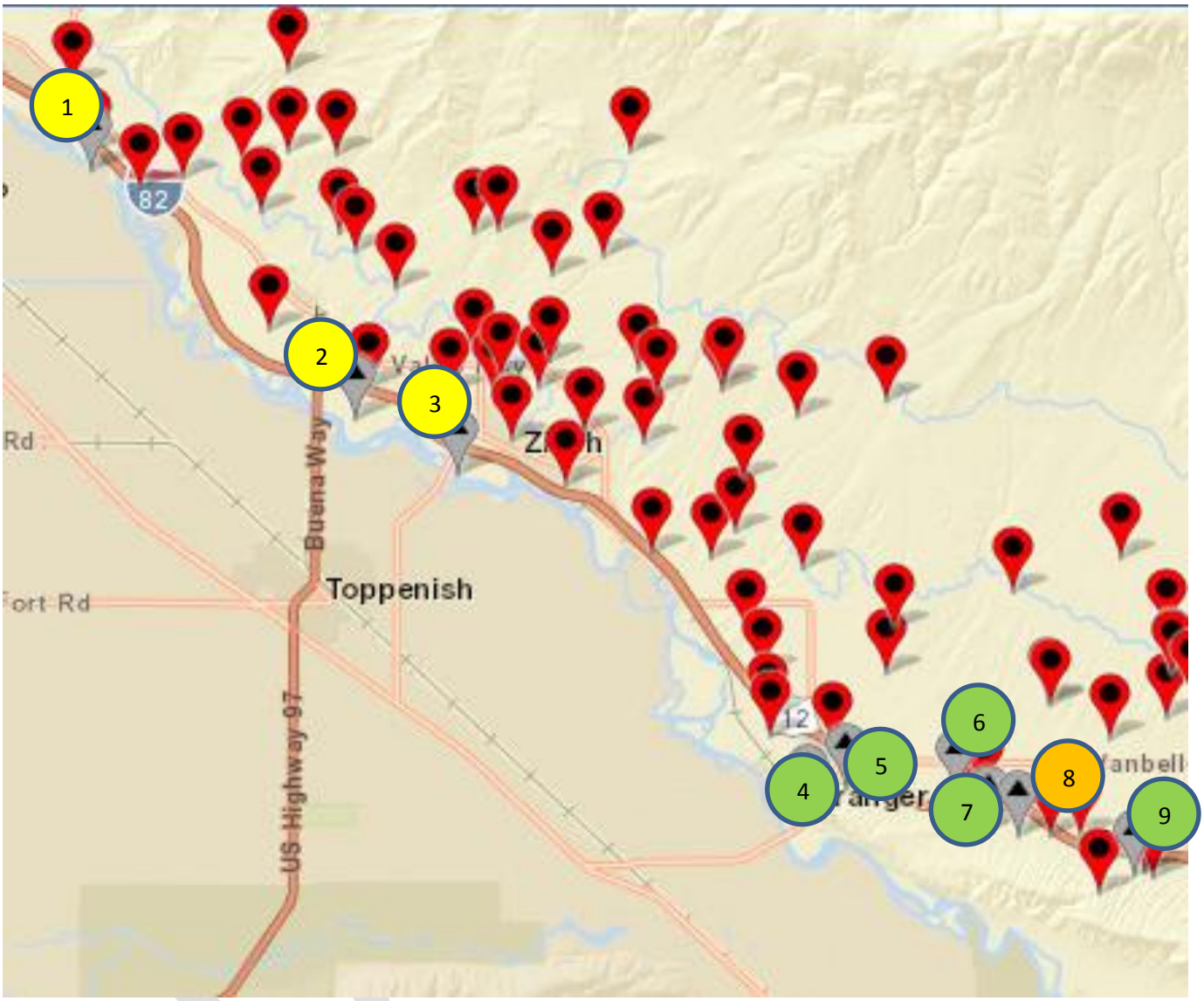
Variations in Bi-Monthly Nitrate Levels - Drain Testing Lower Yakima Valley 2017

In 2017, from April through December, the United States Geological Survey sampled 24 drains in the Lower Yakima Valley on behalf of the LYV Groundwater Management Area. USGS tested for nitrates and other variables. Most drains were sampled about seven times. The readings varied by season. The USGS map below identifies test sites. Domestic wells are coded in red and drains are coded in gray.

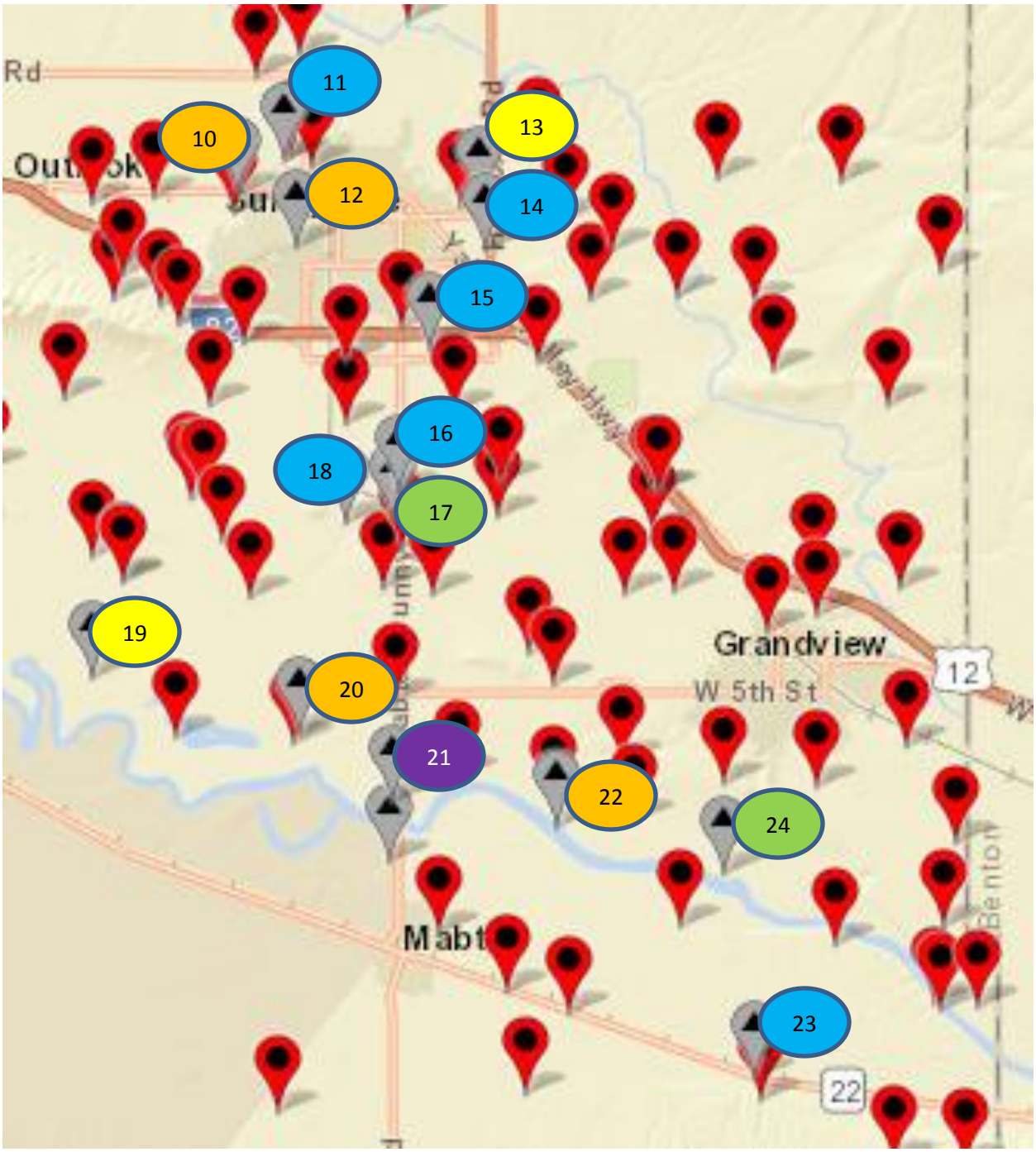


There were wide ranges in values for the various drains. For clarity the average readings are color coded on larger maps on the following pages. There is a map for the northern section of the GWMA and a map for the southern section.

	< 2.5 mg/L nitrate
	2.5 - 5 mg/L nitrate
	5 - 7.5 mg/L nitrate
	7.5 - 10 mg/L nitrate
	> 10 mg/L nitrate



1 = Roza Wasteway	6 = Joint Drain at Van Belle Road
2 = Buena Drain	7 = Joint Drain 28 near Granger
3 = Joint Drain at Chevron Station, Zillah	8 = Drain 2 NEET Site Number 3
4 = Granger Drain at Granger	9 = Joint Drain 32 at Outlook
5 = Joint Drain, Yakima Valley Hwy at Granger	



10 = Joint Drain from Rougk Land near Sunnyside	18 = DID Drain 3 near Sunnyside
11 = Joint Drain 34.2 at Woodin Road	19 = DID 7 near Mabton
12 = Joint Drain near S. First St. in Sunnyside	20 = Sulfur Creek Wasteway near Sunnyside
13 = Sulfur Creek Wasteway at Scheller Road	21 = Drain 31 at West Charvet Road
14 = DID Drain 18 at Sunnyside	22 = Drain 35 off Charvet Road
15 = Washout Drain at Sunnyside	23 = Joint Drain 1 at Bus Road
16 = Joint Drain 40.2 near Tear Road	24 = Grandview Drain at Chase Road
17 = Joint Drain 43.9 at Mabton	

Summary of Average and Median Nitrates for the 24 Lower Yakima Valley Drains

Number	Name	N Average	N Median	N Range
1	Roza Wasteway	0.01	0	0 - 0.072
2	Buena Drain	1.12	0.83	0.177 – 2.61
3	Joint Drain at Chevron Station, Zillah	0.31	0.09	0 – 1.29
4	Granger Drain at Granger	5.21	3.58	2.8 – 8.39
5	Joint Drain, Yakima Valley Hwy at Granger	6.82	5.46	3.49 – 10.9
6	Joint Drain at Van Belle Road	5.24	3.56	3.1 – 9.85
7	Joint Drain 28 near Granger	6.84	5.96	4.06 – 9.98
8	Drain 2 NEET Site Number 3	4.92	4.82	1.27 – 7.97
9	Joint Drain 32 at Outlook	7	4.33	2.33 – 14.3
10	Joint Drain from Rougk Land near Sunnyside	4.58	4.09	1.35 – 9.06
11	Joint Drain 34.2 at Woodin Road	8.95	5.88	4.03 – 16.5
12	Joint Drain near S. First St. in Sunnyside	4.98	4.74	1.97 – 7.78
13	Sulfur Creek Wasteway at Scheller Road	0.11	0.08	0 – 0.242
14	DID Drain 18 at Sunnyside	7.5	6.41	5.57 – 9.87
15	Washout Drain at Sunnyside	8.17	8.3	5.7 - 11
16	Joint Drain 40.2 near Tear Road	9.69	8.32	7.58 – 13.9
17	Joint Drain 43.9 at Mabton	5.36	4.58	3.68 – 8.22
18	DID Drain 3 near Sunnyside	7.99	8.22	3.07 – 12.3
19	DID 7 near Mabton	0.7	0.65	0 – 0.995
20	Sulfur Creek Wasteway near Sunnyside	4.81	3.91	2.4 – 9.2
21	Drain 31 at West Charvet Road	13.07	6.86	4.64 – 25.2
22	Drain 35 off Charvet Road	3.87	3.42	2.41 – 5.49
23	Joint Drain 1 at Bus Road	9.81	7.13	4.35 – 18.6
24	Grandview Drain at Chase Road	5.76	6.24	3.94 – 6.98

Ron Cowin from the Sunnyside Valley Irrigation District kindly provided this description of the different drains:

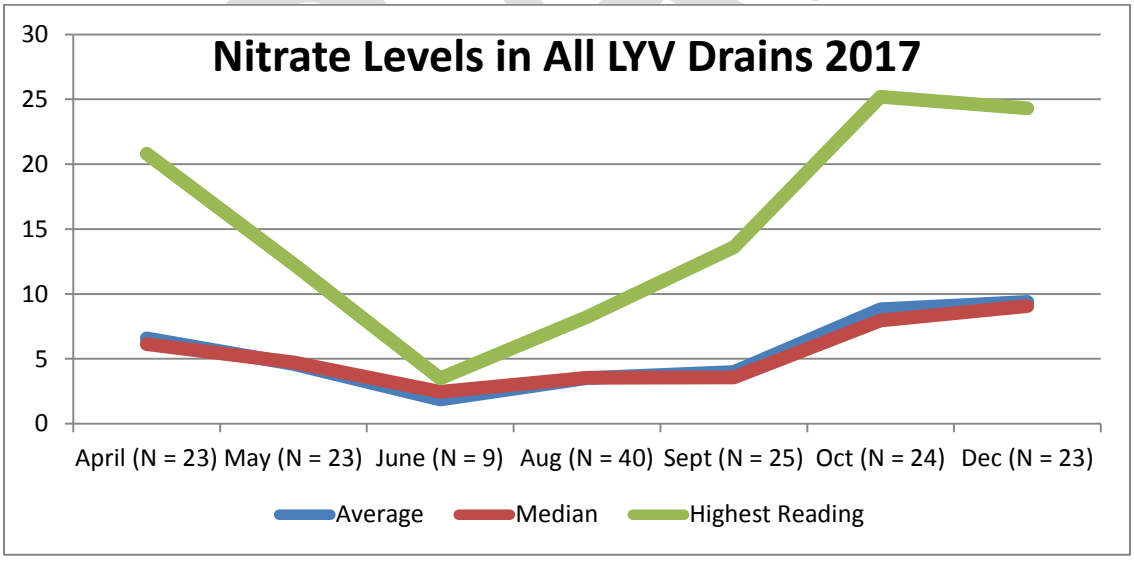
Wasteways are earthen ditches or concrete flumes designed to take excess water from RID's & SVID's main canals so the canal doesn't over top its banks. We can also use the wasteways to dump large volumes of water in an emergency situation such as a canal break. The Sulphur Creek Wasteway takes excess water or waste water (thus the name wasteway) from both RID & SVID. The Sulphur Creek Wasteway also has many large and small drains that flow into it making it the largest drain/wasteway in the GWMA. The Granger drain on the other hand is not a wasteway, it is strictly a drain. Neither RID or SVID spill or waste water directly into the Granger drain from our main canals.

DRAFT

The drains were all built with the purpose of collecting ground water and to provide irrigators with a place to spill unused water and/or tailwater. SVID also spills tailwater from open laterals into the drains. Open laterals aren't piped solid and can't back the water up into the main canal so we will spill the excess water to the drains. The drains vary in size which is usually due to the quantity of acres that they receive water from. The more acres you have in a drainage basin the more water it produces and that creates the need for a larger drain.

Drainage Improvement Districts (DID's) are drains which are paid for through county assessments to landowners in the DID and maintained by local landowners. I believe the County is just the treasurer who collects the assessments and pays the bills but doesn't do the work. There are still a few DID's operating within the SVID but most of them have been handed over to us. We eventually renamed the ones we now maintain from DID's to DR's since this made more sense. It's really a matter of ownership. They're both drains with DID's being maintained by landowners and DR's being maintained by the District. There are also about 30 Joint Drains (JD's) which don't just serve SVID like the DR's do, but both SVID and RID and so the cost of maintaining them is borne by both entities.

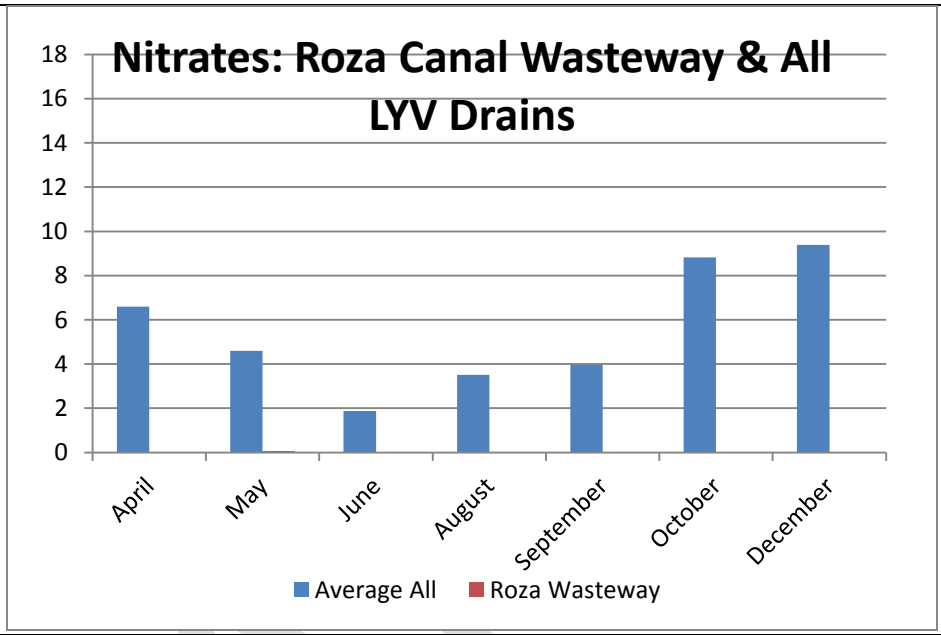
Hopefully this is helpful.

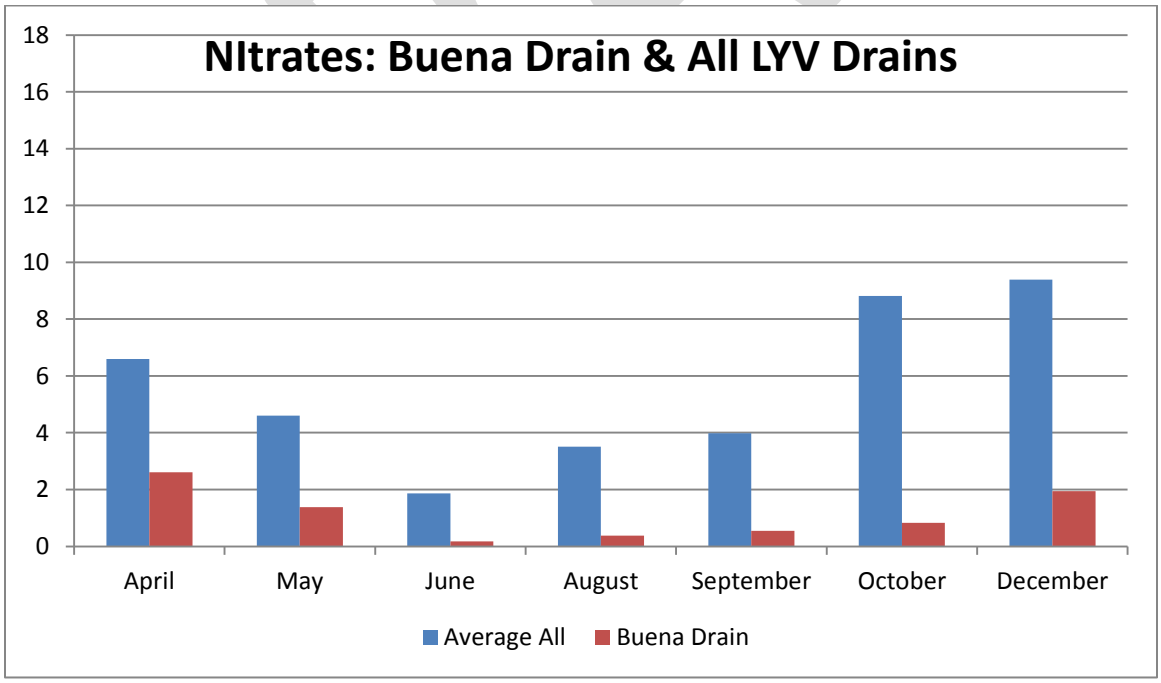


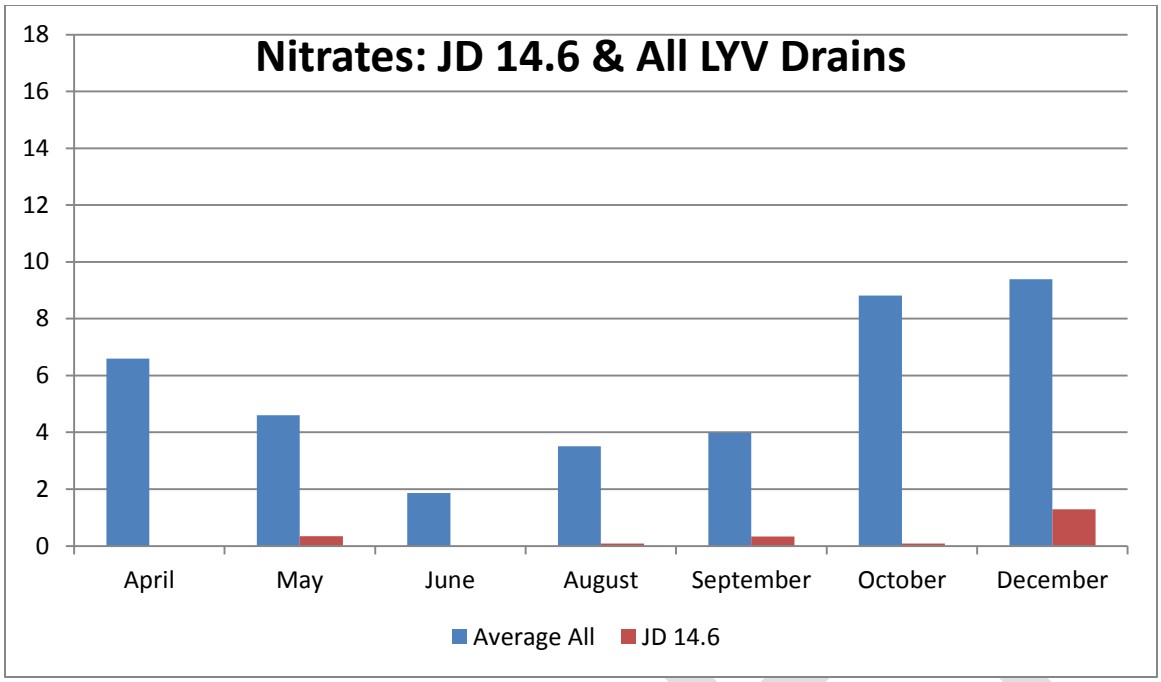
The graphs on the following pages compare readings for each drain with the overall average readings for all drains during the study period. Please note that only 9 drains were sampled in June, 2017, so the June numbers are less reliable.

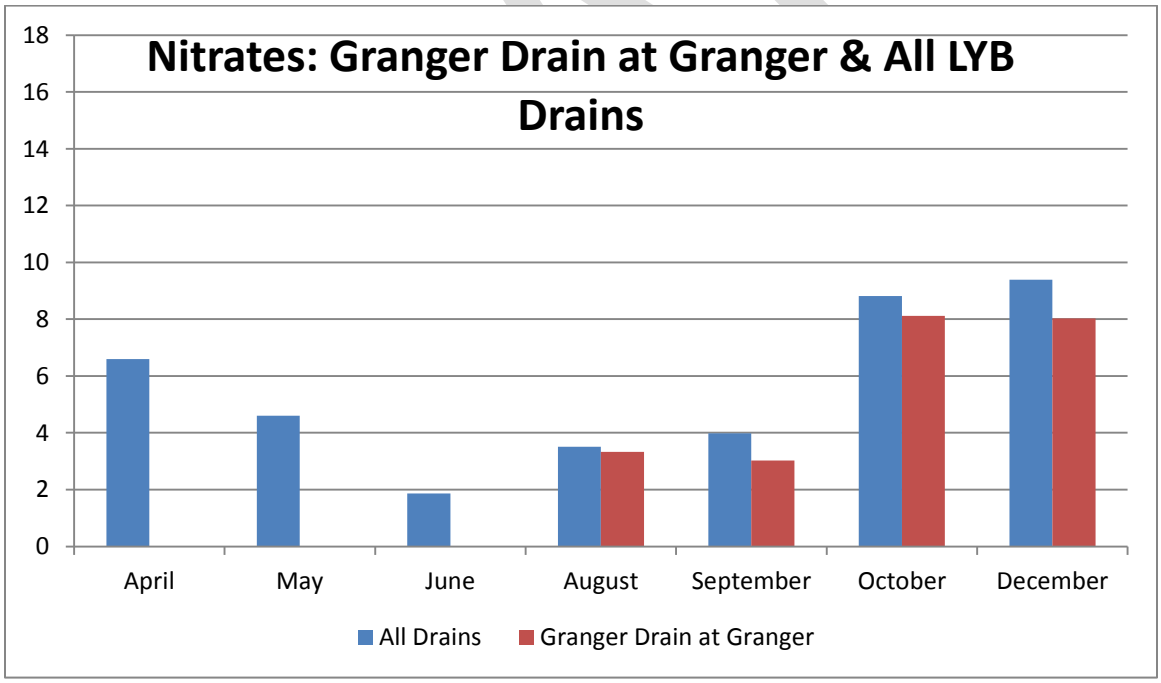
Roza Canal Wasteway had essentially zero nitrates in the 2017 sampling

Month	Roza
April	0
May	0.072
June	0
August	0
September	0
October	NA
December	NA

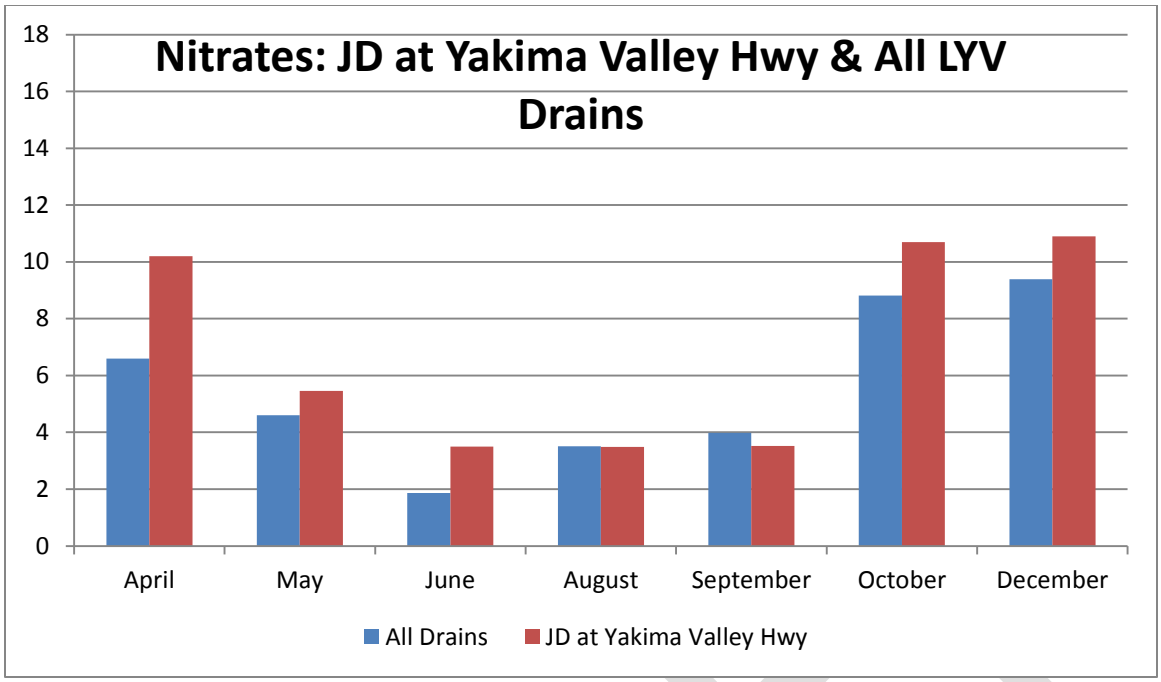


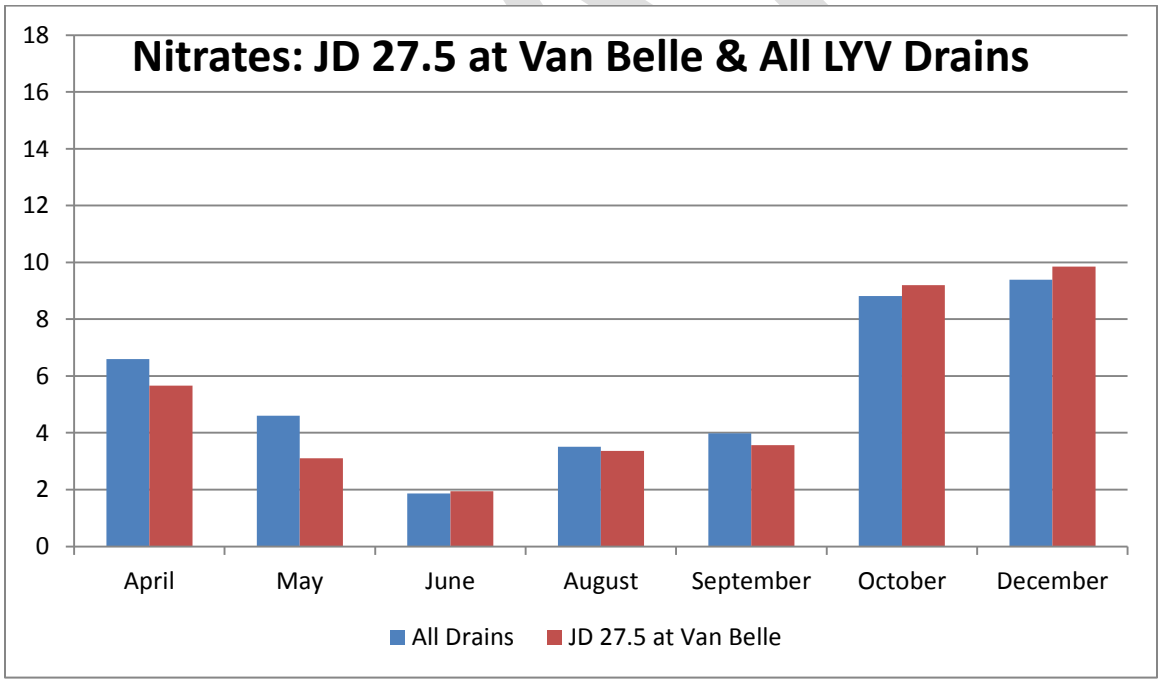


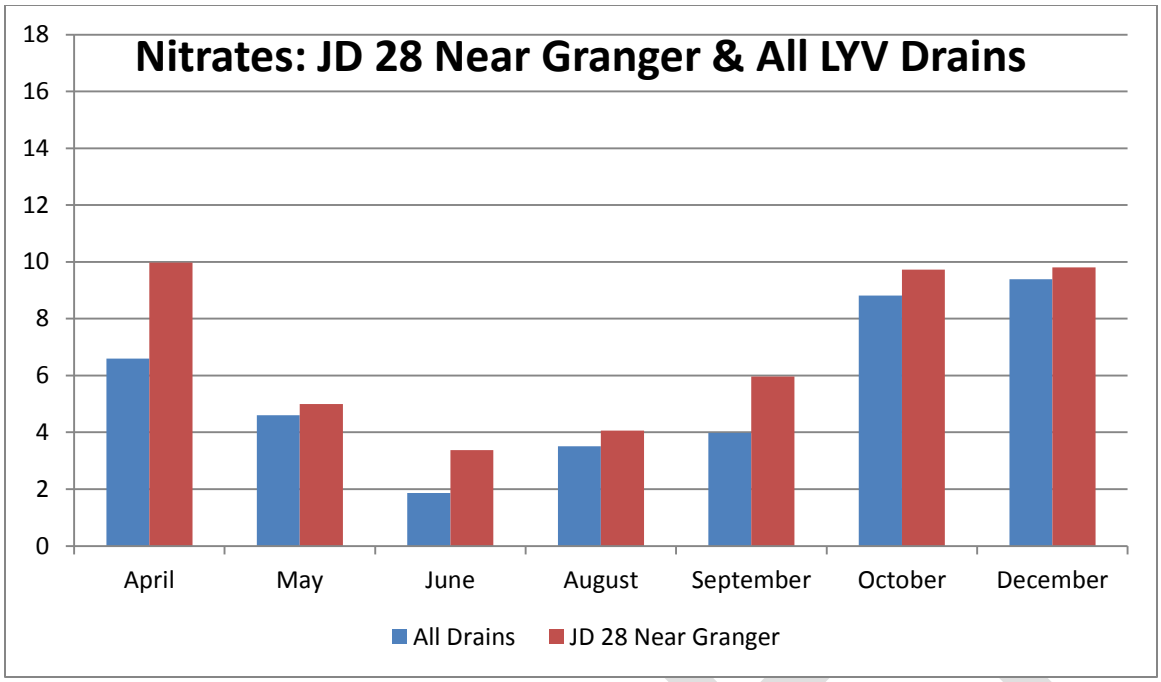


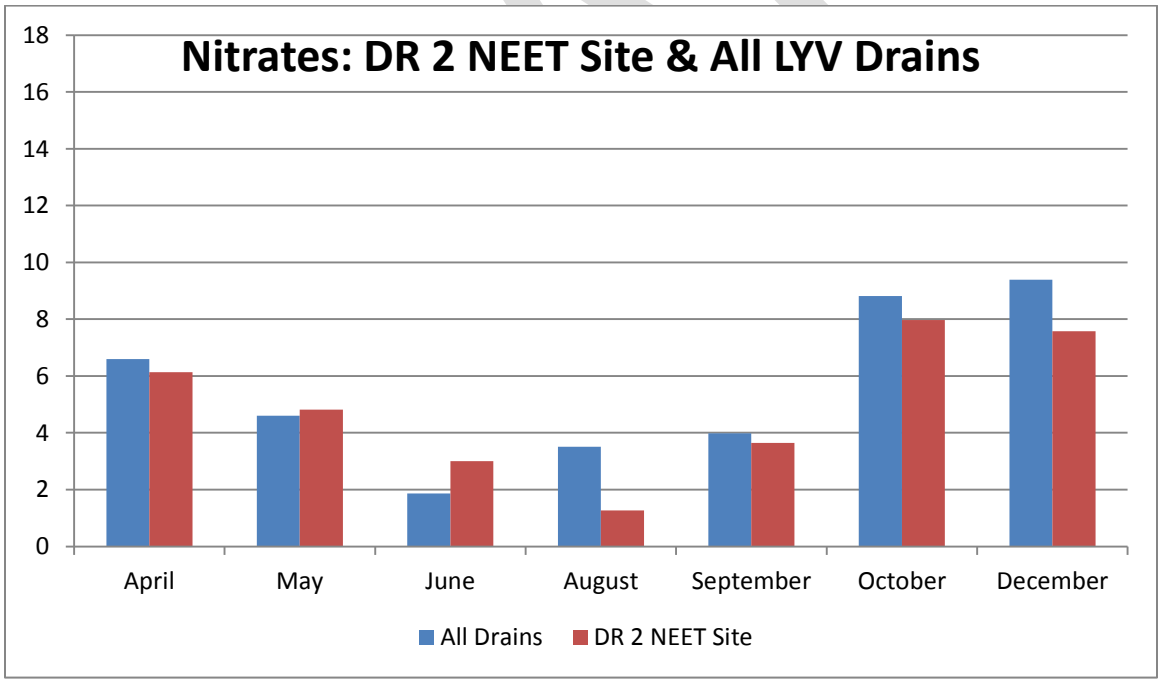


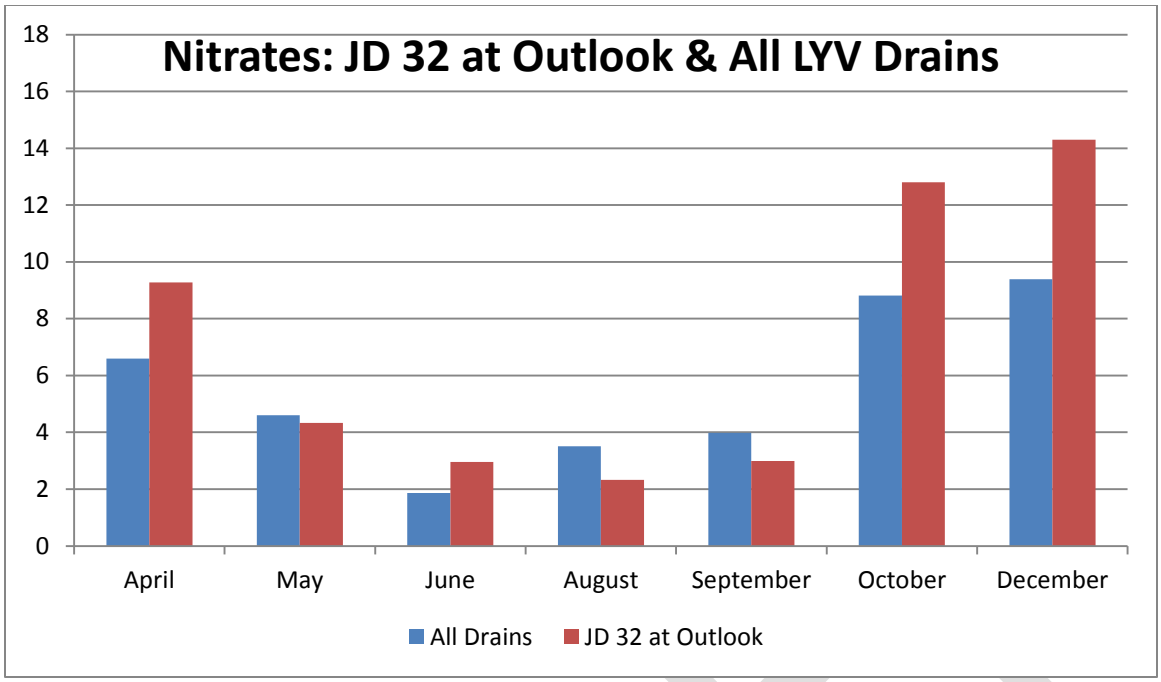
(There was no sampling of the Granger Drain at Granger in April, May & June)

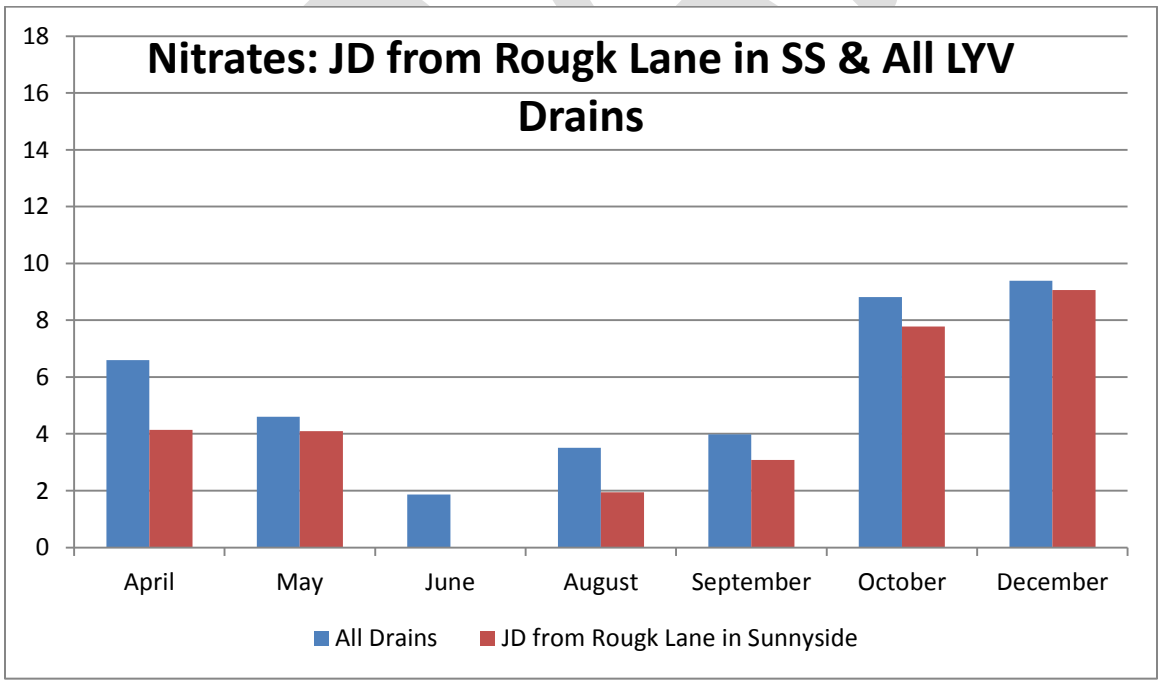

Nitrates: JD at Yakima Valley Hwy & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD at Yakima Valley Hwy

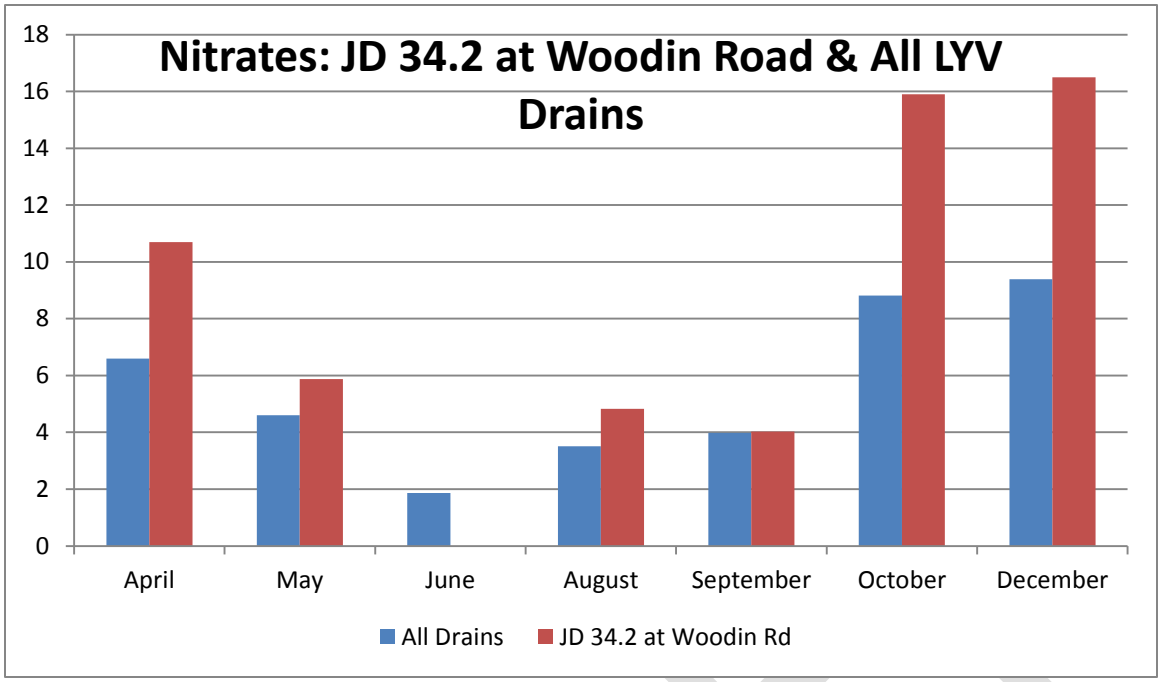

Nitrates: JD 27.5 at Van Belle & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 27.5 at Van Belle

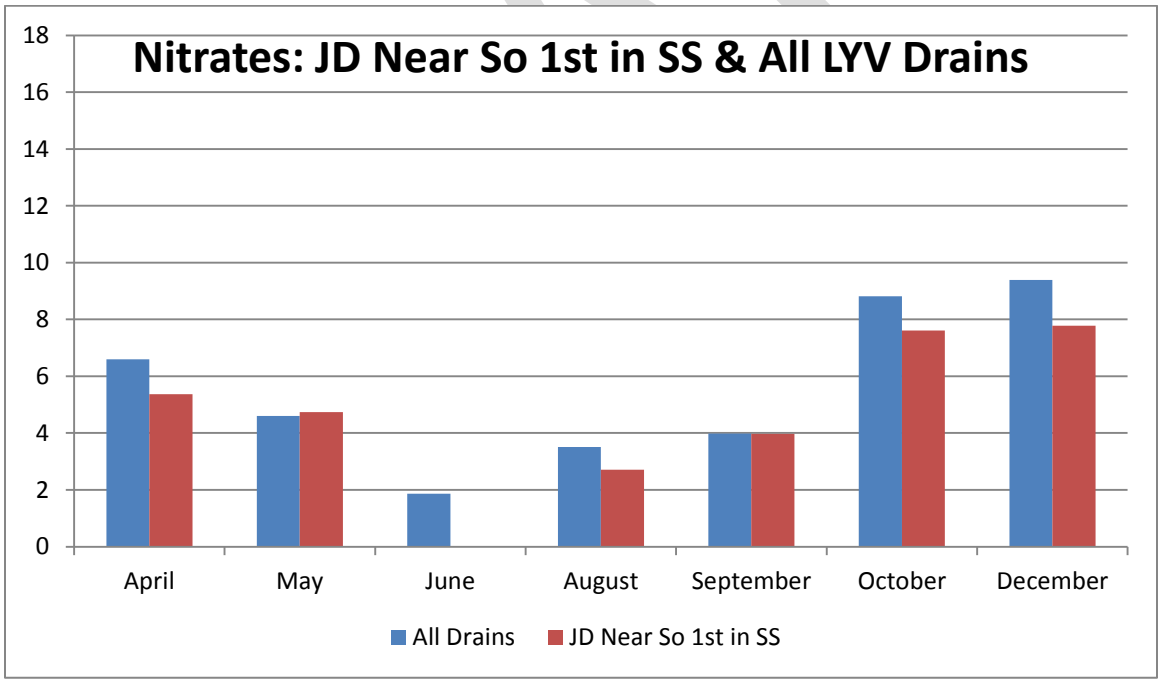

Nitrates: JD 28 Near Granger & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 28 Near Granger

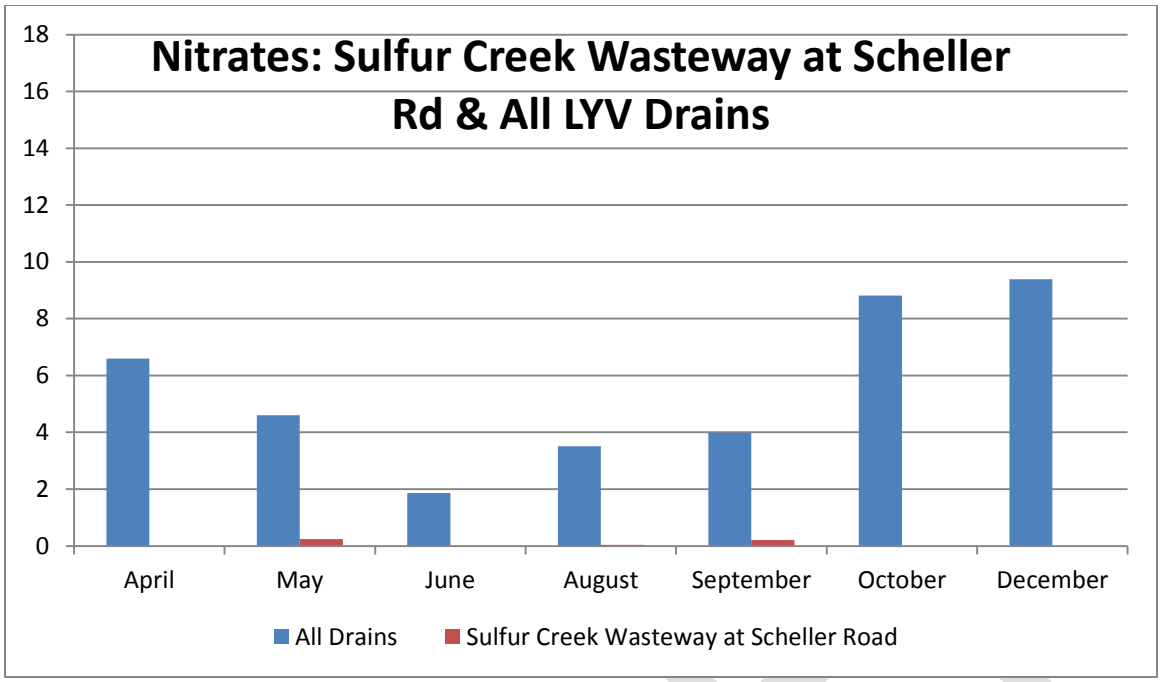

Nitrates: DR 2 NEET Site & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DR 2 NEET Site

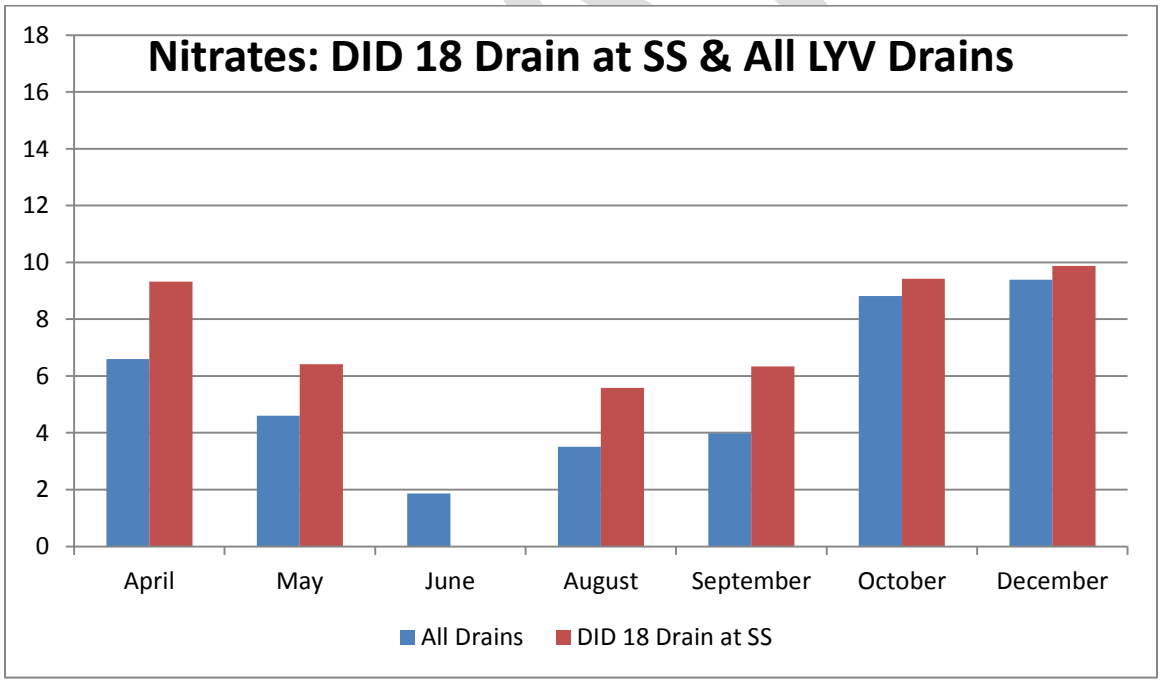

Nitrates: JD 32 at Outlook & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 32 at Outlook

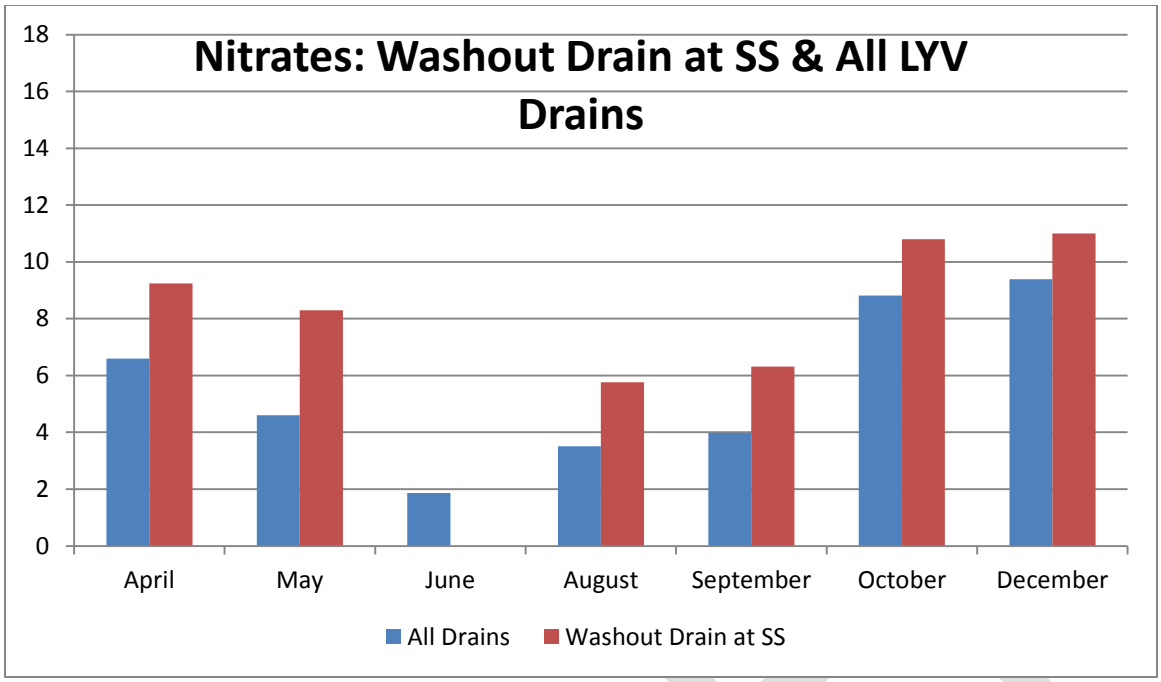

Nitrates: JD from Rougk Lane in SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD from Rougk Lane in Sunnyside

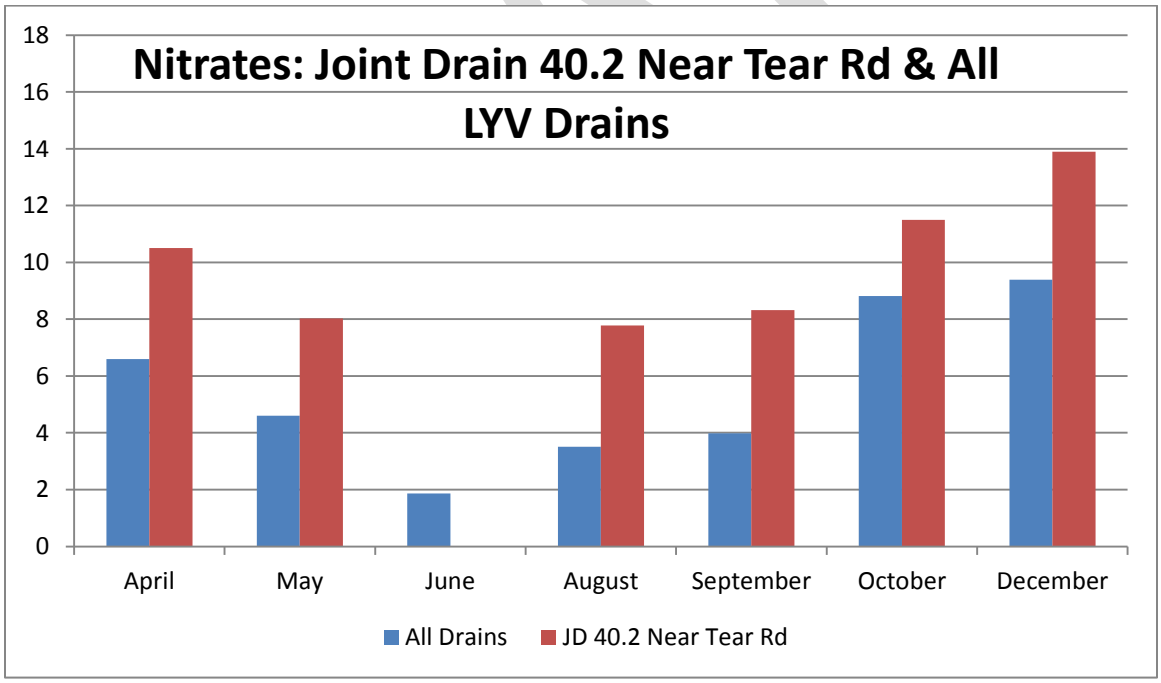

Nitrates: JD 34.2 at Woodin Road & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 34.2 at Woodin Rd

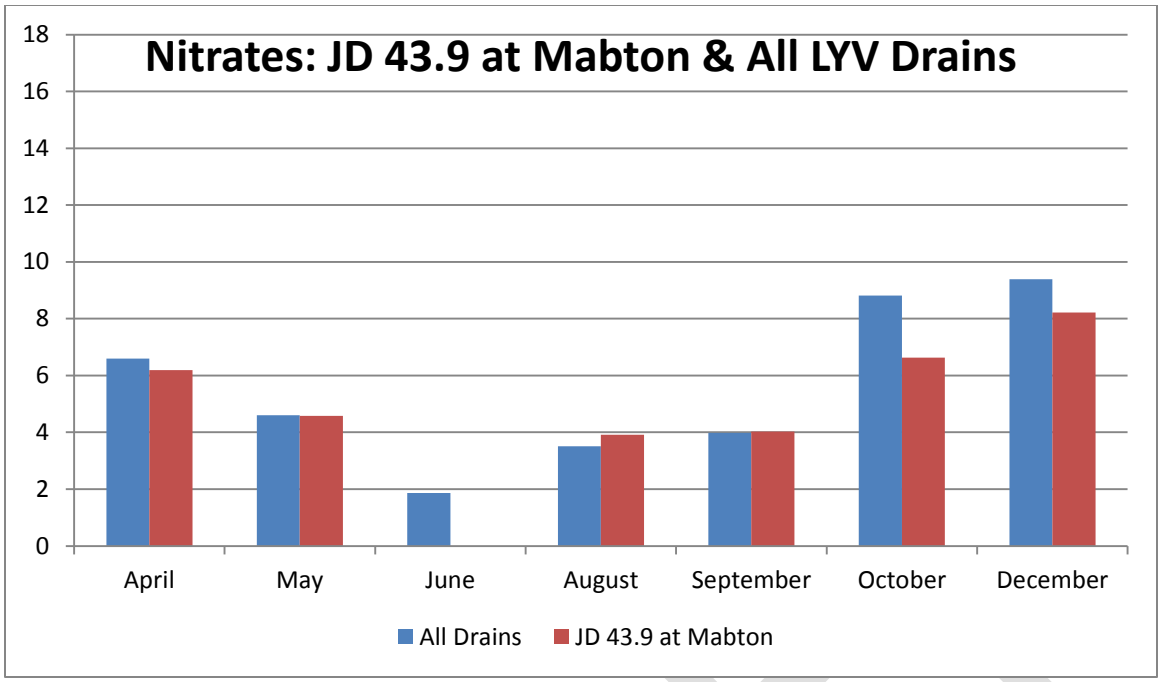

Nitrates: JD Near So 1st in SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD Near So 1st in SS

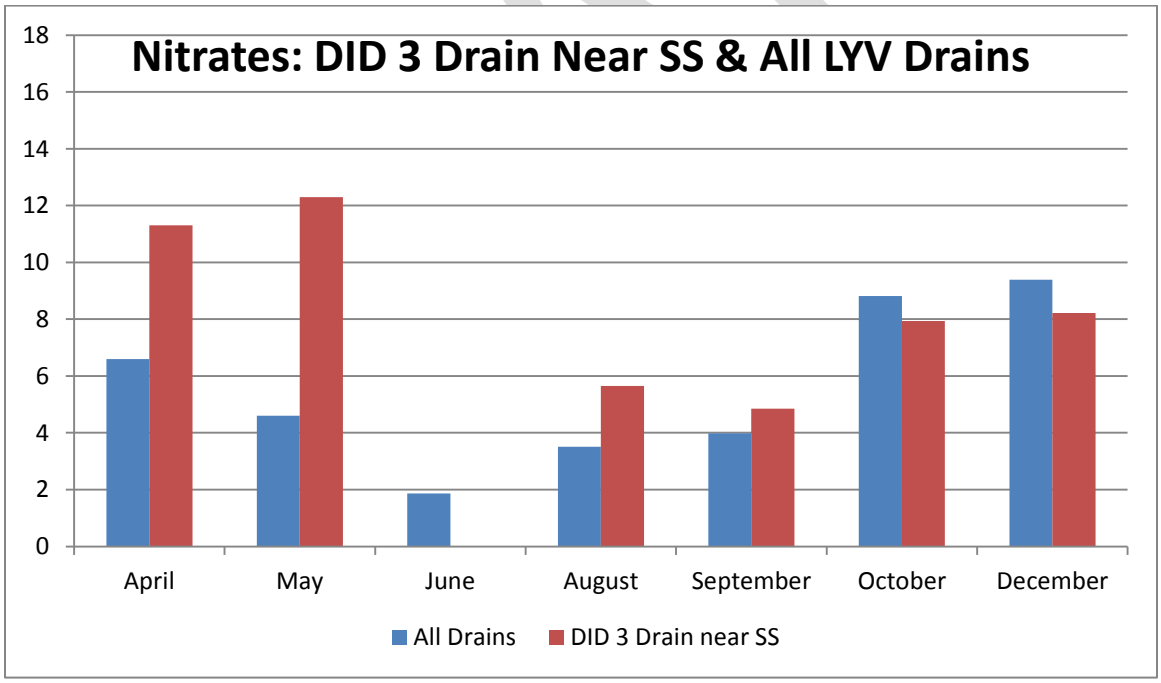

Nitrates: Sulfur Creek Wasteway at Scheller Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Sulfur Creek Wasteway at Scheller Road

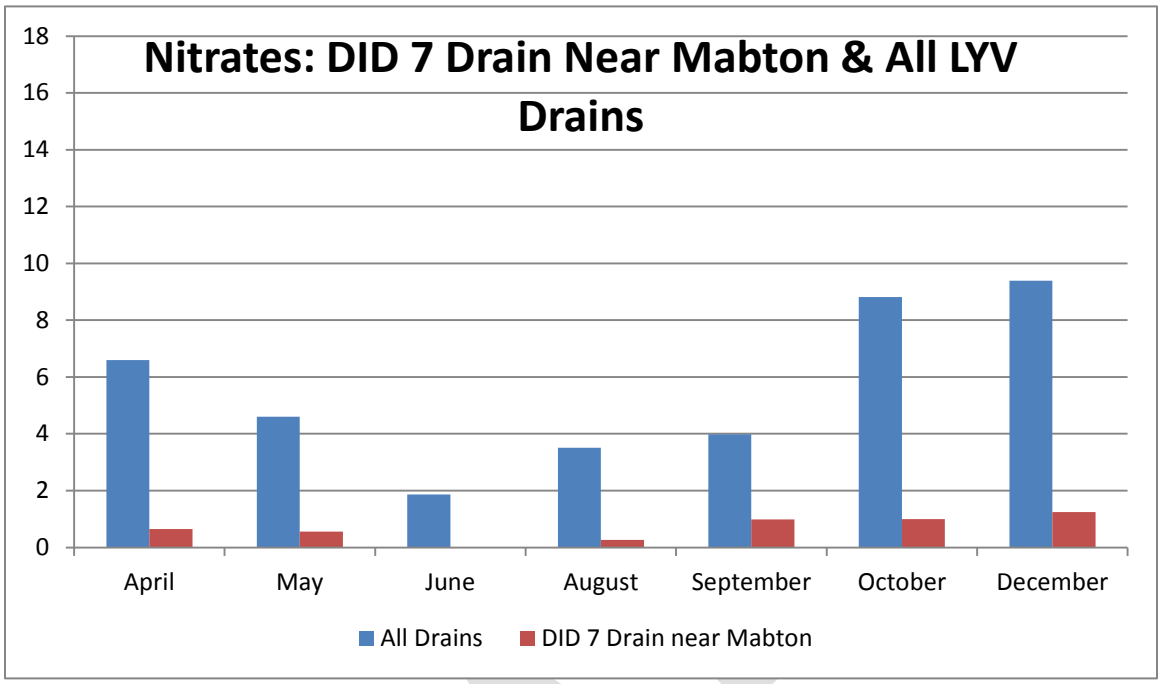

Nitrates: DID 18 Drain at SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DID 18 Drain at SS

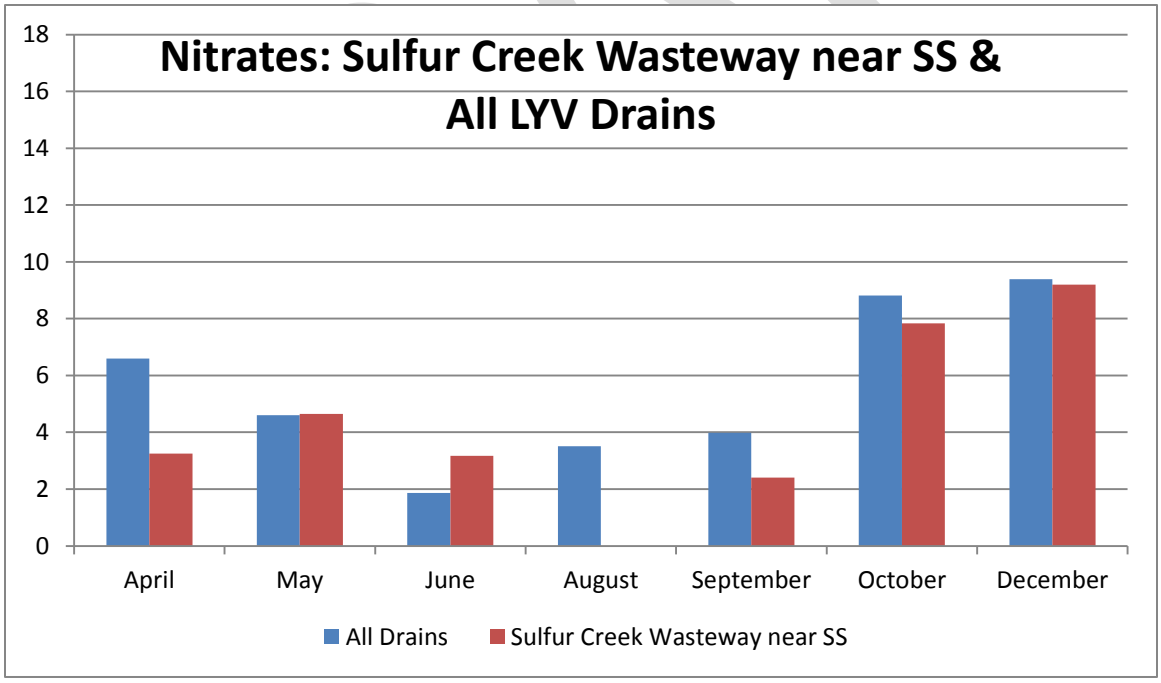

Nitrates: Washout Drain at SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Washout Drain at SS

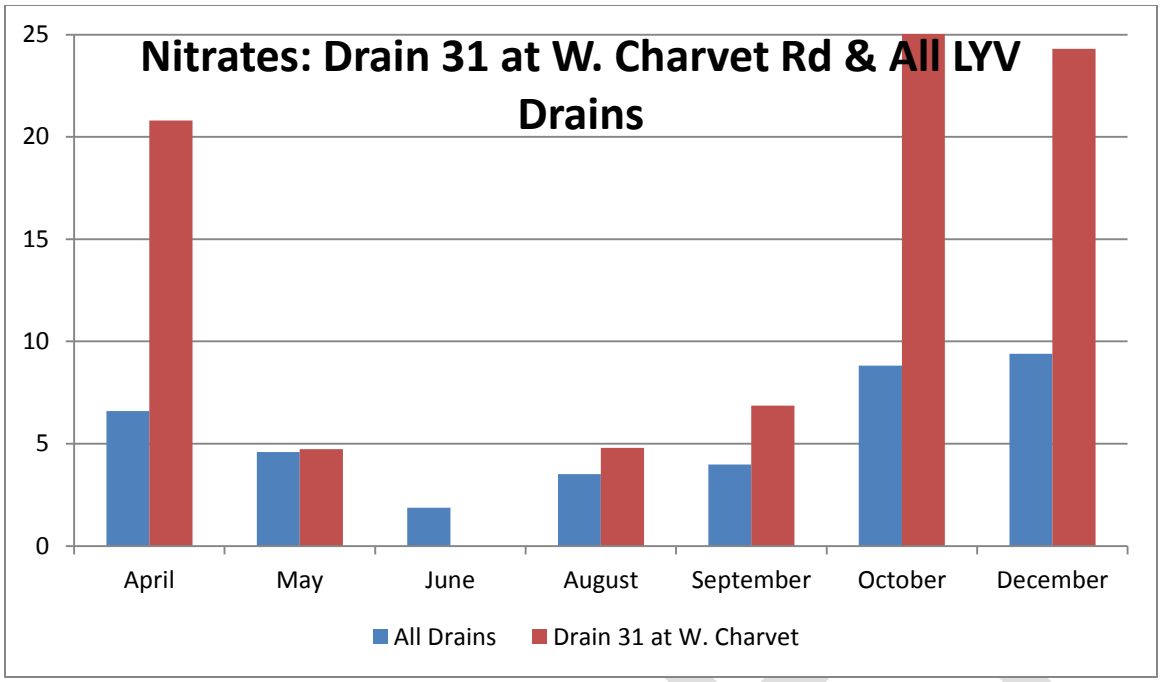

Nitrates: Joint Drain 40.2 Near Tear Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 40.2 Near Tear Rd


Nitrates: JD 43.9 at Mabton & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 43.9 at Mabton

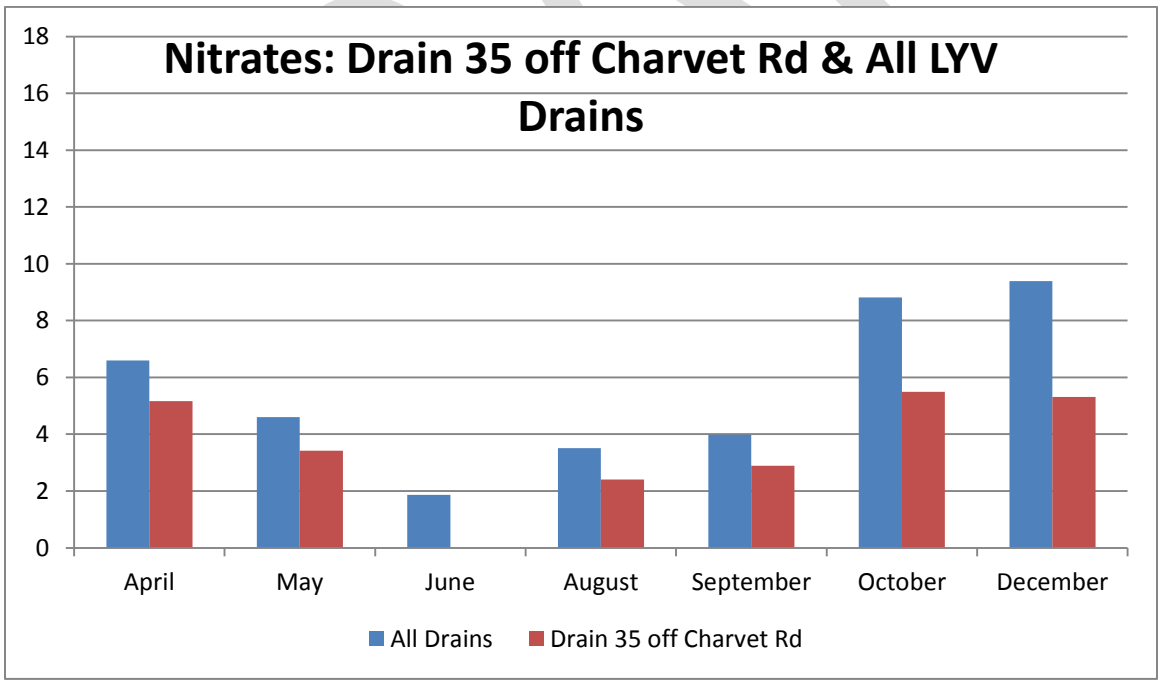

Nitrates: DID 3 Drain Near SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DID 3 Drain near SS

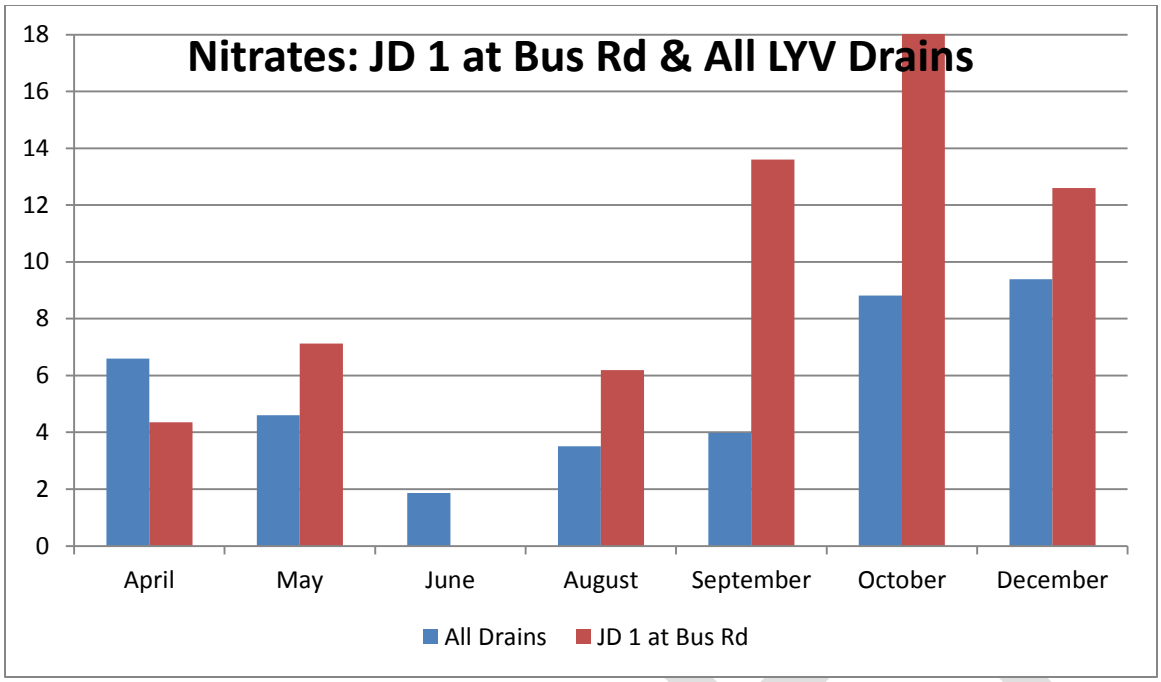

Nitrates: DID 7 Drain Near Mabton & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DID 7 Drain near Mabton

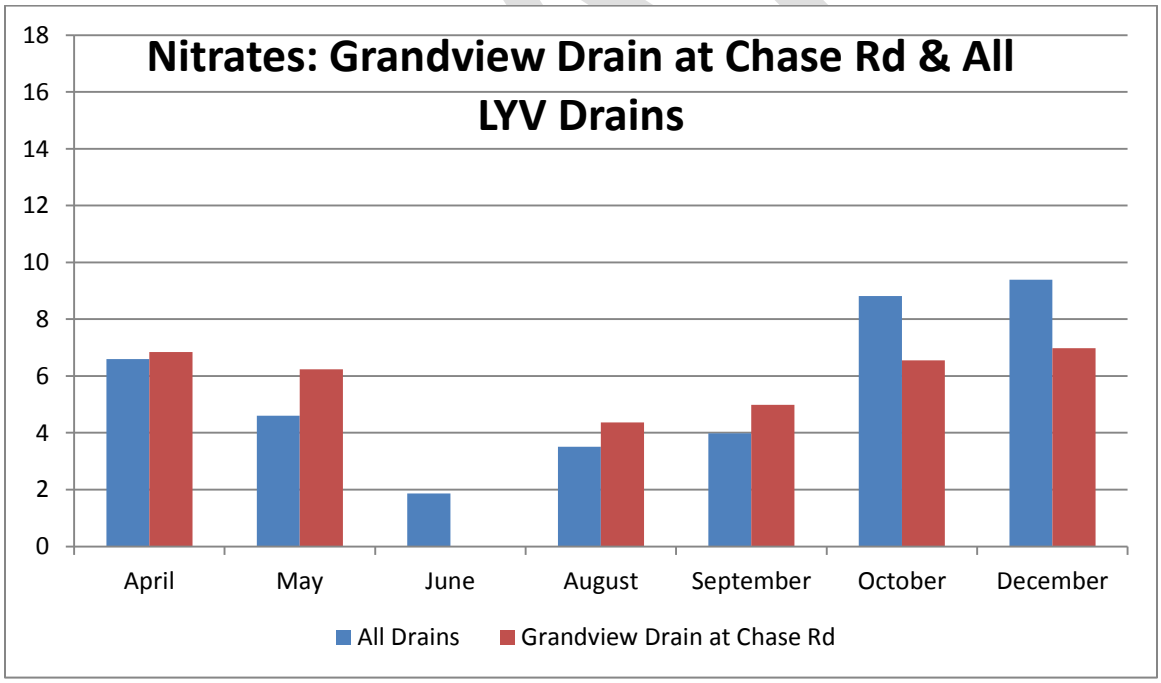

Nitrates: Sulfur Creek Wasteway near SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Sulfur Creek Wasteway near SS



(Note change in Scale)




Nitrates: JD 1 at Bus Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 1 at Bus Rd


Nitrates: Grandview Drain at Chase Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Grandview Drain at Chase Rd

Conclusions

Average nitrate levels for five well groupings are:

- North of Wapato – 0.50 mg/L
- Wapato to Toppenish – 4.00 mg/L
- Granger to Sunnyside – 8.62 mg/L
- Sunnyside to Mabton – 5.11 mg/L
- South of Mabton – 6.45 mg/L

Wells near the Yakima River had lower nitrate levels than those farther from the river

Wells in the area studied by the WA Agricultural Chemicals Pilot Project continue to have low nitrate levels

There was no overall correlation between well depth and nitrate levels

Drains in the northern study area had low nitrate levels

The highest drain nitrate levels were found in the area between Sunnyside and Mabton

Average nitrate levels in drains ranged from 0.01 mg/L to 13.07 mg/L

DRAFT

Last Updated on July 4, 2018

Research (Long List) of Health Problems Related to Nitrates

Abu Naser AA, Ghbn N, Khoudary R. (2007) Relation of nitrate contamination of groundwater with methaemoglobin level among infants in Gasa East Mediterr Health J. 12(5) pp. 994-1004. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18290391

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Brender, J.D., Olive, J.M., Felkner, M., Suarez, L., Marckwardt, W., & Hendricks, K.A. (2004) Dietary nitrites and nitrates, nitrosatable drugs, and neural tube defects. *Epidemiology 15*(3) pp. 330-336. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15097014

Brender, J., Olive, J., Felkner, M., Suarez, L., Hendricks, K., & Marckwardt, W. (2004). Intake of nitrates and nitrites and birth defects in offspring. *Epidemiology*, *15*(4), S184. Retrieved from http://journals.lww.com/epidem/Citation/2004/07000/Intake_of_Nitrates_and_Nitrites_and_Birth_Defects.487.aspx

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Compiled by Jean Mendoza

Last Updated July 16, 2018

Washington State Department of Agriculture

In 2015, the Washington State Department of Agriculture (WSDA) entered into an Interlocal Agreement with Yakima County to study nitrogen sources within the Lower Yakima Valley Ground Water Management Area (GWMA).

Attached you will find the draft report of the study which was produced jointly by the Washington State Department of Agriculture, Natural Resources Assessment Section and Yakima County Public Works Department. This draft is presented to the Ground Water Advisory Committee Work Groups for review and comment. Comments will be evaluated and incorporated for inclusion into future drafts of this report.

Under the provisions of the Interlocal Agreement, this study is limited in scope in several respects. It presents modeled estimates of nitrogen availability throughout the GWMA, but did not calculate how much is actually transported to groundwater. Estimations of nitrogen transport to groundwater would require further analysis and would need to take into account attenuation processes in the soil and vadose zone.

The analyses performed do not reflect site specific conditions, rather they are intended to reflect calculations of potentially available nitrogen within the overall study area. And further, does not reflect individual decisions or management practices. The high, medium, and low nitrogen availability estimates are not intended to capture conditions in any specific portion of the study area. They are intended to provide insight into what sources would likely need additional focus and study to support any future fate and transport analyses or future management decisions.

This draft report has been reviewed by relevant experts for each report section. Peer review by staff of Washington State Departments of Ecology and Health included repeated cycles of draft review, meeting, and editing to reflect peer reviewer's comments. Inputs for the different analyses were reviewed by the relevant working groups (RCIM, Irrigated Agriculture, and CAFO). Finally, the irrigated agriculture analysis was reviewed by faculty in WSU's Department of Crop and Soil Sciences and by the Irrigated Agriculture Working Group.

We have given our best efforts to conduct this study within the parameters established for this project. We look forward to further review and input from the various work groups as we move forward. Questions relating to any aspects of the study should be directed to WSDA's Natural Resource Assessment Section.

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Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area

A Study by the

Washington State Department of Agriculture

and

Yakima County

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Dairy producers:

- voluntarily shared manure testing results with South Yakima Conservation District
- invited WSDA NRAS staff onto their farms to sample soil in pens and compost areas
- invited WSDA NRAS staff onto their farms to learn about operational practices

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- reviewed irrigated agriculture methodology and assumptions
- grower members of the IAWG supplied production information necessary for calculating triticale double-crop production acres
- Jim Trull, Scott Stephens, and SVID compiled crop nitrogen uptake data
- Jim Davenport and Stu Turner compiled water duty data for crops in this report

CAFO Working Group

- made recommendations on inputs for lagoon calculations

Peer review team:

- Melanie Redding (Department of Ecology)
- Ginny Stern (Department of Health)
- Nancy Darling (Department of Health)

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- shared data from their lagoon assessment process
- worked closely with NRAS staff to make sure identification of facilities was as accurate as possible
- reviewed this report to make sure dairy operations were accurately described

South Yakima Conservation District

- collected and anonymized data from dairy producers
- reviewed GIS data for accuracy

Katie Hurlburt, WSDA Natural Resources Assessment Section

- conducted additional crop mapping and QA on the GIS data for this report

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- conducted QA on data entry and calculations for this report

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- provided information on atmospheric deposition monitoring and recommendations for low, medium, and high potential rates of atmospheric deposition

Jean Mendoza, Groundwater Advisory Committee member

- provided a reference for nitrogen loss to atmosphere from irrigated agriculture

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Executive Summary

In recent years, a number of groundwater studies have pointed to concerns about nitrate levels in groundwater in the Lower Yakima Valley. Between 1988 and 2008, 12% of wells tested in the area had nitrate concentrations above the Safe Drinking Water Act Maximum Contaminant Level of 10 mg NO_3-N/L. Another 21% of wells tested were below this level but higher than 5 mg NO_3-N/L (reported in Ecology et al. 2010).

In response, the Washington State Department of Ecology (Ecology) began working with Yakima County to address the issue and provide solutions to prevent nitrate contamination of groundwater in the Lower Yakima Valley. They established the Lower Yakima Valley Groundwater Management Area (GWMA), and in 2011 the Groundwater Advisory Committee (GWAC) was formed.

- The GWMA includes the land area and groundwater located in the lower Yakima Valley from Union Gap to County Line Road in Yakima County, Washington, minus the Yakama Nation. The majority of the GWMA is used for agriculture, including about 99,000 acres of irrigated crop land and more than 50 active dairy farms (WSDA 2016). The remainder of the GWMA land area consists of towns, rural residences, roads, canals, and other nonagricultural lands.
- The GWAC has worked to assess and respond to the groundwater nitrate issues by addressing public education and health concerns, evaluating existing data on groundwater quality, designing new monitoring strategies, evaluating regulatory responsibilities, and determining potential nitrogen availability from the various potential sources.

As partners, Ecology, the U.S. Environmental Protection Agency, Yakima County, the Washington State Department of Agriculture (WSDA), and the Washington State Department of Health have been working to support the GWAC and associated workgroups with educational and scientific products that can assist in decision making to protect groundwater quality.

About the Study

In 2015, the Yakima County Public Services Department and GWAC partnered with WSDA to conduct a study to provide a scientific baseline estimate of the amount of potential nitrogen available for transport from different nitrogen sources within the GWMA boundaries. Nitrogen available for transport is nitrogen that has the potential to move from the land surface or soil profile into groundwater. The study addressed how much nitrogen could be available, but did not calculate how much is actually transported to groundwater. The processes controlling nitrogen movement through the soil were not evaluated, and loading to groundwater was not estimated.

Nitrogen sources are numerous and can include agricultural, human, natural soil organic matter, and atmospheric deposition. Together, state and local partners studied estimated potential nitrogen availability in the landscape from 4 distinct categories:

- Concentrated Animal Feeding Operations (CAFOs) - including livestock pens and manure lagoons;
- Irrigated agricultural activities - including nitrogen balance from the 15 types of irrigated crops that constitute 96% of the irrigated acreage in the GWMA;

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- Residential, commercial, industrial, and municipal (RCIM) sources - including residential onsite septic systems (ROSS), large onsite septic systems (LOSS), commercial onsite septic systems (COSS), residential lawn fertilizers, and hobby and small-scale commercial farms;
- Atmospheric sources - including wet and dry deposition.

Nitrogen estimates were calculated for the land surface, bottom of the root zone, and at the extent of the treatment zone for animal agriculture, irrigated agriculture, RCIM, and atmospheric sources.

The estimates were completed using locally-derived information wherever possible, and information gaps were filled with data from scientific literature. Methodologies varied, depending on the source of nitrogen being studied. For example, some calculations used data gathered from aerial imagery. Some calculations compared inputs and outputs to determine the mass balance of nitrogen from various irrigated agriculture sources. Atmospheric calculations included adjustments to avoid double counting with other categories that already included atmospheric nitrogen. The body of the report addresses the methodologies used for each source studied.

The study was limited by a number of constraints, primarily the limited availability of local background data, the diversity of local or literature data used, and the various assumptions utilized for the calculations in each section of the report. This data used as inputs and the study itself have been reviewed by experts in each field. The data inputs used in each section were reviewed by the relevant GWAC workgroups (Irrigated Agriculture, CAFO, and RCIM). The irrigated agriculture calculations were reviewed by faculty from Washington State University's Department of Crop and Soil Sciences. In addition, the report draft has been reviewed by a peer review team composed of hydrogeologists from the Washington State Departments of Ecology and Health.

Study Results

The nitrogen available for transport was estimated at 3 levels (low, medium, and high) for each nitrogen source category evaluated in this study. The estimates were then assessed both on a per-acre basis and for the entire GWMA, providing 2 ways to consider the nitrogen sources. WSDA and Yakima County results were summarized in associated data spreadsheets and GIS based systems, allowing them to be updated in the future as additional data becomes available.

When the low, medium, and high nitrogen calculations were analyzed for all sources over the entire acreage of the GWMA (Table 1), irrigated agriculture, CAFO lagoons, and CAFO pens were the most significant contributors to potential nitrogen availability in all 3 scenarios. In the low range scenario, agricultural activities constitute 86% of the estimated total nitrogen available. In the medium and high range scenarios, agricultural activities constitute 95% and 96% of the estimated nitrogen available, respectively. The irrigated agriculture nitrogen percent is the highest in the low, medium and high categories due to the large number of acres of agriculture in the GWMA.

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Table 1. Estimated nitrogen available for transport from all sources at low, medium, and high range in tons/year and % of total

Source		Low		Medium		High	
		Tons N/year	%	Tons N/year	%	Tons N/year	%
Irrigated Agriculture		532	62	2,870	66	8,685	76
CAFO	Pens	70	8	502	11	935	8
	Lagoons	142	16	781	18	1,421	12
RCIM	All septic (ROSS, LOSS, COSS)	47	5	83	2	135	1
	Residential fertilizer	10	1	26	1	41	0
	Small scale farms	4	1	11	0	18	0
Atmospheric Deposition		57	7	76	2	227	2

*All numbers in this table have been rounded to the nearest ton, or the nearest whole number, in the case of percentages. Some low but nonzero percentages have been rounded to zero.

When assessed on a per-acre basis (Table 2), the sources that contribute the most nitrogen differ from those contributing the most nitrogen over the entire GWMA. Nitrogen estimates from irrigated agriculture are the top contributor when assessed over the entire GWMA because of the large number of acres assessed, but are not in the top 3 on a per-acre basis.

Some management units have relatively small acreages, but contribute large amounts of nitrogen per acre. For example, the LOSS estimates at the low range are one of the top 3 contributors of nitrogen on a per-acre basis, but they have an extremely small total acreage in the GWMA (3 acres). The CAFO lagoon and ROSS estimates at the low, medium and high ranges are in the group of the top 3 highest contributors on a per-acre basis (shaded in blue in Table 2). CAFO lagoon and ROSS acreage in the GWMA are relatively small when compared to larger source areas such as irrigated agriculture, atmospheric deposition, and residential fertilizer.

Table 2. Estimated nitrogen available for transport per acre from all sources at low, medium, and high range

Source		Area (acres)	Low (lb/acre-year)	Medium (lb/acre-year)	High (lb/acre-year)
Irrigated Agriculture		96,186	11	60	181
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential Fertilizer	4,381	4.7	11.7	18.6
	Small Scale Farms	2,096	4.3	10.7	17.1
Atmospheric Deposition		73,976	1.53	2.05	6.15

Blue shading indicates top 3 contributors in each range (low. medium, high).

Looking Ahead

NRAS has identified a number of data needs to add to these estimates. Both WSDA and Ecology are engaged in work that will aggregate information about lagoon conditions that could potentially be used to adjust these estimates. Calculations could be updated as data becomes available from the DNMP lagoon liner assessment ratings and Ecology CAFO permit reporting assessments and requirements. Washington State University research on lagoon seepage is beginning that may also provide relevant information. New field research on lagoon seepage could also be conducted if

necessary to supply the needed data. The irrigated agriculture mass balance estimates could be compared to current and future deep soil sampling results to improve the accuracy of the analysis. An assessment of additional data for each impoundment classification (lagoon, flush/main lagoon, farm/irrigation pond, settling basin) could be used to apply seepage rates and nitrogen concentrations specific to each use. A statistically-based study of soil nitrogen concentrations beneath pens could be conducted to confirm estimates used in this study that were developed in other regions of the country. Additional areas of inquiry are discussed in the Conclusions and Recommendations section.

Even though estimates may be refined in the future, this comprehensive study was successful in making an initial estimate of potentially available nitrogen from different sources throughout the GWMA. Per-acre estimates from each source category can be reviewed spatially to identify areas where risk and vulnerability are potentially high. The use of this spatial component allows for more complex future analysis with the inclusion of other relevant data layers such as soil type, depth to groundwater, groundwater nitrate concentrations, soil sampling results, and proximity to public drinking water systems.

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Introduction and study area

Yakima County is located in central Washington State. This study focuses on the lower Yakima Valley, located in the southeastern portion of the county and bordered by the Rattlesnake Hills to the north, the Yakama Nation to the west, and Benton County to the east. The Yakima Groundwater Management Area (GWMA) is shown in Figure 1, with major cities and roads noted. The current population of Yakima County is just over 240,000 people, and the major metropolitan area is the city of Yakima (Census 2010). The county's main industry is agriculture, with a 2013 farm gate value of $1.65 billion (USDA NASS 2014). The major commodities produced are apples, milk, and hay. The lower valley agricultural landscape includes more than 50 active dairy farms and approximately 100,000 acres of irrigated farmland (WSDA 2016). The Yakima River runs through the GWMA, and water for agriculture is collectively managed by 5 different irrigation districts: Roza, Sunnyside, Wapato, Zillah, and Grandview.

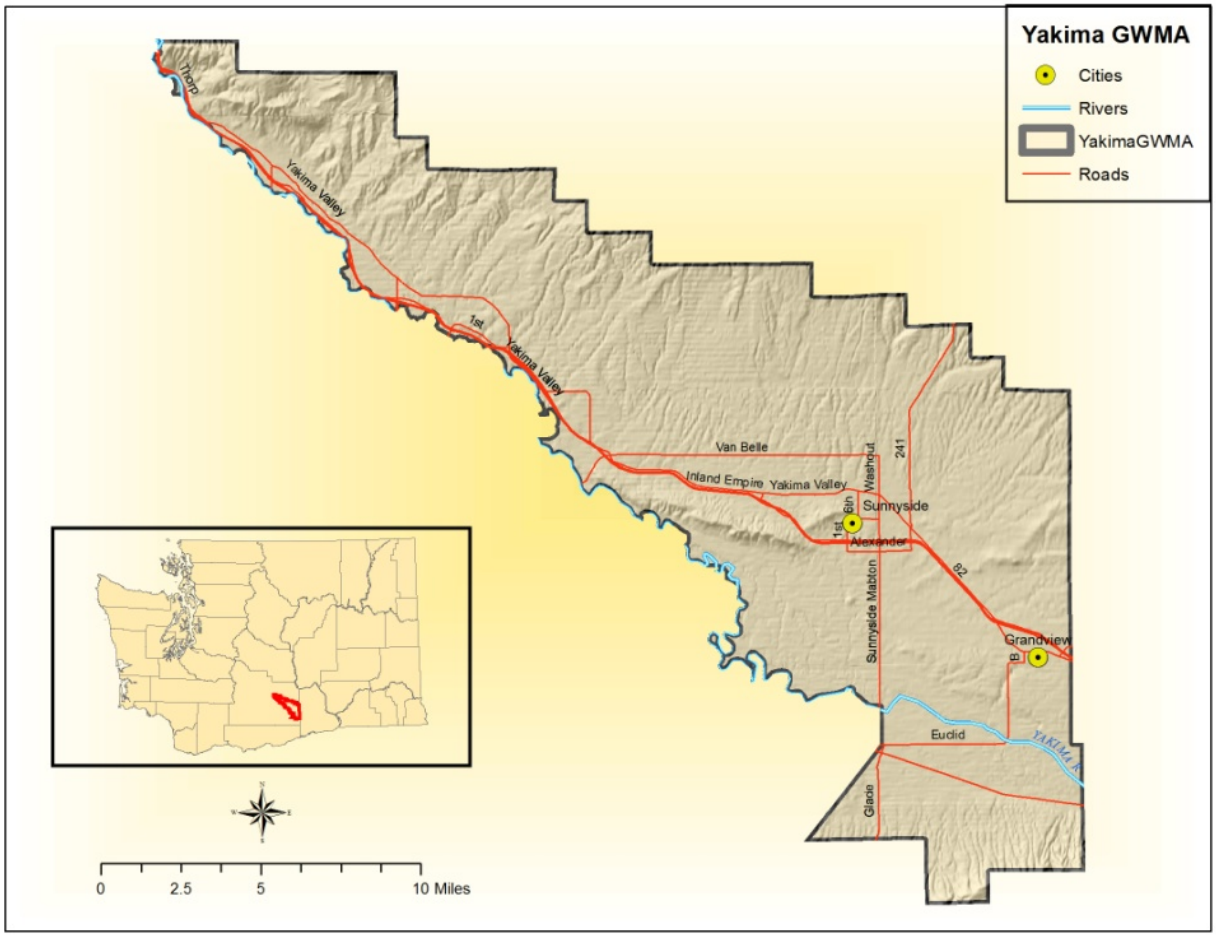

Figure 1. Map of Yakima ground water management area

Within some areas of the GWMA, nitrogen has negatively impacted groundwater quality. The Washington State Department of Ecology (Ecology) summarized results from sampling studies conducted by Ecology, the US Geological Survey, and the Washington State Department of Health

between the early 1990's and June 2008. A total of 1,726 nitrate testing samples from 453 well sites were summarized. Data sources included nitrate test results from 328 domestic wells, 93 public wells, and 33 wells of other types including some used for irrigation. Of wells with nitrate detections, 67% were less than 5 mg NO_3-N/L, 21% were between 5 and 9.9 mg NO_3-N/L, and 12% were greater than 10 mg NO_3-N/L. The Maximum Contaminant Level set by the US Environmental Protection Agency (EPA) for nitrate is 10 mg NO_3-N/L; concentrations approaching and above this level are of concern due to the potential impact to human health (EPA 2013a, Ecology et al. 2010). Shallower wells (which were more likely to be domestic wells) had more nitrate detections and exceedances than deeper wells (Ecology et al. 2010). An EPA study concluded that agriculture and livestock operations within the GWMA were significant contributors to nitrogen loading to the underlying groundwater (EPA 2013a).

In 2011, Ecology authorized the formation of the lower Yakima GWMA. This group, made up of area residents, representatives from the agricultural industry, and scientists and experts from county, state, and federal government agencies, is focused on identifying potential contaminant sources and preparing a management strategy for the affected area.

EPA conducted a multi-phase study to identify potential nitrate sources and other contaminants. After source identification, EPA conducted groundwater monitoring up- and downgradient from potential sources (including several large dairies) in 2010 (EPA 2013a). As a result of this groundwater sampling, in March 2013, EPA signed an Administrative Order on Consent (Consent Order) with 5 dairies in the lower Yakima Valley (EPA 2013b). The purpose of this consent order was to address sources of nitrate contamination in groundwater near and downgradient of the dairies' facilities. These dairies have begun additional work to control nitrate sources, collect data, and monitor groundwater quality to assess the effectiveness of the source control actions.

This report is the result of a request in 2015 by the GWMA's Ground Water Advisory Committee for the Washington State Department of Agriculture (WSDA) Natural Resources Assessment Section (NRAS) and the Yakima County Public Services Department to complete an estimate of nitrogen loading potential within different land use classes in the lower Yakima Valley. This report outlines estimated nitrogen available for transport from the following land uses: irrigated agriculture, concentrated animal feeding operations (which includes both dairies, dairy support such as heifer raising, and beef cattle feedlots), residential, commercial, industrial, and municipal sources. The land uses were divided into 3 separate sections for calculations: irrigated agriculture, concentrated animal feeding operations (CAFOs), and residential, commercial, industrial, and municipal (RCIM) sources. A separate section estimates the potential contribution to groundwater nitrogen from atmospheric deposition of nitrogen. The data was collected from a variety of sources and through different methods, including phone interviews, on-farm data collection, analysis of aerial imagery, ground surveys for spatial analysis, and local zoning and land use information.

Nitrogen has an extremely complex cycle in the environment, with a number of different pathways for accumulation and removal. Figure 2 shows how these pathways might work in an agricultural system (Fertilizer and Lime Research Centre, 2014).

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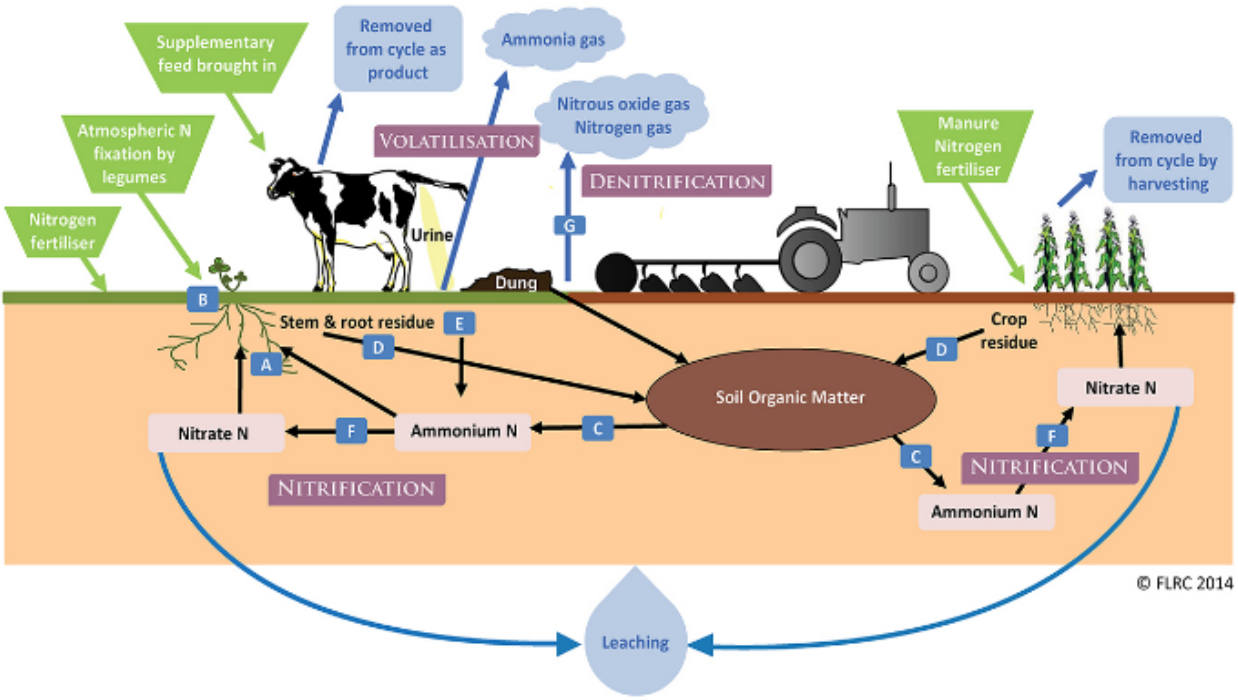

A. Plant uptake of N; **B**. N fixation by legumes; **C**. Decomposition of organic matter to Ammonium; **D**. Plant residues and dung to soil organic pool; **E**. Enzyme conversion of Urea to Ammonium; **F**. Nitrification - the conversion of Ammonium to Nitrate; **G**. Denitrification - the conversion of Nitrate to Nitrous Oxide gas and then to Nitrogen gas.

Figure 2. Nitrogen cycling pathways in agricultural settings

This study is the first conducted in the lower valley that uses local information to address the potential pathways for nitrogen loading. It is also the first project completed for the GWMA that pairs estimated nitrogen surpluses with GIS-based land use information. The purpose of this report is to understand available nitrogen from nitrogen sources and enable the GWMA advisory committee to better direct remediation strategies throughout the region.

Methodology and Limitations

The objective of this report was to provide information to the Groundwater Advisory Committee that can be used to make decisions about how to use limited resources to meet the long-term goals of reducing nitrate concentrations in groundwater until they meet groundwater standards. This report is not intended as a final statement on potential nitrogen contributions from different sources, instead it represents a first step. Recommendations are made for future experimental research to improve estimates, and additional data sets have been identified for future inclusion that are currently available or will become available in the future. These calculations can and should be updated as new information becomes available.

Nitrogen loading potential was assessed differently in each section (irrigated agriculture, CAFO, and RCIM). Fate and transport of the nitrogen through the soil profile to groundwater is not explored in this document. For each operational unit the objective was to determine the total nitrogen available for transport at the end of the 'treatment zone'. This location is different for different sectors,

- for irrigated agriculture it is nitrogen available at the bottom of the root zone, when it becomes unavailable for plant uptake,
- for lagoons it is the bottom of the lagoon liner, when it is available to move through the soil profile under some conditions,
- for pens it is the bottom of the manure-soil interface layer, when it is available to move through the soil profile under some conditions,
- for septic systems it is the end of the drainfield,
- for residential fertilizer use it is the land surface, and
- for small scale commercial and hobby farms it is the land surface.

One challenge for both conducting this study and interpreting and comparing the results in the different sections is the diversity of data sources used for calculations. Data sources included self-reported data from producers, data from peer-reviewed literature, data from state and federal government studies, averaged data, specific local data, general national data, and estimates based on best professional judgment. Examples of just a few of the many data sources used for calculations in this study are:

- fertilizer use practices (self-reported survey information, local and crop specific data),
- analytical results from testing of lagoon nitrogen concentrations (self-reported, testing results from certified labs, sample not statistically selected),
- analytical results from testing of lagoon nitrogen concentrations (local data, EPA sampling and analysis procedures, sample not statistically selected),
- GIS data derived from ground-based mapping, human analysis of aerial imagery, and automated analysis of aerial imagery with ArcMap tools (local data, accuracy may vary depending on analysis method),
- estimates by experts in different specialties (local data, estimates may vary depending on expert judgment), and
- national- and state- level data and estimates for performance of septic systems (larger-scale data may not be accurate for local conditions).

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An additional challenge in reviewing data presented in the literature and experimental results is the many units used and species of nitrogen reported in papers. Nitrogen is often reported as nitrate, nitrate-N, organic nitrogen-N, TKN, ammonia/ammonium, ammonia/ammonium-N, combinations of these, or as total nitrogen, which makes comparison of literature results difficult and sometimes impossible

This study relies on a wide variety of data sources, which has to be considered when interpreting and using the results. Not all sources will be considered equally credible according to the Water Quality Data Act (RCW 90.48.570-90.48.590, Water…2004). This can make it difficult to compare data sources and calculation results. In order to allow readers to evaluate data sources on a case-by-case basis each data source used, the calculation it was used for, the source, and potential concerns with the data source have been collected in a table (Appendix A: Data Sources, Uses, and Potential Concerns). Wherever possible, summary statistics have been presented and a careful choice has been made for what value (mean, median, or an alternative) to use in calculations.

The conclusions section of this report makes suggestions for critical additional research to refine these estimates through additional data collection. The spatial component of this data is extremely important. Wherever possible, nitrogen availability has been presented both as an aggregate over the entire GWMA and on a per-acre basis. This per-acre nitrogen availability can be spatially associated with sources to examine nitrogen availability at different scales and in different regions.

1. CONCENTRATED ANIMAL FEEDING OPERATIONS

WSDA authors: Margaret Drennan, Jaclyn Hancock, Gary Bahr

Background and literature review

Over the past 90 years, the number of cattle and dairy farms has been decreasing. The number of cattle and calves has increased relatively steadily during that time. The number of dairy cows was relatively stable between 1925 and 1969, but after 1969 the number of dairy cows began to increase steadily, which has continued until 2012. Between 1969 and 2012 USDA's estimate of dairy operations went from 7,868 cows on 301 farms to 99,532 milk cows on 97 farms (USDA NASS 2014). Dairy farms are increasing in size while the number of farms is decreasing. As of 2012, USDA also notes the presence of relatively low numbers of other livestock: hogs and pigs, sheep, goats, horses, and poultry (USDA NASS 2014). This USDA statistical data is available only at the county level.

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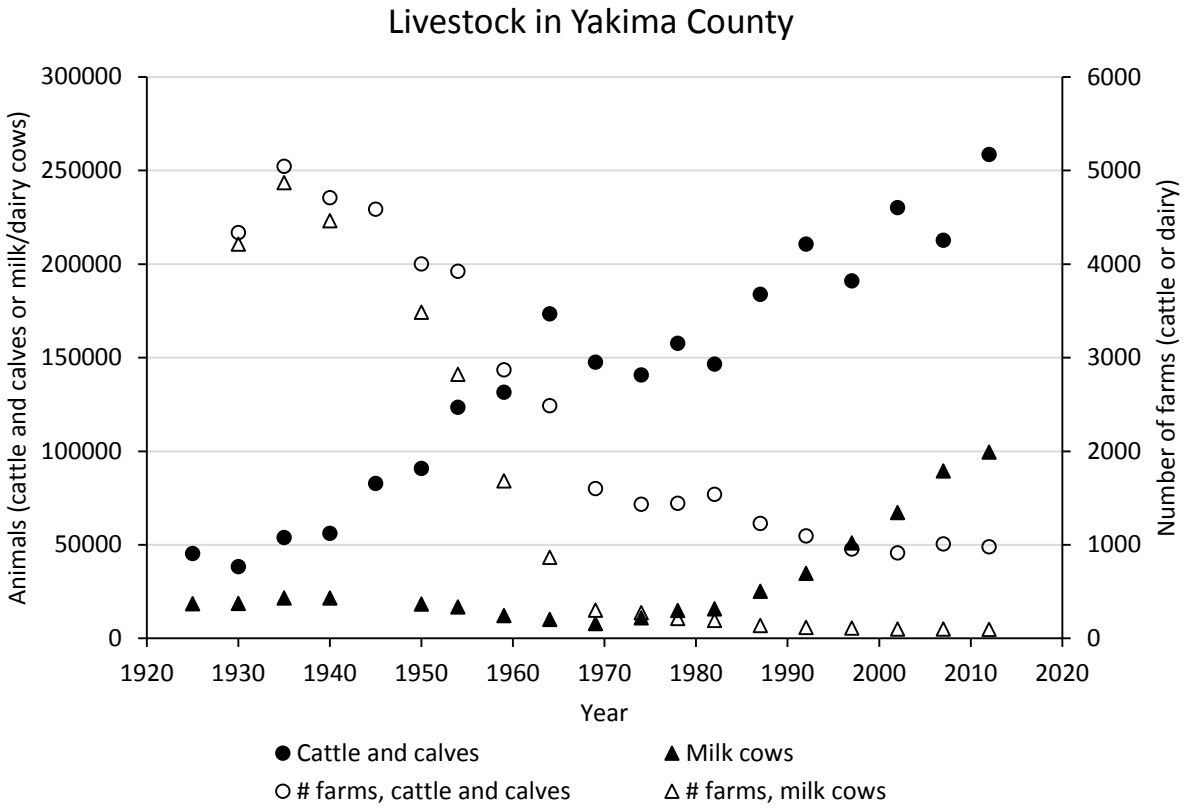

Figure 3. Livestock (cattle and dairy cows) in Yakima County since 1925[1]

Dairies are the only Washington State livestock operations whose manure management is inspected and regulated by WSDA, in accordance with Washington's Dairy Nutrient Management Act (Dairy…1998). Dairies are required to register with WSDA's Dairy Nutrient Management Program, develop nutrient management plans, maintain records of manure applications, and are inspected regularly by DNMP staff. As a result, dairies are the facilities about which most information is available. Dairy support animals (dry cows, calves, and heifers) are sometimes kept in adjacent facilities and sometimes (in the case of calf and heifer raising operations) moved offsite until maturity.

Whether nitrogen or other contaminants move from operational units to surface or ground water depends on dairy age, management practices, meteorological conditions, soil types, geological conditions, unsaturated zone thickness, and groundwater characteristics. Several studies have attempted to quantify nitrogen loading from entire farms and identify which sector (pens, lagoons, or irrigated fields) makes the largest contribution. Two studies in California used monitoring wells up- and downgradient from different management units in an attempt to measure nitrogen additions from each management unit (Harter et al. 2002, van der Schans et al. 2009). Harter

[1] (Commerce 1927, Commerce 1932, Commerce 1936, Commerce 1942, Commerce 1946, Commerce 1952, Commerce 1956, Commerce 1961, Commerce 1967, Commerce 1972, Commerce 1977, Commerce 1981, Commerce 1984, Commerce 1989, Commerce 1994, USDA NASS 1999, USDA NASS 2004, USDA NASS 2009, USDA NASS 2014)

monitored groundwater at 5 dairies for 4 years and found that it was very difficult to exclude effects from neighboring management units, they concluded that the largest nitrogen contributor on dairies was manure-treated cropland. Total contributions from cropland were much larger than pens or lagoons largely because the acreage of cropland was much larger and made it difficult to distinguish contributions from pens and lagoons (Harter et al. 2002). Another study in California used monitoring wells to calibrate groundwater models specific to 2 dairy farms in California. The study identified nitrate-N losses of 486 kg/ha-yr from manure-treated fields, 872 kg/ha-yr from pens, and 807 kg/ha-yr from lagoons (van der Schans et al. 2009). Another study conducted by a University of California at Davis (UC Davis) team assessed nitrate loading to ground water in prominent agricultural and dairy production areas within the Tulare Lake Basin and Salinas Valley of California. The UC Davis study estimated loading from pens at 75-1,000 kg N/ha-yr. Based on a variety of estimates of seepage rates from manure lagoons and lagoon nitrogen concentrations the UC Davis study estimated nitrogen loading from lagoons at 200-2,000 Mg/year for the entire study area. With a total lagoon area of 1,265 ha this results in a loading rate of 158-1581 kg N/ha-yr (Viers et al. 2012).

Pens

Dairies contain a variety of different operational units dedicated to animal housing, manure management and storage, and sometimes also crop production. Animal holding areas can include concrete-surfaced freestall barns, as well as holding areas which are generally constructed with compacted earth surfaces. These are referred to by a variety of names in different studies but will be referred to in this report as pens. Pens at facilities housing support animals have been classified as 'nondairy CAFO' pens while pens at facilities housing milking cows have been classified as 'dairy CAFO' pens.

The combination of weight and compaction due to the presence of cattle with the physical and chemical changes to underlying soil due to the mixing of soil and manure have been observed to form an interface layer under the deposited manure that allows very little infiltration of liquid to the underlying soil (Mielke et al. 1974). At one feedlot site, researchers were not able to record any infiltration during a 20-day period (Mielke et al. 1974). A study of 3 feedlots in Alberta, Canada confirmed that this interface layer formed within 2 months of cattle stocking. In addition, experimentally-determined permeabilities were similar for coarse- and fine-textured soils. However, despite this interface layer and expected low leaching potential, chloride leaching was detected at all 3 feedlots (Miller et al. 2008). Similarly, at feedlots in Kansas, despite apparently limited infiltration, soil testing beneath pens found elevated concentrations of ammonium, organic nitrogen, nitrate, chloride, and phosphorus. This study compared a mass balance approach to estimate nitrogen leaching from feedlots to subsurface soil testing results. Although elevated concentrations of contaminants were detected, movement of contaminants through the feedlot surface was much lower than what was expected from the mass balance calculation and concentrations were consistent with diffusion through the interface layer (Vaillant et al. 2009). Seepage rates through feedlot surfaces documented in other studies ranged from 0.005 to 2.4 mm/day (reported in Vaillant et al. 2009). The effectiveness of this manure-soil interface layer is dependent on maintenance and surface conditions. Dry conditions combined with animal hoof action or on-farm practices such as pen scraping can damage the aggregated structures,

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compromising the interface layer and allowing infiltration or altering subsurface conditions to favor nitrogen transformations and subsequent leaching (Mielke et al. 1974, Vaillant et al. 2009).

The UC Davis report identified 2 large beef cattle feedlots in the Tulare Lake Basin, with stocking rates of 125 and 300 animals/acre. The dairies studied in the Tulare Lake Basin had stocking rates of 50 animals/acre, which does not include support animals (Viers et al. 2012). As of the 2014 DNMP dairy registration, dairies in Yakima County had just over 100,000 milking and dry cows (the vast majority of which were located within the GWMA boundary), making for a stocking rate of around 50 cattle/acre, based on the NRAS estimate of pen acreage, similar to that of dairies in the UC Davis study.

The UC Davis study assessed these studies and local soil testing data (unpublished) to choose low and high nitrogen loading rates for pens. The authors chose 75 kg N/ha-yr as the low loading rate, based on a locally-observed recharge rate below corrals of 50 mm/year and soil moisture nitrate concentrations of 675 mg/L (unpublished data). Citing recharge rates as high as 300 mm/year reported in other studies the UC Davis study used 1,000 kg N/ha-yr as an upper limit for nitrogen loading from pens. However, the authors of that study suggest that the upper bound is an overestimate, potentially as much as an entire order of magnitude too high (Viers et al. 2012).

Lagoons

Depending on the dairy's management practices, manure and urine deposited in freestall barns and pens is transported to storage areas which may be liquid storage impoundments (generally through underground piping and pumping systems) or solids storage and composting areas where solids are dried, stacked, and sometimes composted for further use.

Liquid storage impoundments themselves serve a variety of on-farm uses. Lagoons can provide storage for manure and urine cleaned from barns, but may also capture runoff from roofs and other surfaces and process water from the milking parlor. In addition, lagoon liquid may be recirculated to clean barns with flush systems. Distinguishing between an impoundment primarily used for manure storage and one primarily used for irrigation water storage can be difficult. Contents are transferred between impoundments as needed to meet cleaning, storage capacity, and maintenance needs. The term lagoons is used here to refer to impoundments whose primary purpose is manure storage. In addition to lagoons, some dairies also have dedicated impoundments used for separating solids and liquids. The technical sophistication of these impoundments could range from a pond with a weeping wall to an engineered concrete basin with baffles directing and slowing flow to promote settling.

There is substantial variation both in the composition of solids, liquids, and dissolved constituents, and in seepage rates from lagoons, resulting in wide variation in the potential to impact ground water quality (Ham 2002; Harter et al. 2014). A study of 20 lagoons (14 swine, 5 feedlot, and 1 dairy) found seepage rates between 0.2 and 2.4 mm/day, with an average of 1.1 mm/day (Ham 2002). Groundwater monitoring up- and downgradient from lagoons confirms that contaminants leaching from lagoons contribute to shallow groundwater contamination (Harter et al. 2002, van der Schans et al. 2009, Viers et al. 2012). In one study, testing detected elevated concentrations of TKN (total Kjeldahl nitrogen, a measure of organic N and ammonium/ammonia N combined)

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outside the edges of 3 dairy lagoons, and the authors estimated a leaching rate of approximately 1 m/year (Harter et al. 2002).

Nitrogen concentration within lagoons has been tested in a number of studies, and is extremely variable. The UC Davis study conducted extensive literature review and modeling of lagoons and the authors used nitrogen concentrations of 500 and 1,000 mg N/L in their estimates (Viers et al. 2012). A survey of lagoon contents in California sampled more than 60 dairies in California's San Joaquin Valley in 1999 and 2000 and found lagoon TKN concentrations of 47-2,420 mg N/L, with an average of 560 mg N/L (Campbell Mathews et al. 2001). A University of California Cooperative Extension publication reports lagoon nitrogen concentrations from other research on California dairies: one study of 11 dairies found median lagoon total N concentrations ranging from 164-645 mg N/L and another study of 8 dairies found mean TKN in lagoons of 670 mg N/L (Pettygrove et al. 2010). Sampling at 5 Yakima Valley dairies by EPA found total nitrogen concentrations ranging from 290 to 1,800 mg N/L with an average of 1,212 mg N/L (EPA 2013a). These results are summarized in Table 3.

Table 3. Dairy lagoon manure sampling results derived from or used by studies in California and the Yakima Valley

Citation	Project Location	Actual or estimated nitrogen concentration (mg N/L)
EPA 2013a	Yakima Valley, 5 dairies	range 290 - 1,800 average 1,212
Viers et al. 2012	Tulare Lake Basin and Salinas Valley, California	500 1,000
Campbell Mathews et al. 2011	San Joaquin Valley, California	range 47-2,420* average 560*
Pettygrove et al. 2010 (reporting 2 studies)	California	165 – 645 670*

*TKN is a measure of organic N + ammonia N. In lagoons nitrate is very low or undetectable and TKN is comparable to total N.

PENS AND COMPOST AREAS

Methods, limitations, and assumptions

Limitations

Every effort has been made in this report to identify facilities and facility uses that are current as of 2015. Staff with WSDA's Dairy Nutrient Management Program (DNMP) worked closely with NRAS to correctly identify facilities and unit operations. However, facilities close and open, and the use of individual unit operations changes. As a result some dairies are included in this analysis that have since closed. Individual pens have been associated with either dairy or nondairy CAFOs. The majority of pens that have been identified as nondairy CAFOs are likely dedicated to raising or housing dairy support animals (calves and heifers). However, individual pens may hold calves during one time period and after those animals are moved out, heifers or adult cows may be moved into that same corral or pen. NRAS has attempted to capture primary uses of different pens but use practices are subject to variation. A small number of the pens identified as nondairy CAFOs are associated with 2 beef cattle feedlots. The calculation used for pens identified as dairy and nondairy

CAFOs is the same, both are based on the methods used by the UC Davis study team (Viers et al. 2012). The same rate was used for both dairy and nondairy CAFOs despite the fact that beef cattle feedlots, dairies, and heifer raising facilities have different characteristics and management practices that would be likely to affect nitrogen loss. Stocking rates, manure volume, manure nitrogen content, animal size, and feed choices would be likely to differ between dairy and nondairy CAFOs, all of which would affect the nitrogen loss at these facilities. NRAS did not have the amount of facility-specific on-site information that would be needed to generate different rates for dairy and nondairy CAFOs. Dividing pens into dairy and nondairy categories would allow different calculations to be conducted in the future if more facility-specific information becomes available. This analysis also does not account for any contribution from cattle kept anywhere other than CAFO pens, such as rangeland or pasture. An estimate of nitrogen available for transport from pasture land is included in Section **2.** IRRIGATED AGRICULTURE.

Manure composting areas were identified and the acreage was calculated as part of this analysis. Differences between composting areas and pens include surface construction, the lack of animal movement compacting surfaces, and the difference in moisture inputs between composting areas and pens. Due to these differences, as well as the diversity of potential compost management practices, NRAS did not feel use of the dairy/nondairy CAFO pen rate was appropriate for compost areas. The diversity of composting practices could include composting in windrows, composting in bags, spreading material out over a large surface to dry, turning frequency, moisture additions to maintain optimal composting conditions, or the use of a concrete pad for composting. With no information available in scientific literature about potential loading from compost areas, NRAS did not attempt a calculation for these areas. With the locations and dimensions of composting areas already identified, nitrogen loss from compost areas could easily be calculated in the future if new information becomes available.

Potential nitrogen loss from buildings housing animals was not assessed. Animals may spend time in freestall barns and milking parlors. These facilities are built with concrete floors and cleaned multiple times a day. Although poorly maintained or old concrete may develop cracks that could provide a pathway for contaminants to reach the soil profile, any potential losses from these types of buildings would be orders of magnitude smaller than potential losses from pens and lagoons. Additionally, material removed from these facilities is sometimes transported to lagoons onsite; making the analysis of what nitrogen originated at which unit operation challenging.

Calculating storage in corral subsurface soil was beyond the scope of this report. An accurate calculation would require historic information about dairy and beef cattle numbers and management practices. However, other research demonstrates that soil beneath corrals may hold large amounts of nitrogen that could be released when these facilities are turned to other uses and demonstrates the importance of appropriate decommissioning procedures (Vaillant et al. 2009, Viers et al. 2012).

Potential emissions of nitrogen compounds to the atmosphere from pens and corrals have not been estimated in this report. It is unknown what proportion of emissions from GWMA CAFOs may redeposit within the GWMA, as emissions may travel large distances before eventual deposition (Viers et al. 2012). The rates used for the pen calculations are based on leaching rates and soil and

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groundwater testing results from other studies. The influence of atmospheric nitrogen deposition would be accounted for in those testing results already; any atmospheric nitrogen deposited on pen surfaces and lost to soil or groundwater would contribute to nitrogen detected when soil and groundwater are tested. As a result, the pen acreage was removed from the atmospheric deposition summary calculation conducted in the atmospheric deposition section (4. ATMOSPHERIC DEPOSITION).

GIS methodology

The results of this study were summarized using geographic information systems (GIS). A spatial database called a file geodatabase contains all the GIS data for the livestock section of this study. This database contains both attributes and spatial locations of this data. It contains five feature classes and one table: YakimaGWMA (polygon, GWMA boundary), WSDACrop_2015 (polygons, crop identification), Lagoons (points), Ponds (points), and CAFO_Pen_Compost (polygons, boundaries of pens and compost areas). This database also contains a table, IrrigatedMassBalance, which contained the mass balance calculations and results.

Pen and compost area boundaries represent the locations of dairy and nondairy CAFO unit operations including corrals, feedlots, holding pens, and manure composting areas. These are displayed as polygons in the geodatabase and attributes include the category (dairy CAFO, nondairy CAFO, or compost), area in acres, and low, medium, and high potential nitrogen loss (if calculated). Polygons were drawn by WSDA staff using published 2014 dairy registration locations as a reference along with 2013 National Agricultural Imagery Program (NAIP) imagery from USDA. Dairy and nondairy CAFO pens were distinguished based on information from WSDA's Animal Services Division, facility size, and proximity to a known dairy location, which was based on records from WSDA's DNMP. DNMP staff were consulted to assure accuracy of both location and type of operation. Any roofed area likely to be a freestall barn or milking parlor was excluded.

Quality assurance was performed from November 2015 through February 2016 on all components of the geodatabase. This was a 3-step process. First, a random sampling of each dataset was performed using Excel's random number function and a field survey was conducted of the selected polygons and points in conjunction with USDA NAIP 2013 imagery to ensure the accuracy and location of the data. For the pen and compost boundaries, it was to ensure the operation was a CAFO or compost facility. The last step was to double-check all polygons and points with USDA NAIP 2015 imagery that became available in early 2016, which resulted in several updates due to changes in facility status. All geospatial data used in this study met WSDA data quality error rate of less than 10% (Beale and Baker 2009).

Metadata is included with the GIS database to further describe the additional aspects of the GIS data. This includes information such as the extent, credits, use limitations, scale, processing environment, author, and spatial reference.

Calculation methodology

The pen nitrogen calculation was based on the low and high loading range used in the UC Davis nitrogen loading study (Viers et al. 2012). The loading rates used in the UC Davis study were chosen based on several other research studies. The low range (75 kg N/ha-yr, or 67 lb N/ac-yr) was

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chosen based on unpublished research conducted by UC Davis study authors in the Tulare Lake Basin that was reported in the UC Davis study (Viers et al. 2012). Meteorological conditions in the GWMA are similar to the Tulare Lake Basin, with 7.55 inches or rain each year, on average, in Tulare, CA, and 6.8 in Sunnyside, WA (mean 1894-2012, WRCC 2012, Viers et al. 2012). The high range used in the UC Davis study (1,000 kg N/ha-yr, or 892 lb N/ac-yr) was based on research conducted in the Tulare Lake Basin and Salinas Valley by the study authors, as well as research in California's San Joaquin Valley (van der Schans et al. 2009) and in Kansas (Vaillant et al. 2009). Meteorological conditions in Kansas are significantly different from conditions in either the Tulare Lake Basin or the Yakima Valley (annual rainfall ranged from 24 to 36 inches at the study sites) (Vaillant et al. 2009). However, due to the lack of a large body of similar research to compare results with, there limited data to choose from. The high rate is likely a significant overestimation of the available nitrogen, due to factors that include lower precipitation and higher evapotranspiration in the Yakima Valley than in the regions where the research this nitrogen loading rate was based on was conducted. The lower precipitation and higher evapotranspiration would result in both lower groundwater recharge and higher losses of nitrogen to the atmosphere, reducing the nitrogen available to move through the pen surface.

The calculation itself consisted of multiplying either the low or the high rate by the acreage of each pen. The medium rate for pens was determined by averaging the results of the low and high rates for each individual pen; it has no physical significance. Individual pen results were added to determine estimated losses for all pens in the region.

$$N\ loading\ rate\ \left(\frac{lb\ N}{acre \cdot year}\right) \times Pen\ acreage\ (acre) = Potential\ N\ loading\ \left(\frac{lb\ N}{year}\right)$$

Results and discussion

The total area of pens and compost areas is summarized in Table 4. Areas were categorized as either dairy CAFO (pens associated with a dairy operation), nondairy CAFO (pens believed to be associated with either a beef cattle feedlot or dairy support, housing calves or heifers), or compost (areas at either dairy or nondairy facilities where composting is taking place). The total acres of dairy CAFO pens are the largest subset of the pens identified, making up 60.7% of the total 2,632 acres identified as pens or composting areas. The areas of nondairy CAFO pens and compost are similar; those facilities make up 18.9 and 20.4% of the total, respectively.

Table 4. Acres of dairy CAFO, nondairy CAFO, and compost in the GWMA, with the percentage each category represents of the total area identified

	Acres	%
Dairy CAFO pens	1,597	60.7
Nondairy CAFO pens	499	18.9
Compost	536	20.4
Total (pens and compost)	2,632	100

Based on the low and high rates discussed in the calculation methodology and the acreage of different facilities in Table 4, the following potential nitrogen losses were determined (Table 5).

Results were rounded to the nearest ton/yr or 1,000 kg/yr, to be consistent with the estimated accuracy of these calculations. Available nitrogen was calculated for the 2,096 acres of dairy CAFO and nondairy CAFO areas only, as discussed in the Limitations section above. No calculation was conducted for compost areas.

Table 5. Potential nitrogen available for transport from dairy and nondairy CAFOs

	lb N/ac-yr	kg N/ha-yr	Ton N/yr	kg N/yr
Low rate (Viers et al. 2012)	67	75	70	64,000
Medium rate (average)	480	538	502	456,000
High rate (Viers et al. 2012)	892	1000	935	848,000

The high rate is an entire order of magnitude above the low rate. With the information currently available, WSDA is not able to narrow this range.

Management practices onsite such as maintaining an intact interface layer to inhibit liquid movement through the pen surface, changes in precipitation and evapotranspiration from season to season, and animal stocking rates will all affect potential loading.

The 2 large feedlots in the Yakima Valley have a combined acreage of 291 acres. Because only dairies are required to share animal numbers with WSDA, the numbers of animals on these feedlots is unknown. The total number of cattle and calves in Yakima County is 258,663 as of the 2012 Census of Agriculture by USDA NASS. Also from the 2012 Census of Agriculture, the total number of dairy cows in Yakima County is 99,532, which would include only milking and dry cows, not other dairy support animals (calves and heifers) (USDA NASS 2012). The difference (159,131 animals) would include beef cattle on feedlots, cattle and calves on range, and dairy support animals (for example, calves and heifers at dedicated facilities). Of these animals, cattle on feedlots and dairy support animals are accounted for in the calculations, while cattle on rangeland or pasture are not. The census information is for the entire county rather than specific to the GWMA region, but it is likely that the majority of these animals are within the GWMA boundary.

In July 2015, NRAS conducted a soil sampling survey in pens and compost areas at 5 dairies within the GWMA. This data is used here to compare conditions observed beneath pens in the GWMA to conditions observed beneath pens in the Tulare Lake Basin and Salinas Valley, where the loading rates used in the UC Davis study were derived. Similar soil testing results would suggest that the loading rates used in the UC Davis study are appropriate for the GWMA.

Producers who participated in this study allowed NRAS staff onto their property, dig large pits to sample at depths up to 6 feet, and sample multiple locations on the property. Project quality assurance documentation (such as standard operating procedures or a quality assurance project plan) was not developed before sampling, and as a result this data is not considered credible under the requirements of Washington's Water Quality Data Act (RCW 90.48.570-90.48.590, Water…2004). This data should not be used for decision making and it was not used to develop the nitrogen loss rates used in this report. WSDA believes that there are 2 main potential sources of bias or error in this data set. The first is the lack of a statistically-based sampling procedure, meaning that the results may not be useful for assessing the subsurface nutrient concentrations at all the dairies in the GWMA, just at the dairies that were sampled. The second is the potential for

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sample cross-contamination due to sample transfer on equipment, meaning that making conclusions based on individual sample results is not recommended. Samples were analyzed at an accredited lab (Northwest Agricultural Consultants, Kennewick, WA). WSDA has used these results (in the aggregate) to gain a better understanding of nitrogen movement and retention in the soil underlying dairy pens and composting areas in the region. These data were compared to subsurface conditions reported in the literature that potential nitrogen loading rates were drawn from. The soil testing results were not used to identify specific rates to use, however, similarities between soil testing results from GWMA dairies and literature results give us more confidence that these rates are appropriate for this study.

Pen samples were collected from 12 locations at depths of 0 (surface) to 6 feet in 1-foot intervals. The table below displays the range in nitrate concentrations found in pens at each 1-foot depth interval (Table 6). Nitrate concentrations from different samples at the same depth were extremely variable. The average concentration decreased throughout the soil profile from 273.3 mg NO_3-N/kg at the surface to 30.4 mg NO_3-N/kg at a depth of 6 feet. The average nitrate concentrations by depth were also plotted in a nitrate profile in Figure 4.

Table 6. Soil sampling results beneath 12 pens in the Yakima Valley

Depth in pen (ft)	0	1	2	3	4	5	6
Minimum (mg/kg NO_3-N)	22.6	21.8	10.6	8.3	6.1	6.5	3.8
Maximum (mg/kg NO_3-N)	962.6	409.7	199.2	186.5	109.6	93.4	124.7
Average (mg/kg NO_3-N)	273.3	165.9	98.5	71.2	45.7	36.7	30.4
Median (mg/kg NO_3-N)	118.6	153.8	89.9	63.6	38	29.6	17.1
Standard dev. (mg/kg NO_3-N)	308.6	115.3	54.5	45.9	31.1	26.4	36.8

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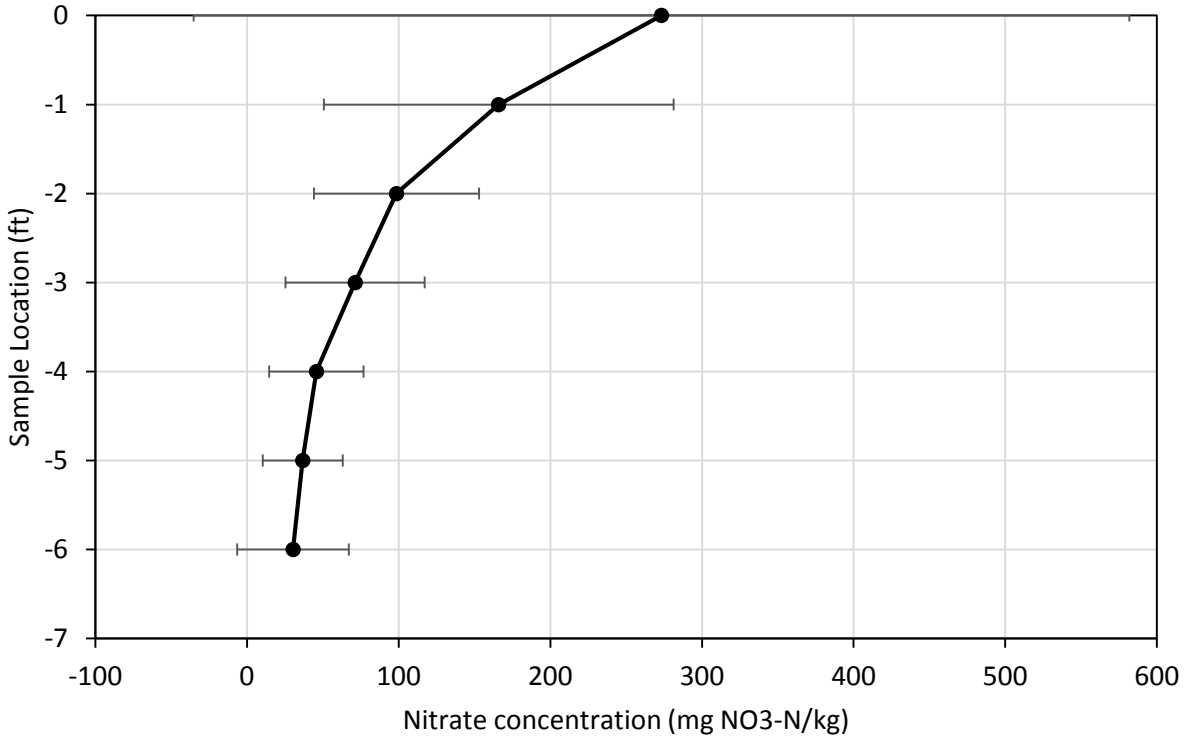

Figure 4. Average nitrate profile beneath 12 pens in the Yakima Valley. Error bars represent one standard deviation from the mean.

Pen soil samples were elevated at the surface and decreased with increasing depth. Soil sampling results are generally compared to a reference number to identify the depth at which numbers return to background levels; no such reference is available in this case. The trends in these results are consistent with those found by Viers et al. (2012) where soil nitrate concentrations were elevated around 200 mg NO_3-N/kg near the surface with a slow decrease to 20-50 mg NO_3-N/kg at depths of 10-15 m. A more detailed comparison is impossible because individual core results, aggregated data, and intermediate depths were not reported in that study. Another study that published soil testing results sampled soil to depths ranging from 1.8 to 4.7 m at 4 beef cattle feedlots in Kansas (Vaillant et al. 2009). A total of 18 soil cores were taken, of which 12 were below their chosen background level (4.1 mg NO_3-N/kg) for the entire core. The remaining 6 cores had elevated nitrate in the top meter of the core ranging from 10.7 mg NO_3-N/kg to 510 mg NO_3-N/kg and a return below the background concentration with increasing depth. Again, the soil testing results from GWMA dairies are similar to these results in magnitude of nitrate concentration, although the nitrate levels at depths greater than 1 m (3.28 feet) were higher in the GWMA soil sampling results than the Kansas feedlot results. Since this study (Vaillant et al. 2009) was the source that the UC Davis researchers (Viers et al. 2012) relied on to identify their high range loading rate of 1,000 kg N/ha-yr, similarity with these results gives us another indicator that this rate is appropriate for use in the GWMA. One large challenge in reviewing literature and comparing results in this field is the diversity of units and species of nitrogen reported in papers. Reporting of nitrogen as nitrate, nitrate-N, organic nitrogen-N, TKN, ammonia/ammonium,

ammonia/ammonium-N, combinations of these, or as total nitrogen is common and makes comparison of literature results difficult and sometimes impossible. Next steps for field research in the GWMA to improve estimates of loading rates from pens should include development and execution of a credible statistical sampling program whose results could be used to develop a GWMA-specific rate with a narrower range.

LAGOONS

Methods, limitations, and assumptions

Limitations

As with the pen identification, every effort has been made in this report to identify facilities and facility uses that are current as of 2015. The distinction between a lagoon, a settling basin, a settling pond, or an irrigation pond can be hard to clarify. Different professionals in this industry use different terms for different manure storage impoundments, and different impoundments may be used for different purposes at different times of year. In addition, producers may mix manure and water in additional impoundments before land application. NRAS has identified lagoon impoundments which are primarily used for storage of manure, as opposed to impoundments which are primarily used for storing irrigation water or which are used for mixing manure and water for land application. These impoundments (primarily used for storing manure) will be referred to as lagoons in this report. This difficulty in classification may result in impoundments being placed in the wrong category, despite NRAS's efforts at accuracy.

Lagoon nitrogen concentrations depend on unit operations onsite and on-farm practices. Variations can include the use of flush versus scrape systems to clean barns, the type and efficiency of solids separation systems used, whether and where irrigation water is mixed with manure for land application, and seasonal effects such as precipitation and evaporation rates. Lagoon nitrogen concentrations used in this report are based on 2 data sources. The first is a relatively large subset of farms in the GWMA (approximately 20) whose operators voluntarily shared lagoon nitrogen testing results with WSDA for this study. The second was EPA's lagoon testing results from 5 dairies sampled in 2010 (EPA 2013a). All testing results from these 2 sources were combined and averaged. The resulting nitrogen concentration is higher than lagoon nitrogen concentrations reported in other studies.

Calculating storage in lagoon subsurface soil was beyond the scope of this report. An accurate calculation would require historic information about dairy and beef cattle numbers, management practices, and lagoon construction practices. However, other research indicates that soil beneath lagoons holds large amounts of nitrogen that could be released and emphasizes the importance of appropriate decommissioning at the end of use (Viers et al. 2012).

GIS methodology and lagoon identification

Lagoon points included in the geodatabase represent locations for both dairy and non-dairy lagoons. Point locations were derived using latitude and longitude locations from the WSDA DNMP database in conjunction with aerial imagery from Google Maps or USDA NAIP 2013 imagery. Identified lagoon points were compared with DNMP lagoon assessment data followed by direct

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consultation with DNMP staff to ensure accuracy. Lagoon area is an attribute and was determined using aerial imagery technology (area = length X width), known dimensions from DNMP (length X width), or using the polygon area (calculated area using GIS) from the DNMP assessment. Depth is also an attribute; depth used was the design depth of the impoundment. Lagoons where the design depth was unknown were assigned an estimated depth, which was the average of all known lagoon depth measurements. Whether depth was the actual design depth or an estimate was documented in an additional Depth Method attribute with values of Actual or Estimate.

The quality assurance procedure conducted for the lagoon points was the same as that for pens and compost areas. Randomly selected points were field surveyed to confirm the identification and accuracy of the lagoon location. Any errors were corrected, and all points were checked against USDA NAIP 2015 imagery.

Lagoon dimensions

WSDA's DNMP has recently completed a lagoon assessment project following NRCS Technical Note 23 (USDA NRCS 2013). The DNMP staff visited every lagoon on a dairy with a milk license, with the exception of the Consent Order dairies, either 2 or 3 times in 2015 in order to assess the lagoon both when it was near full and near empty. During these assessments staff recorded design length, width, storage capacity, and depth. Length, width, and depth of lagoons were determined from existing nutrient management plans and were likely measured at the time of lagoon construction. If DNMP did not have access to the design dimensions, staff used ArcGIS Collector to obtain the perimeter of the lagoon they visited. Length and width measurements at time of construction and Collector application polygons were taken along the border of the embankment and therefore reflect the area of the lagoon at maximum capacity. Surface area was calculated from the polygon or the length and width measurements.

NAIP imagery was utilized to identify additional lagoons that were not included in this assessment process. DNMP staff was consulted to determine if the impoundments identified in the aerial imagery were lagoons, ponds, or neither. Only polygons identified as lagoons were included in this analysis. NRAS staff used NAIP 2015 imagery to measure the length and width of these lagoons. NRAS staff then randomly selected a population of these lagoons for quality assurance checks. Staff visited each of these randomly selected lagoons to confirm identification and location.

Individual lagoon design depths were used when this data was available. The average design depth of the 105 lagoons with known depths was 11.3 ft. This average design depth was used as the depth for lagoons that did not have a measured design depth.

In addition, at each visit DNMP staff estimated the percentage of the lagoon's total capacity in use, and categorized each lagoon as either empty or full. The percentage of lagoon capacity utilized (and as a result, the liquid depth and surface area) varies depending on both season and on-farm management practices. The same farm may have several lagoons that transition from full to empty and back again throughout the year, while another is consistently full; farms may also use lagoons to store irrigation water in addition to manure or use lagoon contents to operate flush systems. During the lagoon assessment process, DNMP staff visited each lagoon either 2 or 3 times in an attempt to view each lagoon both while it was full and while it was empty.

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In an attempt to capture a reasonable average yearly liquid depth and surface area to use, NRAS staff used the information recorded by DNMP staff on repeated lagoon visits during the lagoon assessment process. The total number of lagoons visited in 2015 was 115, of which 102 were visited twice and 13 were visited 3 times. Lagoon utilization (% full) varies dramatically depending on the season, so DNMP generally visited each lagoon during both the summer and the winter to account for seasonal variability. The percentage of total capacity utilized at successive visits to the same lagoon was averaged for each of the 115 unique lagoons visited to generate an average capacity used for each lagoon. This average capacity used for each lagoon was then itself averaged across all lagoons, resulting in an average percent capacity used for 2015 visits of 43%. The depth used in the Darcy's Law calculations is 43% of the actual or estimated design depth.

This percentage depth reduction was also used to adjust the surface area of the lagoons. Surface area of the lagoons was determined based on one of the methodologies discussed above (lagoon assessment or aerial imagery). Because of the side slope of lagoons, a reduction in depth results in a corresponding reduction in surface area. The surface areas used for calculations were adjusted based on NRAS's estimation that a lagoon with a working depth of 43% of its design depth would have a corresponding surface area reduction to 73% of the design surface area. The basis for this estimate is described in Appendix C: Lagoon Surface Area Reduction Methodology.

Lagoon nitrogen concentration

WSDA relied on pre-existing sources of information on lagoon nitrogen concentration for this study. One source of lagoon total nitrogen concentrations was the EPA's sampling in 2010, which was published in their 2013 report (EPA 2013a). This data set consists of 15 lagoon samples from 5 dairy farms (at each farm, 1 sample was taken at the inflow to the farm's lagoon system, and 2 samples were taken at the outflow of the farm's lagoon system). Influent concentrations were slightly higher than outflow concentrations, but a statistical comparison was not conducted (EPA 2013a). The average of the 5 influent concentrations was 1,317 mg N/L and the average of the 10 outflow concentrations was 1,159 mg N/L. The range of sample concentrations was 290- 1,800 mg N/L with a mean of 1,212 mg N/L (EPA 2013a).

Another source of lagoon nitrogen concentration data was lagoon testing conducted by the dairy producers themselves. Dairy producers are required to take yearly samples of lagoon content and have them analyzed by an accredited laboratory. This is regulatory data used by WSDA's DNMP to assess whether or not producers are making nutrient applications at agronomic rates. The South Yakima Conservation District (SYCD) asked dairy producers to voluntarily share lagoon testing results with WSDA for use in this assessment; SYCD collected testing results from producers, anonymized them, and forwarded the information to WSDA. A total of 23 lagoon total nitrogen testing results were provided. The exact number of dairy farms that shared data is not known; conservation district staff have estimated the number at 20 farms. The sample concentrations ranged from 180 – 3,624 mg N/L with a mean of 949 mg N/L. More detailed analysis of these data sources is presented in Appendix B: Lagoon Nitrogen Concentration Statistical Analysis.

The mean of the SYCD data set is lower than the mean of the EPA data set. There are many potential reasons for this difference. Neither data set was collected using a statistically-based sampling procedure. The SYCD data was voluntarily shared with WSDA; producers with high lagoon nitrogen

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concentrations may not have been comfortable sharing their testing results. The EPA study was an effort to identify potential contributors to groundwater contamination; dairies identified for sampling were large, far from other potential nitrate sources, in areas with consistent groundwater flow, and close to drinking water wells with known high nitrate levels. Details of on-farm practices at the dairies in both data sets are unknown. Flush or scrape cleaning systems and the presence and scale of solids separation may affect in-lagoon nitrogen concentrations. At a flush dairy, separated lagoon water is often recirculated to clean barns, while at a scrape dairy, lagoon contents are not generally recirculated. The degree of solids separation depends on the system (and corresponding removal of nitrogen contained in or bound to solids) and will also affect lagoon nitrogen concentration.

NRAS consulted supplemental data provided by DNMP to gain additional information about the types of dairy operations within the GWMA boundary. Of the 52 dairies in the data set, 12 were flush dairies, 39 were not flush dairies, and 1 was out of business. Most (83%) of the dairies have some type of solids separator system on site. A minority of the dairies (25%) rely solely on settling basins for solids separation, while 58% of the dairies have secondary processes including slope screen separators, centrifuges, barrel screen roller presses, screw presses, and gravity flow separation. A small number (15%) of dairies have no solids separation systems.

Total nitrogen concentration data used in other studies varies greatly. The UC Davis report used concentrations of 500 and 1,000 mg N/L for different calculations and estimates (Viers et al. 2012). Dairies in California's San Joaquin Valley have lagoon TKN concentrations between 47 and 2,420 mg N/L (Campbell Mathews et al. 2001). Lagoon nitrogen concentrations from 2 studies in California were reported in a University of California Cooperative Extension publication; they were total N of 164-645 mg N/L and TKN of 670 mg N/L (reported in Pettygrove et al. 2010). Local data was chosen over non-local literature data in an attempt to use the most accurate values. In addition, this provides a more protective estimate since local values were higher than those utilized in the literature. The SYCD testing results were combined with the EPA results, resulting in an average total nitrogen concentration of 1,053 mg N/L (n = 38); this is the value that will be used in the calculations in this section. Calculations in this section can be easily updated if additional data is made available.

Atmospheric deposition and volatilization in lagoons

The lagoon nitrogen concentration used for calculations in this report was derived from analysis of lagoon samples. Atmospheric deposition of nitrogen onto the surface of lagoons would already be accounted for by this testing, it would become part of the nitrogen content of the lagoon. The lagoon testing results did not include any assessment of the age of the material being tested. Without information about when the material was added to the lagoon and how long it was retained, it would be impossible to determine whether the tested nitrogen concentration represented material that had not yet experienced storage losses or had already experienced storage losses. It was assumed that the nitrogen testing results included a range of fresh and aged manure and that the sample would provide enough variety to be representative.

Since this data already accounts for atmospheric deposition to lagoons, the total area of all lagoons was removed from the atmospheric deposition analysis in section 4. ATMOSPHERIC DEPOSITION.

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Lagoon liner permeability and thickness

Current NRCS standards for lagoon liners depend on site characteristics, proximity to wells, depth to groundwater, and soil and aquifer characteristics. Depending on conditions, a site may be considered too vulnerable for lagoon construction or may require the use of a synthetic, compacted clay, or potentially no liner. Rather than specifying hydraulic conductivity or permeability required of liners or underlying soils, current guidelines require that lagoon construction meet required specific discharge rates. These specific discharge rates have been based on historically used permeability of $1x10^{-7}$ cm/s, with an assumed order of magnitude reduction in permeability due to manure sealing, allowing liner permeability to be $1x10^{-6}$ cm/s (USDA NRCS 2009). Lagoon liner permeability options were also discussed with some GWMA workgroups in 2015. The groups agreed that 2 liner permeability scenarios should be considered in lagoon seepage calculations. Based on these discussions and limitations in the data available, liner permeabilities of 1×10^{-7} and 1×10^{-6} cm/s were used to determine a low and high rate seepage estimate, respectively.

Construction dates for lagoons in the GWMA are unknown. Without information on how many lagoons were constructed before the 2004 standard, it is impossible to say how many lagoons may have permeabilities higher than 1×10^{-6}. The current NRCS Engineering Handbook and other documentation outlines historic practices and guidance published by NRCS (USDA NRCS 2009, USDA NRCS 2016a, USDA NRCS 2016b).

- Prior to 1990: manure sealing was assumed to significantly reduce seepage from lagoons.
- Late 1980s: A guidance document (South National Technical Center (SNTC) Technical Guide 716) was released specifying that relying on manure sealing to reduce seepage in a finished lagoon was insufficient and specified some site conditions when clay liners should be used.
- 1993: South National Technical Center (SNTC) Technical Guide 716 was updated and reissued. All waste storage ponds are required to have a 1-foot liner and soil must meet certain characteristics (percent fines).
- 1998: Agricultural Waste Field Management Handbook is issued containing material from SNTC Technical Guide 716.
- December 2004, Practice Standard 313 is updated, still requiring a minimum 1-foot liner thickness and adding a required permeability less than $1x10^{-6}$ cm/s.

Clearly lagoons constructed prior to the current guidance documents are unlikely to meet current NRCS standards. However, no information is available about what seepage might be for lagoons constructed before 1990, or between the 1993 guidance and the 2004 guidance. As a result, it is impossible to estimate what the permeability endpoint would be to estimate a high seepage rate. In addition, lagoon liners can be damaged through inappropriate operation and maintenance activities, which would result in increased leakage rates. The only experimental data on lagoon water loss found was Ham's study of Kansas feedlot and swine lagoons, which identified a seepage rate of 1.1 mm/day. The authors used this rate and experimentally determined depths and liner characteristics of lagoons to calculate a liner permeability of $1.8x10^{-7}$ cm/s (Ham 2002). A top priority for additional research on potential nitrogen loss from lagoons would be to conduct similar water balance lagoon seepage measurements to determine typical rates for GWMA lagoons. This information could be used to narrow the large range of these estimates.

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Although the date of construction is not known, the type of liner was known for most of the lagoons that were part of the DNMP lagoon assessment process. Liner types of the lagoons assessed (n=115) were bentonite amendment (45, or 39%), compacted clay (58, or 50%), flexible membrane (10, or 9%), and unknown (2 or 2%). Current NRCS standards for minimum liner thickness are based on the normal full pool storage depth. The average design depth of lagoons visited by DNMP was calculated to be 11.3 feet. For lagoons with depths of 16 feet or less, the minimum liner thickness required is 1 foot (USDA NRCS 2016a). The average liner thickness of several lagoons studied in Kansas was approximately 1 foot (Ham, 2002). No local data was used to support the 1 foot liner thickness used in the seepage calculations. Based on the current NRCS standard, WSDA has chosen to use the minimum liner thickness required for lagoon seepage calculations.

Calculation methodology

Potential seepage from dairy lagoons was calculated using Darcy's Law. This approach relies both on assumptions derived from the literature (liner permeability and thickness) as well as local information (GWMA lagoon surface areas, depths, and nitrogen concentrations). The result of these calculations is the amount of nitrogen expected to pass through the liner, which is then available to move through the soil profile under some conditions. Transport and fate of nitrogen through the soil profile after exiting the lagoon liner is not within the scope of this study.

For the following calculations, all significant figures were kept until the final nitrogen loss estimate was determined. At this point, calculations were rounded to the nearest 1 ton/year or nearest 1,000 kg/year.

First, the volume of fluid leaving the lagoon was estimated using Darcy's Law, then multiplied by the total N concentration to determine the nitrogen loss from lagoons within the GWMA.

$$Q = k * \frac{(H + d)}{d} * A$$

Where

Q = the calculated volumetric flow rate (L^3/T)

k = coefficient of permeability (hydraulic conductivity, $1x10^{-7}$ or $1x10^{-6}$ cm/s) ($L^3/L^2/T$)

d = thickness of soil liner (estimated at 1 foot) (L)

H = vertical distance between top of liner and top of liquid storage (L)

A = lagoon area (L^2)

L = length

T = time

$$N\ Loading = Q * C$$

C = Total N concentration, 1053 mg N/L

Results and discussion

Potential loading was calculated for each individual lagoon within the GWMA boundary. Actual measurements for lagoon depth and surface area were used when available. Estimates for these

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parameters were used when actual measurements did not exist as discussed above. An example calculation can be found in Appendix D: Darcy's Law Example Calculation.

Darcy's law calculations were run using the two different permeabilities discussed above ($1x\ 10^{-7}$ and $1x10^{-6}$ cm/s) to determine a low and high range estimate. Since this is the only parameter that differed between the two calculation scenarios, the estimated loss for high and low differs by a factor of 10. The medium rate was calculated by averaging the low and high rates. Table 7 displays the results from these calculations. The rate per area was determined by dividing the total loss by the total design surface area of lagoons in the GWMA.

Table 7. Estimated high and low loss rates based on Darcy's law

	Low	Medium	High
N Loss (kg N/year)	129,000	709,000	1,289,000
N Loss (ton N/year)	142	781	1,421
N Loss (kg N/ha-year)	1,518	8,348	15,178
N Loss (lb N/ac-year)	1,354	7,448	13,542

These estimates are much higher than those calculated in the UC Davis study (Viers et al. 2012). The totals are not comparable because of the much larger geographic area studied by the UC Davis authors, but the results can be compared on a per-acre basis. In the UC Davis study, the authors identified several different potential loading rates, including several upper limits via different methods and an expected range for loading under typical circumstances. The UC Davis report determined an upper and an alternative upper value for nitrogen loading of 5,100 tons N/year and 1,100 tons N/year, respectively. Using the total area of lagoons identified in the UC Davis study (3,126 acres) to calculate the loading rates on a per-acre basis give upper limits of 0.35 – 1.63 tons N/ac-yr, or 700 – 3,260 lb N/ac-yr. These upper limits were chosen based on liquid loss rates and lagoon nitrogen concentrations from research reviewed here: Ham 2002, van der Schans et al. 2009, Campbell Mathews et al. 2001, and Pettygrove et al. 2010. This research was conducted in Kansas and California. In addition to these upper limits, the authors of the UC Davis study also chose an estimated loading range based on unpublished data from the Tulare Lake Basin and Salinas Valley of 220 – 2,200 tons N/year. Making the same adjustment for lagoon area of 3,126 acres in the UC Davis study, this results in a loading rate range of 0.07 – 0.70 tons N/ac-yr, or 141 – 1,407 lb N/ac-yr (Viers et al. 2012).

The expected loading range for the UC Davis study is much lower than the range expected in GWMA lagoons from the Darcy's law calculation. The high end of the UC Davis expected loading range is similar to the low end of the GWMA expected range. Even the upper limits of the UC Davis expected loading are extremely low compared to the range identified for GWMA lagoons. One contributing factor is the difference in lagoon nitrogen concentrations between the UC Davis study and this calculation. The UC Davis study estimates were largely based on lagoon nitrogen concentrations of 500 mg N/L, although a lagoon nitrogen concentration of 1,000 mg N/L was discussed in that study also. In contrast, the Darcy's law calculations use a much higher lagoon nitrogen concentration of 1,053 mg N/L, which results in a large increase in estimated losses. In addition, the UC Davis estimates are based on experimentally determined rates, while the Darcy's law calculations are based on a theoretical model that, while it includes real world data on lagoon characteristics, is not calibrated with experimental data on lagoon seepage.

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SETTLING PONDS

Some challenges of identifying settling ponds have been discussed above, in the lagoon limitations. Distinctions between impoundment functions may be difficult to identify and impoundment functions themselves can fluctuate. Different industry experts classify impoundments based on different criteria and experience. In addition, there are a wide variety of different construction techniques and operational techniques for settling ponds and basins. Some are earthen ponds that are drained and cleaned as needed. Some are concrete lined, engineered basins, which would make using permeabilities for a clay lined impoundment inappropriate. The lack of information about the diversity of settling basins and their construction techniques makes it impossible to make reasonable assumptions for calculation. The work involved in correctly identifying and characterizing settling ponds or basins well enough for an accurate calculation makes addressing settling ponds beyond the scope of this report.

Conclusions and recommendations

This work is intended to be used as a planning and management tool for the GWMA when determining where to use limited resources. Although the best available information has been used to assess nitrogen available for transport, many of these calculations are partially based on literature values and assumptions due to a lack of local data. Current and new work by state agencies may provide additional information about lagoon conditions that could be used to adjust the permeabilities chosen for the Darcy's law calculation: WSDA DNMP's assessment of Yakima County lagoons through the Natural Resources Conservation Service's Technical Note 23 (USDA NRCS 2013) and the CAFO permit recently issued by the Washington State Department of Ecology, which requires producers to assess lagoons by the process in Technical Note 23. However, translating these condition ratings into a functional permeability that could be used in Darcy's law may be challenging.

The single most useful piece of information that could be used to improve this estimate would be measured lagoon seepage rates in the GWMA, which could be used to refine and narrow the range of the lagoon estimate. In addition, both lagoon and corral estimates could be improved through additional statistical sampling of total nitrogen concentrations in lagoons and statistical sampling of soil nitrogen concentrations below pens.

In order to make sure nitrogen losses from corrals and lagoons are as low as possible, producers should be consistent with maintenance and inspection of facilities. Maintenance activities include:

- Check to make sure piping and pumps are free from leaks and operating well.
- Check and maintain lagoon interior to make sure no erosion is occurring at inlet and transfer pipes.
- Check lagoon interior for erosion due to waves caused by wind; repair as needed.
- Maintain an intact manure seal inside lagoons
- Keep vegetation low on the embankments so that burrows and cracks can be detected and repaired.

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- Maintain proper freeboard in lagoons to prevent overtopping.
- Protect the manure-soil interface layer in pens; its presence is protective of groundwater.
- Manage pen moisture levels carefully - if the surface dries out completely cracks can form, serving as a channel for contaminants to get through the interface layer, but if liquid is allowed to pool that can also result in liquid movement through the interface layer.

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2. IRRIGATED AGRICULTURE

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Background

Estimated nitrogen available for transport from irrigated agricultural production (including all nitrogen sources used) is discussed in this section. Use of both manure and commercial fertilizer on cropland associated with dairies is discussed here instead of the CAFO section of the report. In order to determine whether irrigated agriculture in the region is adding nitrogen or removing nitrogen, a mass balance technique was used, in which all inputs and outputs of nitrogen were accounted for. The largest and most complicated inputs in this mass balance are crop fertilizer applications. Crop fertilizer applications are influenced by crop type, crop nitrogen needs, application recommendations, and expected yields. Other inputs and outputs (potential nitrogen fixing, nitrogen removal through crop harvest, irrigation water use, and plant residual removal or incorporation) are also crop dependent. Because of the large number of different crops grown in the GWMA (50 different crop types), WSDA NRAS staff identified the top 15 crops by acreage (based on 2014 WSDA crop data) within the GWMA boundary (WSDA 2015). NRAS staff then interviewed commodity-specific experts to obtain a typical range of use rates for manure, compost, and commercial fertilizer for each of these top 15 commodities. These top 15 commodities represent 96% of the irrigated agricultural land within the GWMA, and irrigated agriculture makes up 57% (approximately 99,000 acres) of the total land area within the GWMA boundary (WSDA 2016). A significant proportion of this acreage (31,790 acres or 32%) is dedicated to crops and land uses (corn, triticale, pasture, and alfalfa) that support livestock operations. The other main crops in the region are tree fruit, grapes (both juice and wine), hops, wheat, mint, and asparagus. Table 8 shows the crops evaluated in this section and their respective acreage within the GWMA (WSDA 2016).

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Table 8. Top 15 crops and their acreage in the GWMA

Crop	Acreage
Apple	17,333
Corn (silage)	16,778
Triticale	10,780
Grape (juice)	10,257
Alfalfa	7,989
Pasture	6,731
Cherry	6,336
Hops	5,961
Grape (wine)	5,126
Pear	3,331
Mint	1,418
Wheat	1,283
Corn (grain)	1,166
Asparagus	854
Peach/Nectarine	843

Methods, limitations, and assumptions

Limitations

This assessment is not intended to evaluate the practices of individual farming operations within the GWMA. Growers are not required to share fertilizer or soil amendment application information with outside entities (like WSDA) unless required through statutory requirement (for dairy operations) or legal discovery. The objective was to determine ranges bracketing commonly used application rates for manure, compost, and commercial fertilizer for the top 15 crops (by acreage) grown within the GWMA boundary. The data collected is categorized by commodity; this allows as much anonymity as possible to agronomists and growers who provided nutrient application information.

This report does not explicitly associate information on irrigation methods with the crop types and mass balance. Irrigation practices can affect the likelihood of nitrogen leaching through the soil profile. In addition, removed from the field relocated through irrigation return flows would represent another output in the mass balance, reducing total nitrogen available for transport to groundwater. In managed irrigation systems, water can be used as many as 4 or 5 times before being discharged from the system. Nitrogen concentration of this water will be increased by repeated use; accurately estimating this was beyond the scope of this study. In addition, it is possible for nitrogen-containing water to leak from unlined irrigation canals; an assessment of this potential was also beyond the scope of this study. Timing of fertilizer applications, plant uptake, irrigation applications, and crop residue incorporation was not part of this study. Timing of these events as well as timing of weather events such as rainfall, snowfall, and freezing temperatures can

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all affect whether or not nitrogen in the soil will be taken up by plants, be likely to move with runoff, or be available to leach through the soil profile.

This study does not include information on the use or benefits of nitrogen-fixing cover crops used within the GWMA boundaries. Although cover crops benefit soil health, reduce erosion, and can provide nutrients for future crops, the behavior and cultivation of different cover crops and/or winter crops used in double cropping systems was beyond the scope of this study.

Results from this study were not compared to the Yakima county deep soil sampling results: that was beyond the scope of this study. Grower responses about application practices and soil organic matter content were the only deep soil sampling results used in this study. An analysis of the deep soil sampling results for comparison to the mass balance would provide a valuable opportunity to calibrate and adjust the mass balance results.

This study does not distinguish between nitrogen availability as a result of nitrogen source applied. Commercial fertilizers are formulated to release a specific amount of nutrients at a specific rate over a certain period of time. In contrast, a large amount of the nitrogen present in an application of manure or compost fertilizers is organic nitrogen, which is not immediately available for plant growth. This organic nitrogen will mineralize over time, making more nitrogen available for plant growth for several years after the initial application. The actual nitrogen available in the first and subsequent years depends on the nitrogen source, weather and temperature conditions, and the breakdown rate of the organic matter containing the nitrogen. WSDA did not attempt to account for these nuances of nitrogen availability from different sources; all nitrogen contained in any fertilizer application is assumed to be immediately available in the first year after application, regardless of source.

Data Collection

Irrigated agriculture is mapped statewide by WSDA and includes the area within the Yakima GWMA boundary. This statewide data was clipped to the Yakima GWMA boundary to contain only those crops grown within the GWMA. The data was updated with WSDA's 2015 crop mapping to reflect current agricultural activates within this area. WSDA did some additional mapping work for field corn to distinguish between grain and silage corn acreage for this project. The crop data is captured in the GIS database as polygons with attributes that include locations, crop type, irrigation method, acres, and if it was documented as organic according to WSDA organic program GIS data.

Fertilizer application data was collected via telephone survey. In order to increase participation, participants' identities were not recorded; the goal was to gather enough data to develop a typical use range that would be used to estimate total usage for each commodity, not tie any application rates to specific farming operations. As mentioned above, data was collected for the top 15 crops (representing 96% of the total irrigated acreage in the GWMA) for applications of commercial fertilizer, compost, and manure.

In order to develop a representative estimate for each crop, WSDA's goal was to survey enough producers and crop consultants to get nutrient application data covering a minimum of 30% of the acreage for each target commodity. There are thousands of individual farms operating within the GWMA boundaries, making farmer-specific data collection very difficult. Crop consultants or

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agronomists are used by the majority of commercial farms operating in the valley. There are only a few companies that do this type of work, limiting the number of interviews required to access information. While these consultants are not usually farmers, they create prescriptions for fertilizer applications across multiple crops on many different farms.

The data collection goal was met for all commodities, with the exception of pasture, for which information on only 11% of the GWMA acreage could be collected. In total, WSDA included information about more than 58,000 acres of the 15 targeted commodities, or 61% of the acreage dedicated to those commodities in the GWMA (Table 9). All respondents were asked to provide a range of typical use for the three main inputs (commercial fertilizer, manure, and compost) to create a low and high use estimate, as well as questioned about average use rates (to design a weighted average to include in the final dataset).

Table 9. Acreage in each commodity, with data collection targets and collection results

Commodity	Total acreage of commodity in GWMA	30% goal (acres to collect)	Acreage collected	Percent of total acreage collected
Apple	17,333	5,200	14,165	82%
Corn (silage)	16,778	5,033	11,480	68%
Triticale	10,780	3,234	7,500	70%
Grape (juice)	10,257	3,077	3,849	38%
Alfalfa	7,989	2,397	6,194	78%
Pasture	6,731	2,019	725	11%
Cherry	6,336	1,901	3,826	60%
Hops	5,961	1,788	3,760	63%
Grape (wine)	5,126	1,538	2,500	49%
Pear	3,331	999	1,741	52%
Mint	1,418	425	780	55%
Wheat	1,283	385	490	38%
Corn (grain)	1,166	350	348	30%
Asparagus	854	256	506	59%
Peach/Nectarine	843	253	630	75%

Data about grower's fertilizer use practices was also drawn from the surveys conducted through the deep soil sampling process. A thorough statistical analysis comparing the deep soil sampling results to the WSDA interview data could be used to confirm the accuracy of the survey responses. Unfortunately, out of the commodities surveyed, juice grapes and hops are the only commodities that had multiple responses from both data sources. For the rest of the crops surveyed for this study, the respondents came largely from either the deep soil sampling results or the WSDA NRAS survey, without enough responses from both sources to allow a comparison.

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Mass Balance

In a mass balance (in this case, focused on nitrogen) all material moving into or out of a system is accounted for. In this case, the system is defined as a 1-acre crop field. Inputs, or additions of nitrogen to the field, are categorized as positive (+). Outputs, or removals of nitrogen from the field, are categorized as negative (-). In addition, processes that transform nitrogen may be significant, and may result in either an increase (+) of available nitrogen in the field or a decrease (-). All known inputs, outputs, and transformations are summed, and the sign and magnitude of the resulting sum can be used to determine whether there is a net accumulation or a net loss of material in the field, or whether there are unknown material flows or transformations.

$$N\ accumulation\ or\ loss\ = Inputs \pm Transformations - Outputs$$

In this case, the list of inputs and transformations includes:

- commercial nitrogen applications (lb N/ac-yr) (evaluated at low, weighted average, and high values);
- manure nitrogen applications (lb N/ac-yr) (evaluated at low, weighted average, and high values);
- compost nitrogen applications (lb N/ac-yr) (evaluated at low, weighted average, and high values);
- atmospheric nitrogen deposition (lb N/ac-yr) (evaluated at low, medium, and high values);
- irrigation water nitrogen (lb N/ac-yr);
- calculated residual nitrogen incorporated (lb N/ac-yr) (evaluated at low, average, and high for some crops and one value for others);
- soil organic matter conversion to nitrate (lb N/ac-yr) (evaluated at low, average, and high values).

The outputs (or nitrogen losses) are:

- crop nitrogen uptake, removed through harvest (lb N/ac-yr) (evaluated at low, average, and high for some crops and one value for others); and
- nitrogen loss to atmosphere (lb N/ac-yr).

Determination of Inputs, Outputs, and Transformations

Commercial, manure, and compost nitrogen applications: Growers and agronomists reported use of commercial fertilizer, manure, or compost, as well as application rates and acreages. In order to account for the use of multiple nitrogen sources, within each commodity the proportion of acres each source was used on was a weighting factor in the final calculation. This weighting factor appears as a multiplier for each nitrogen source and was calculated separately for each commodity and nitrogen source. It was generated by calculating what proportion of acres that nitrogen source was used on out of the total acres of that commodity surveyed. For example, in apple production commercial nitrogen application was reported on 86.3% of the total surveyed acres, so 0.863 is used as a multiplier whenever inputs to apple production from commercial nitrogen applications are calculated. This weighting allows the survey data to be scaled from the hundreds of acres for

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which applications were reported to the theoretical 1-acre field the mass balance is calculated for and make standardized comparisons between crops and other nitrogen sources.

The low, medium, and high application rates were drawn directly from the survey results. The low and high rates used were the lowest and highest reported application rates for each nutrient source and commodity. The medium application rate was a weighted average of all single application rates reported where each reported rate was weighted by the acreage that survey respondent controlled before averaging.

Synthetic fertilizers are formulated to release nutrients at a specific rate over a certain period of time. The nitrogen in compost or manure is released over a longer period of time at a lower rate, and these products are often applied to improve soil health in addition to providing fertilization. In soils with a history of regular manure applications, the breakdown of organic matter from applications in previous years combines with the available nitrogen from the current year's application to make the full applied amount of nitrogen available during that growing season. For this calculation, WSDA assumes that growers using manure or compost have been applying manure or compost regularly and the nitrogen content from those materials is considered to be immediately available because of the nitrogen contributions from historic applications.

Atmospheric nitrogen deposition: This input is the same for every crop assessed. The low rate for atmospheric deposition for the lower Yakima Valley was taken from the most recently reported (2012) wet and dry atmospheric deposition at the Mt. Rainier National Atmospheric Deposition Program (NADP) station; 1.53 lb/ac (EPA 2016). The medium deposition rate is the result of a 5-day modeled average from December 2015; 2.05 lb/ac. To estimate a high rate, the medium atmospheric deposition was multiplied by a safety factor of 3 to account for potential higher deposition during weather conditions resulting in decreased circulation and poor air quality[2]. More details on the methodology and assumptions for atmospheric deposition can be found in Section 4. ATMOSPHERIC DEPOSITION.

Irrigation water nitrogen: The nitrogen input from irrigation water is also unique to each commodity. It is based on the nitrogen content of the lower Yakima River and the irrigation water duty for each commodity. Yakima River nitrogen concentration was taken at the U.S. Geological Survey station on the Yakima River at Kiona during the 2012 irrigation season (April through September) (USGS 2012). This time period was chosen to represent the typical time frame during which irrigation water would be withdrawn for use, including both high flow conditions during the late spring (when nitrogen concentration would be low) and low flow conditions during the late summer (when nitrogen concentration would be high). Summary information about this data set was calculated, and the mean (0.809 mg N/L) of the 10 samples was used in the mass balance (Table 10).

[2] Medium and high deposition values were recommended by Dr. Ranil Dhammapala, an atmospheric scientist with Washington State Department of Ecology's Air Quality Program, during a meeting on November 3, 2016.

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Table 10. Summary statistics for Yakima River nitrogen concentrations (n=10) (USGS 2012)

Minimum (mg N/L)	0.42
Maximum (mg N/L)	1.26
Mean (mg N/L)	0.809
Standard deviation (mg N/L)	0.366
Median (mg N/L)	0.675

Although the sampling location is located in the mainstem of the Yakima River and downstream of the irrigation districts serving the GWMA agricultural lands, WSDA believes that it serves as a good surrogate for potential irrigation water nitrogen levels in the area. The majority of the irrigation water in the lower Yakima Valley is surface water. Very little groundwater is used for irrigation with the exception of a drought year when use of emergency drought wells is permitted. A detailed analysis of sources of irrigation water was not within the scope of this project.

The second part of this input includes commodity specific irrigation water duty for the 15 commodities included in the mass balance. It also takes into account total precipitation and effective precipitation. The data was provided by the Jim Davenport and the Irrigated Agriculture Working Group (IAWG) of the GWMA. The water duty (in inches) values for apples and cherries were reflective of current use patterns, and were edited by Stu Turner, agronomist and member of the IAWG (Appendix F: Irrigation Water Use).

Calculated residual nitrogen: Calculated residual nitrogen is the nitrogen taken up during the growing season that is left in the plant after harvest. This term is based on plant nitrogen uptake during the growing season (which appears in the mass balance as an output) and the amount of nitrogen removed when the crop is harvested. As a result, it is different for each commodity. The components of the residual nitrogen calculation were estimated by the Jim Trull and Scott Stevens, as well as the IAWG and Sunnyside Valley Irrigation District and were based on regularly used resources. Depending on the crop type, the residual nitrogen taken up during the growing season but remaining after harvest may be left in the field and incorporated (as in the case of annual crops) or that residual nitrogen may be retained in the plant, in the new growth of vegetation during the season (as in the case of perennial crops). For perennial crops, some of this new growth will be removed during pruning and through seasonal leaf loss and will eventually still return to the soil, and some may be retained on the plant and not return to the soil. For this analysis, it was assumed that calculated residual nitrogen should be wholly counted as an input to the system for all crop types, despite the fact that some crops may differ in that regard; this is an input that can be varied as more information becomes available. Estimates of nitrogen removed during harvest and the inputs used are presented in Appendix G: Nitrogen Uptake Estimates. This appendix includes data on typical crop yields, nitrogen removed through harvest, nitrogen uptake by the plant during its growing cycle, and estimates of nitrogen applied.

Soil organic matter conversion to nitrate: This term represents the breakdown of organic matter (containing nitrogen) to nitrate-nitrogen available for both crop uptake and leaching below the crop root zone. This input was the same for every commodity analyzed. The native organic matter content of most lower Yakima Valley soils is around 1% but when these soils have a history of

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organic inputs such as manure, it can increase by 2 to 3 times[3]. This was confirmed by a review of the deep soil sampling results. WSDA reviewed results from the fall and spring sampling of 2015 (Table 11) and decided to use the average organic matter content of 2.17% to represent these soils.

Table 11. Summary statistics of organic matter percentage of sampling in the 2015 Yakima Valley deep soil sampling study (n = 108)

Minimum (%)	0.84
Maximum (%)	4.24
Mean (%)	2.17
Standard deviation	0.69
Median (%)	2.15

In general, organic matter in soils can mineralize to provide between 20 and 65 lbs N/ac per 1% organic matter for crop utilization. However, it is not well understood whether the available N is closer to 20 lbs N/ac or 65 lbs N/ac per % organic matter. Previously, practice has been to allow for a minimum of 20 lbs N/ac per % organic matter; however, based on recent soil testing data in the Yakima Valley it appears that the contribution from organic matter should be increased from 20 lbs N/ac to 35-50 lbs N/ac per 1% organic matter when the fields have a history of manure applications[3]. In this mass balance, WSDA used 2.17% organic matter (based on the deep soil sampling results) and conversion rates of 20, 42.5, and 65 lb N/ac for each 1% organic matter. One source for this soil organic matter content can be manure, and the average 2.17% organic matter content of the soil tested during the deep soil sampling may be due to a history of manure applications on those fields. However, there are a number of agricultural practices that producers use to increase the organic matter content of their soil. Direct seed and no-till practices both leave the soil undisturbed, preventing the rapid decomposition of organic matter that takes place when the upper layers of the soil profile are exposed to the atmosphere. Cover cropping can also be used to increase soil organic matter content.

Crop nitrogen uptake: This is the amount of nitrogen taken up by the plant from the soil during the growing season. The crop nitrogen uptake is also part of the calculation for residual nitrogen above. This output is unique for each commodity, and was estimated by the IAWG. This output represents the amount of nitrogen taken up by the crop during the growing season; the estimates, ranges, and sources are detailed in Appendix G: Nitrogen Uptake Estimates.

Loss to atmosphere: The numbers used in this output of the mass balance equation were taken directly from Table 36, pages 117-118 of the 2006 NRCS publication "Model Simulation of Soil Loss, Nutrient Loss, and Change in Organic Carbon Associated with Crop Production" (Potter et al. 2006).

The full equation, with all inputs and outputs, is:

[3] Personal communication, based on experience and best professional judgment of Virginia Prest, WSDA Dairy Nutrient Management Program manager and agronomist,

$$Est.N\ Loading\ per\ year = \Big(\big((Comm\ N \times proportion) + (Compost\ N \times proportion) + (Manure\ N \times proportion) + (Atmos\ N\ Dep + Irrigation\ Water\ N + Calculated\ Residual\ N + N\ Soil\ Conversion)\big) - \big((Crop\ Uptake\ N + N\ Loss\ to\ Atmosphere)\big)\Big) \times (Total\ Commodity\ Acres)$$

This calculation was used for each individual commodity of the top 15 identified.

GIS Compilation

The GIS data for the irrigated agriculture section of this study is stored in a file geodatabase that contains both attributes and spatial locations of this data. It contains five feature classes and one table: YakimaGWMA (polygon, GWMA boundary), WSDACrop_2015 (polygons, crop identification), Lagoons (points), Ponds (points), and CAFO_Pen_Compost (polygons, boundaries of pens and compost areas). This database also contains a table, IrrigatedMassBalance, which contained the mass balance calculations and results.

Metadata is included with the GIS database to further describe the additional aspects of the GIS data. This includes information such as the extent, credits, use limitations, scale, processing environment, author, and spatial reference.

Results and discussion

During the data collection phase of the irrigated agriculture component of this report, interviewees were asked what percentage of their acreage were fertilized with commercial fertilizer, manure, or compost. Table 12 shows the results from this portion of the survey; the most commonly used product is commercial fertilizer. The only exceptions are silage corn and triticale where more acres are fertilized with manure than with commercial fertilizer. In this table, crop acres fertilized with multiple products appear more than once. As a result, for some crops the percentages sum to more than 100%. For example, all acres grown (100%) of wine grapes were fertilized with commercial fertilizer. In addition, 20% of the acres of wine grapes were fertilized with compost. As a result the total acres fertilized for wine grapes adds up to 120%: 20% of the acres were fertilized with 2 different products. The only crops where growers or crop consultants reported use of all 3 fertilizer products were hops and triticale. The percentage of acres on which multiple sources were used is calculated in the last column.

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Table 12. Summary of fertilizer types used for the top 15 crops by acreage in the GWMA

Crop	Commercial fertilizer (% acres)	Manure (% acres)	Compost (% acres)	Acres using multiple sources (%)
Apple	86.3	0	13.7	0
Corn (silage)	49.6	53.9	0	3.5
Triticale	27.2	74.8	0.8	2.8
Grapes (juice)	91.0	0	11.6	2.6
Alfalfa	91.8	8.2	0	0
Pasture	97.2	2.8	0	0
Cherry	80.5	0	19.5	0
Hops	97.3	2.7	16.0	16
Grapes (wine)	100.0	0	20.0	20
Pear	76.6	0	23.4	0
Mint	100.0	0	0	0
Wheat	93.9	22.4	0	16.3
Corn (grain)	71.3	62.6	0	33.9
Asparagus	100.0	0	0	0
Peach/Nectarine	81.0	0	19.0	0

Application rates reported by growers are presented in Table 13. The range of application rates is first, followed by the weighted average (used for the medium rate applications) in parentheses. For several crops (apples, alfalfa, and pears), some growers reported using no commercial fertilizer during some years. For almost all crops, the range spans an order of magnitude between low and high. This indicates the diversity of practices used by different growers. It also suggests that some growers are customizing application rates to crop needs each year, based on soil testing results.

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Table 13. Ranges of application rates (with weighted average in parentheses) reported for commercial fertilizer, manure, and compost

Crop	Commercial fertilizer (lb N/ac)		Manure (lb N/ac)		Compost (lb N/ac)	
Apple	0-150	(60)	0	(0)	15-100 (47)	(47)
Corn (silage)	40-434	(214)	20-324	(203)	0	(0)
Triticale	60-225	(107)	20-350	(104)	170	(170)*
Grapes (juice)	50-100	(80)	0	(0)	21.5-90	(64)
Alfalfa	0-210	(74)	10-300	(161)	0	(0)
Pasture	50-200	(120)	17	(17)*	0	(0)
Cherry	20-125	(56)	0	(0)	15-72	(52)
Hops	25-225	(192)	132	(132)*	30	(30)*
Grapes (wine)	15-40	(25)	0	(0)	36.6-54.9	(46)
Pear	0-100	(57)	0	(0)	15-80	(58)
Mint	80-300	(269)	0	(0)	0	(0)
Wheat	60-120	(106)	90-240	(131)	0	(0)
Corn (grain)	100-300	(214)	50-220	(135)	0	(0)
Asparagus	40-100	(99)	0	(0)	0	(0)
Peach/Nectarine	30-80	(51)	0	(0)	15-30	(28)

*When no range was reported only a single value is presented in this table.

To better understand the role different nutrient sources play in the amount of nitrogen available for transport, the mass balance inputs were examined (Figure 5). All inputs other than nutrient applications were categorized together ("Other"). The "other" category includes atmospheric deposition, irrigation water concentration, calculated residual nitrogen, and soil organic matter conversion; these inputs are not directly influenced by fertilizer applications. The magnitude of this category is largely determined by calculated residual nitrogen and soil organic matter conversion. Calculated residual nitrogen is unique to the individual crop type, while soil organic matter conversion is related to soil properties and the same calculation was used for all crops. For most crops, fertilizer applications consist mostly of synthetic fertilizer. Some exceptions are corn (silage and grain) and triticale, some of which consistently receive manure applications and are often grown to support dairy operations.

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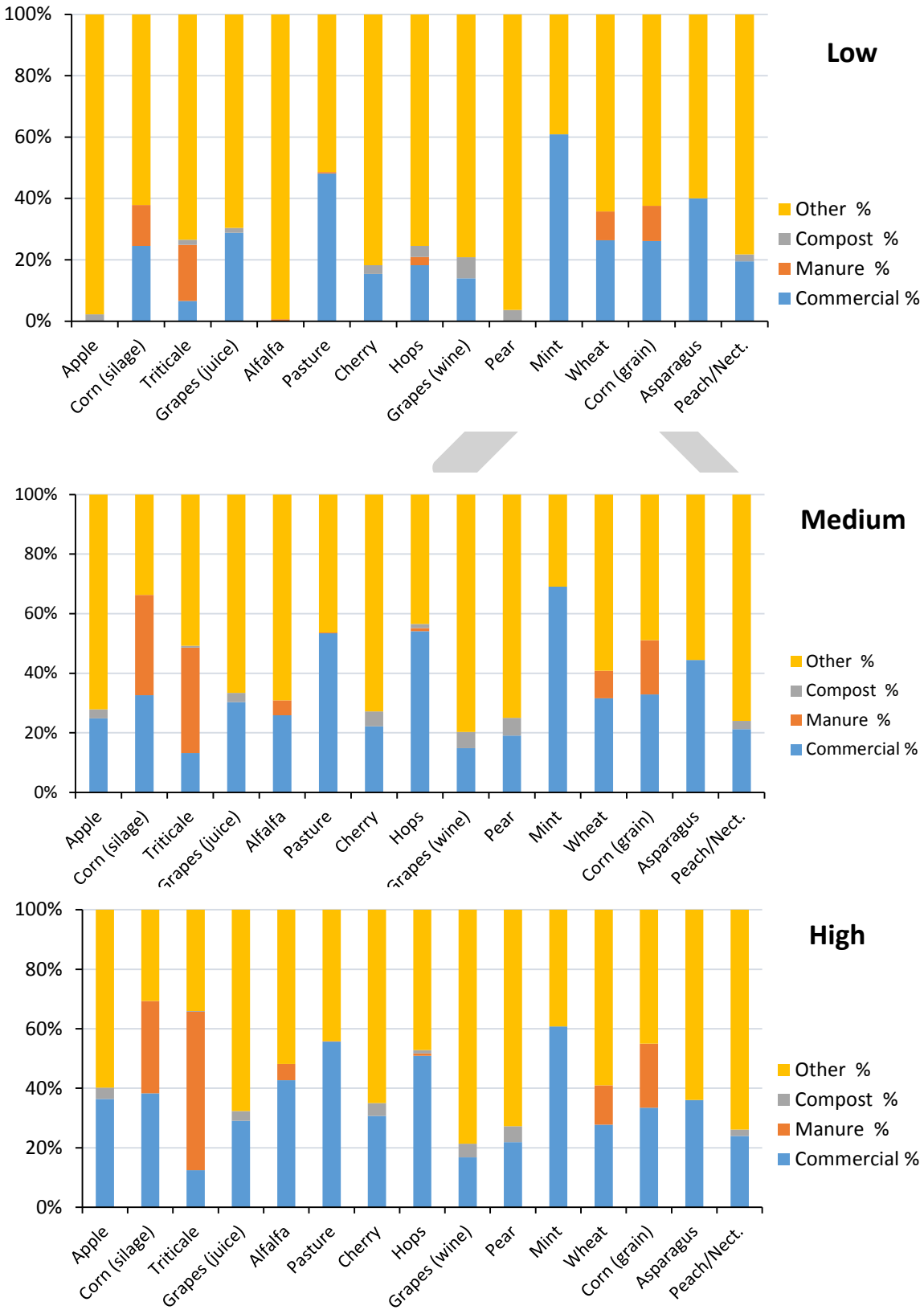

Figure 5. Inputs in the irrigated agriculture mass balance

Data on irrigation practices was collected through WSDA's agricultural land use mapping (Figure 6). For this report irrigation types were divided into 4 main categories based on whether the irrigation type is likely to result in water loss through the soil and contribute to available nitrogen: sprinkler, micro, macro, and miscellaneous. This information is summarized for both all the irrigated acreage in the GWMA and for the top 3 crops in terms of nitrogen surplus per acre (identified in Table 14).

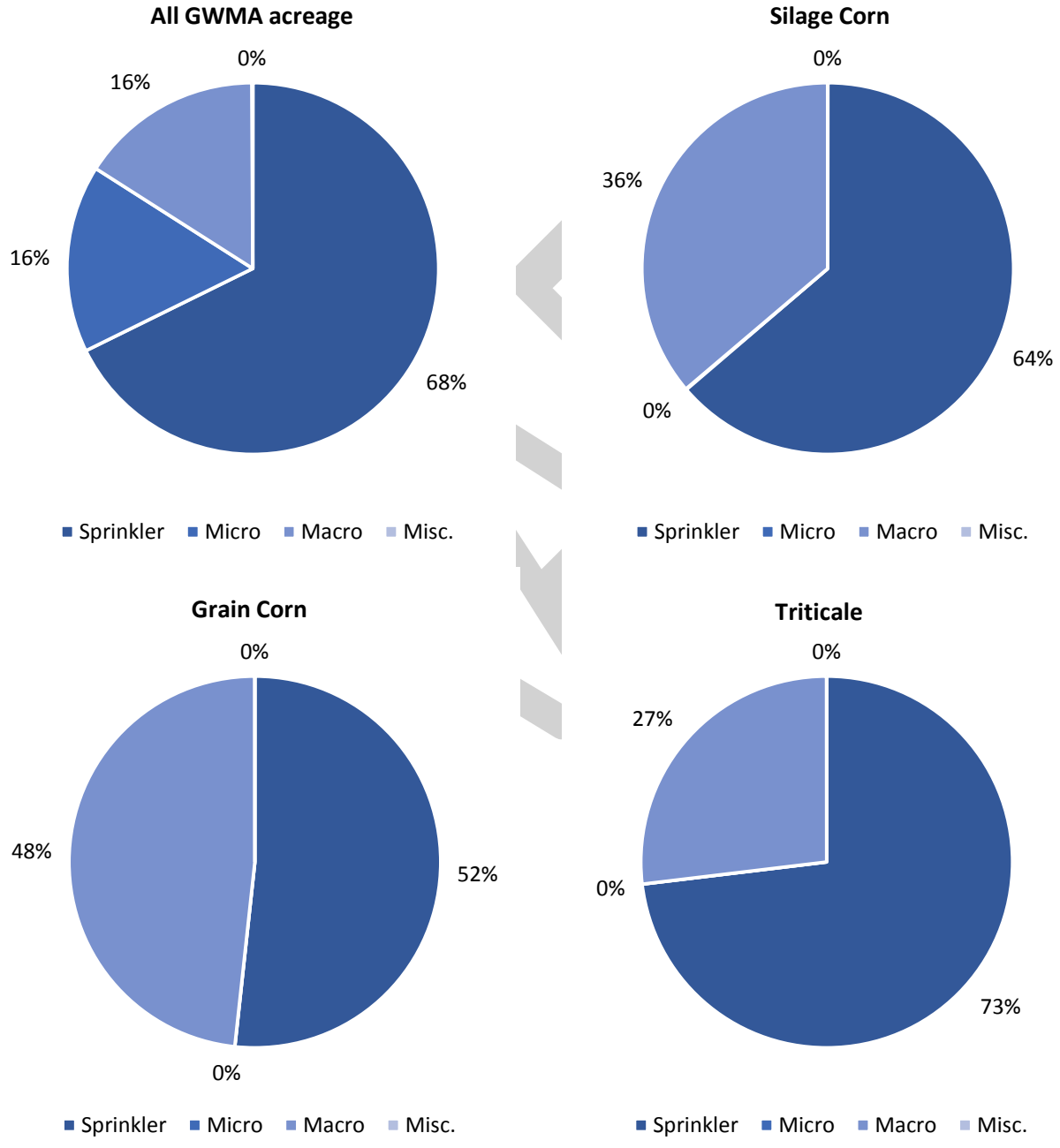

Figure 6. Irrigation types for all GWMA acreage and top 3 commodities with surplus nitrogen inputs (per acre). Due to rounding, categories with 0% are either 0 or values less than 1 that rounded to 0.

The most used irrigation type in the GWMA's irrigated acreage was sprinkler irrigation, which includes center pivot, big gun, sprinkler, wheel line, and combinations of these. Of the total irrigated acreage in the GWMA, sprinkler irrigation was used on 68%. Micro irrigation was the second most common and accounts for about 16% of the irrigation. Micro irrigation includes drip, micro sprinkler, drip/sprinkler, and combinations. The third most common was macro irrigation which includes flood, rill, and combinations with the sprinkler group; macro irrigation accounted for almost as much acreage as micro irrigation, accounting for over 15% of the GWMA acreage (these values have been rounded in Figure 6). The miscellaneous group included irrigation by hand or acreage for which the irrigation type is unknown; this group made up less than 1% of the irrigated acreage in the GWMA.

Because of the potential for irrigation type to affect nitrogen leaching, the irrigation types for the top 3 crops with nitrogen surpluses on a per acre basis (silage corn, grain corn, and triticale) were also analyzed individually. For each of these crops, over 50% of the acreage was irrigated with sprinklers. For silage corn, the second most common technique is macro irrigation (the most likely to result in excess water application and leaching), which accounts for approximately 36% of the acreage. Macro irrigation is also the second most commonly used irrigation type for both grain corn and triticale, used on 48% and 27% of the acreage, respectively. Micro irrigation and miscellaneous irrigation types were used on less than 1% of the acreages of silage corn, grain corn, and triticale. Without detailed information about water loss through excess application, nitrogen content of lost water, and soil testing results, WSDA was unable to specifically relate the individual irrigation practices to any potential nitrogen surpluses.

The results of the mass balance equation are shown below for the 15 commodities evaluated (comprising 96% of the total irrigated agricultural acreage in the GWMA). These values represent the estimated nitrogen surplus resulting from one year of inputs and outputs. These estimates do not account for nitrogen already present in the soil before fertilization. Values shown in Table 14 include low, average, and high potential nitrogen surplus in lb/ac-yr for each commodity resulting from one year's worth of applications and removals. Negative values represent a localized removal of nitrogen and do not offset excess nitrogen from other crops or areas within the GWMA.

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Table 14. One year's worth of inputs and outputs for the top 15 crops in the GWMA

Commodity	Acreage	Sum of inputs and outputs for one year (lb N/ac-yr)		
		Low	Medium	High
Apple	17,333	-5	91	219
Corn (silage)	16,778	-200	25	242
Triticale	10,780	-135	-9	250
Grapes (juice)	10,257	61	132	197
Alfalfa	7,989	-365	-236	-46
Pasture	6,731	-186	-68	62
Cherry	6,336	27	105	210
Hops	5,961	-84	78	113
Grapes (wine)	5,126	40	94	156
Pear	3,331	-1	92	173
Mint	1,418	-166	73	157
Wheat	1,283	-79	23	113
Corn (grain)	1,166	-48	126	284
Asparagus	854	58	157	210
Peach/Nectarine	843	12	81	158

At the low end of the range, the sum of one year's worth of inputs and outputs for many crops is less than zero. The survey results these calculations are based on include both typical year-after-year application practices and a range of practices which should encompass both a producers best possible year (where high nitrogen in a pre-plant soil test allowed a producer to make very low or even no nitrogen applications) and worst possible year (where a producer needed to make high nitrogen applications to meet crop growth needs). In addition, a net negative sum from a year's worth of inputs and outputs doesn't mean that there is no nitrogen loss during the year – losses may still take place after fertilizer applications if heavy rainfall or irrigation applications take place before plant growth uses the applied nutrients. However, the presence of these low values in the range of practices suggests that producers are responsive to the information in pre-plant soil tests and work to tailor nutrient applications to crop growth needs as possible. Successive years with a net nutrient deficit are likely to be followed by higher nitrogen applications to maintain yields.

Table 15 has been shaded to illustrate which commodities, based on our survey, have agricultural practices that may remove nitrogen (green) or add excess nitrogen (yellow) to the system. Commodities that have a negative value for the sum of the inputs and outputs are displayed with a dashed line to reduce confusion. Practices used on these crops are not making nitrogen available for transport (considered over the course of a year) nor are they removing excess nitrogen available from fertilization practices of another commodity. Only positive values are summed for the totals estimated in the low, medium, and high scenarios.

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Table 15: Sum of inputs and outputs for the top 15 crops in the GWMA (entire acreage)

	Estimated total N surplus in GWMA (ton N/yr)		
Commodity	**Low**	**Medium**	**High**
Apple	-	786	1,897
Corn (silage)	-	208	2,029
Triticale	-	-	1,346
Grapes (juice)	312	677	1,008
Alfalfa	-	-	-
Pasture	-	-	209
Cherry	87	333	666
Hops	-	232	337
Grapes (wine)	103	240	400
Pear	-	153	288
Mint	-	52	111
Wheat	-	14	72
Corn (grain)	-	74	165
Asparagus	25	67	90
Peach/Nectarine	5	34	67
Total	532	2,870	8,685

A nonzero result in a mass balance (Table 15) can indicate either unknown inputs, outputs, or transformations, or net accumulation or loss. Of the 15 crops assessed, 10 did not have a yearly nitrogen surplus when evaluated at the low range estimates. Only juice grapes, cherries, wine grapes, peaches/nectarines, and asparagus had calculated nitrogen surpluses at the low range. At the high level, the majority of crops had calculated excess nitrogen. The only crop that did not was alfalfa.

Alfalfa was not estimated to have a nitrogen surplus at any evaluation level (low, medium, or high). Alfalfa is a complex perennial crop. It removes large quantities of nutrients from the soil (Koenig et al. 2009). It can meet most of its nitrogen needs from the atmosphere through nitrogen fixation, but is dependent both on the presence of rhizobia bacteria in the soil and on whether or not supplemental nitrogen is added. Alfalfa is considered a "lazy" plant and will use nitrogen from other sources such as manure or commercial fertilizer if given the chance. The practice of nitrogen supplementation on alfalfa does occur within the GWMA. However, agricultural practices used for perennial crops like alfalfa and pasture remove the majority of the plant residue from the field during harvest (hay/silage) or through grazing, which may contribute to the fact that these crops largely did not have calculated nitrogen surpluses.

One of the reasons for differences in the excess nitrogen for different commodities lies in the unique cultivation practices for each crop. The orchard and vineyard crops listed above (apples, grapes, cherries, pears, and peaches/nectarines) are permanent crops. Producers of these crops don't have access to options like crop rotations or fumigation to deal with disease and pest pressure and as a result may rely on tools like high nutrient applications or applications of multiple nutrient sources in order to improve soil health and maximize fruit production. In addition, producers of crops intended for human consumption may be reluctant to make manure and compost applications because of concerns about pathogen transfer, reducing their fertilization options further. The majority of manure and compost applications observed were taking place on crops intended for animal feed or prior to planting permanent crops.

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Annual crops such as silage corn, grain corn, triticale, and wheat use both commercial nitrogen and manure throughout the GWMA. Triticale is double-cropped (2 crops in one growing year) with silage corn, and triticale cultivation occurs on almost all sprinkler or center pivot irrigated fields in the GWMA. Triticale cultivation rarely occurs on rill irrigated fields. In this case, triticale is planted in the fall, harvested in the spring (April-May) with silage corn, wheat, or oats seeded immediately afterward and harvested late summer or fall (August-September). Generally, the nitrogen application for this corn/triticale cropping system is split – 1 application in the fall and 1 in the spring. Corn (silage and grain) use fairly even amounts of commercial nitrogen and manure on most of the acreage.

The crops with the highest estimated total nitrogen surplus (over the entire GWMA) aren't necessarily the crops with the highest surpluses per acre. The top 4 crops in terms of nitrogen surplus are also the 4 crops with the highest cultivated acreage. There are crops with comparable or higher nitrogen surpluses per acre (cherries, grain corn, and asparagus) but these crops are cultivated on far fewer acres. They may still represent localized risk to groundwater.

The mass balance sums at low, medium, and high range were combined with WSDA's cropland data layer to generate maps showing which areas of the GWMA have nitrogen surpluses under low, medium, and high range scenarios (Figure 7, Figure 8, and Figure 9). In these maps, commodities without calculated nitrogen surpluses are all represented as green while those with calculated nitrogen surpluses are represented as pink (0 – 500 ton N/yr) and red (greater than 500 ton N/yr).

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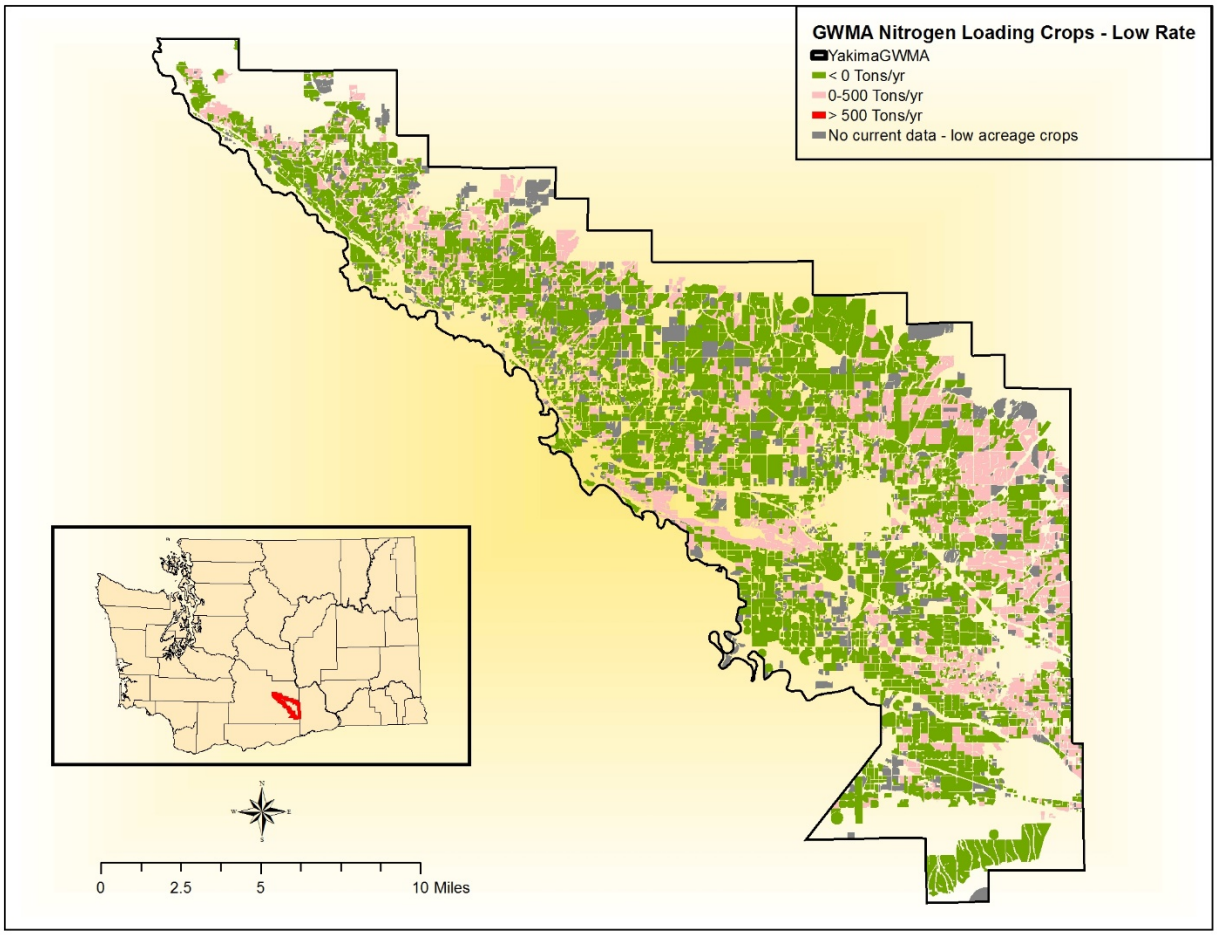

Figure 7. Map of Yakima GWMA with low range nitrogen availability estimates

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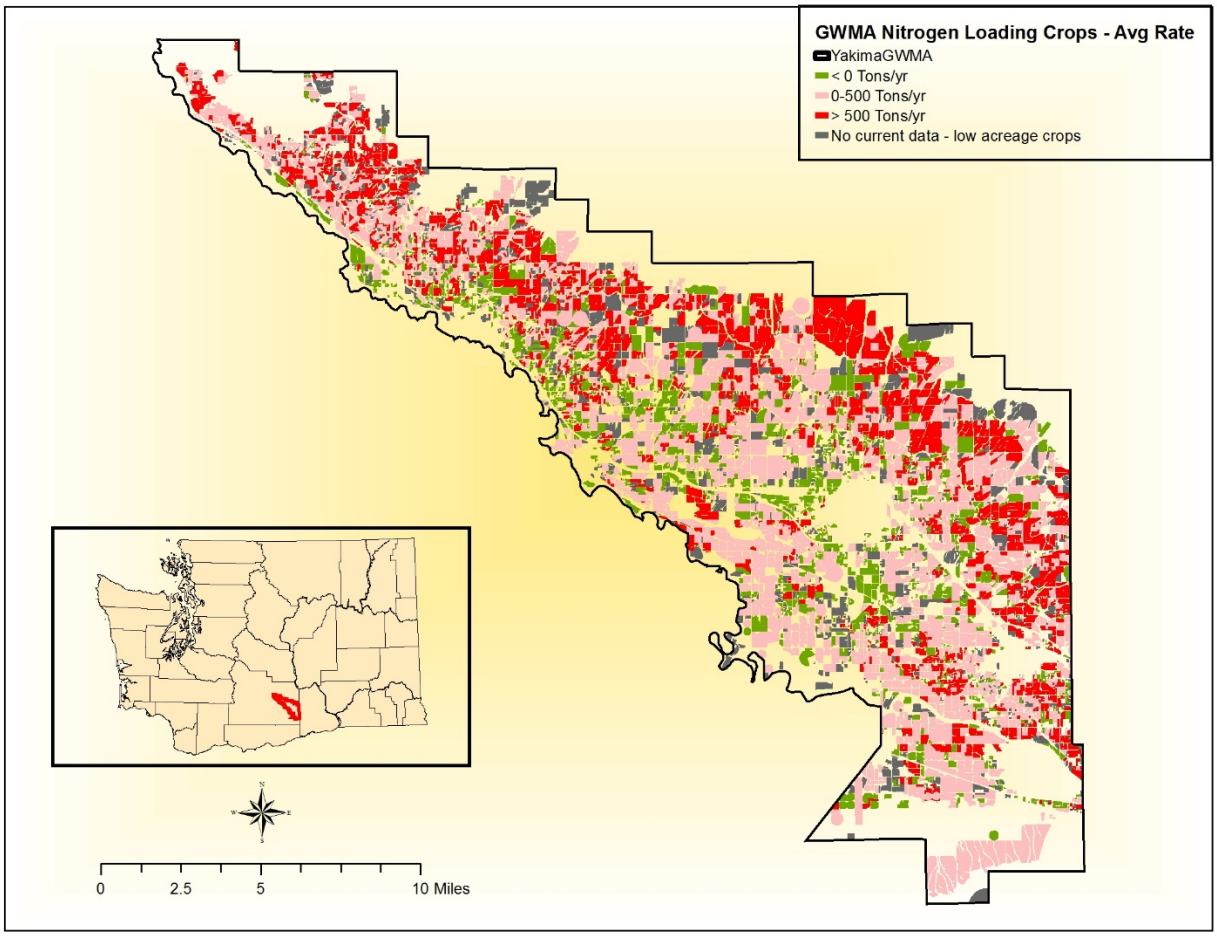

Figure 8. Map of Yakima GWMA with medium range nitrogen availability estimates

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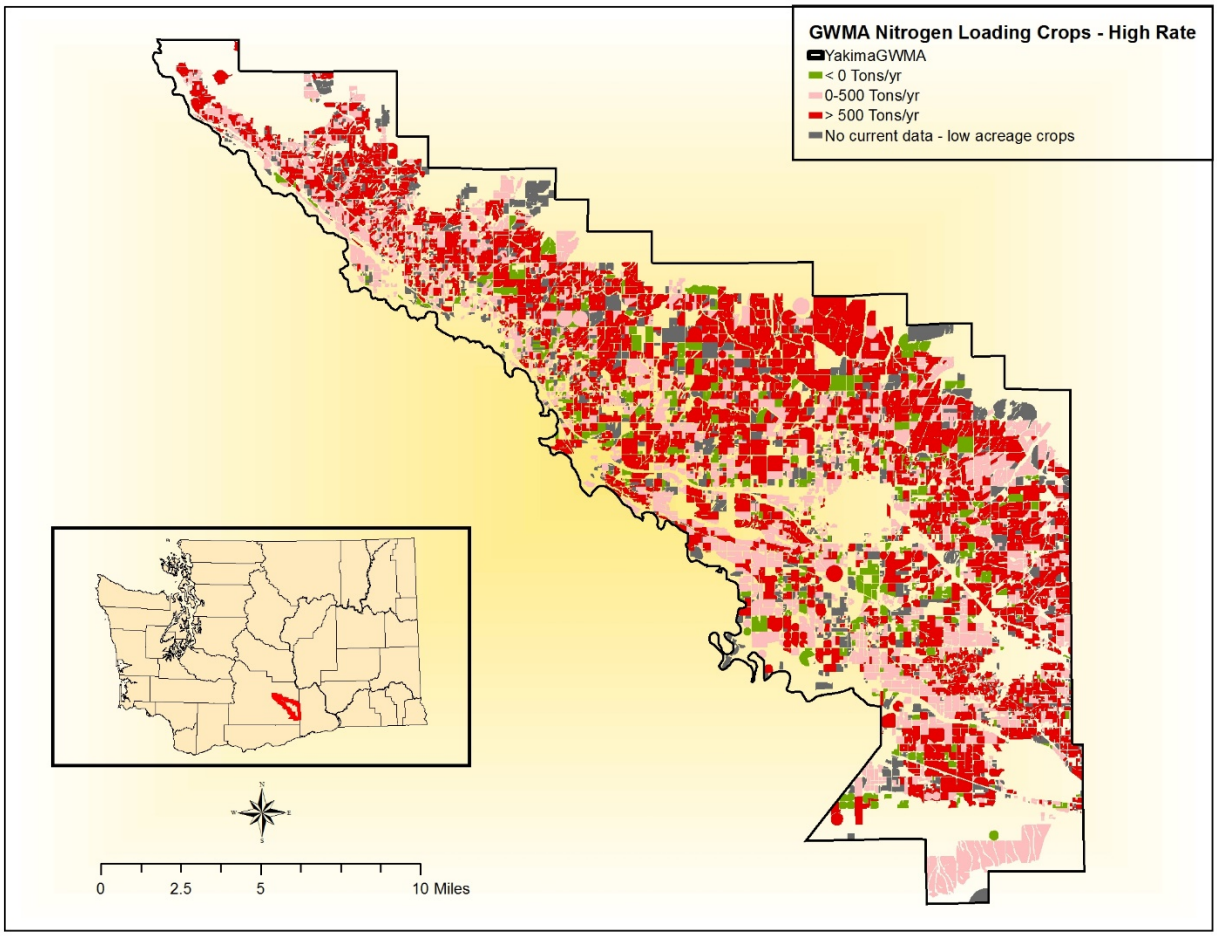

Figure 9. Map of Yakima GWMA with high range nitrogen availability estimates

Based on the information gathered through the survey and crop mapping, it is impossible to identify which part of the range (low, medium, or high) is the most likely scenario. It is likely that there are producers and crop types whose application practices occupy all parts of the range (some making low range applications, some making high range applications). Nutrient application decisions are complicated and depend on expected crop pricing, anticipated yields, recommendations from crop consultants and fertilizer guides, historical practices, and practices of other growers in the community. This variability, in combination with effects of fertilizer types used, irrigation type and practices, and nutrient application timing, will all affect whether or not any fertilizer application will result in a nitrogen surplus. Additional variation comes from soil type and organic matter content, soil nutrient content, manure nutrient content, handling, and storage before application, organic carbon cycling and mineralization, and fertilization and nitrogen fixing in alfalfa.

Conclusions and recommendations

Based on this initial survey data, WSDA has identified specific commodities where nitrogen surpluses could results in available nitrogen that could move from the soil profile into groundwater

in the lower Yakima Valley. This information can be used to identify target regions where excess nitrogen is high or risk to groundwater may be elevated (based on available data like depth to groundwater or soil type). In addition, WSDA has identified both next steps to improve this study and recommendations for research that would supply useful information to growers making fertilization decisions:

- The next priority for additional work on the mass balance calculations should be comparing the estimated nitrogen surpluses from the different commodities to the deep soil sampling results for validation and improvement of the nitrogen mass balance.
- Most Washington State University Extension fertilizer guidance dates to the 1970's; updating and expanding this guidance would make a valuable information source available to growers. Information on considerations when combining nutrient applications from commercial sources with manure and compost applications should be included.
- Field research on the following topics would provide growers with information about the fate of fertilizer applications, plant uptake, and nitrogen availability from different fertilizer sources:
    - in-depth evaluation of potential nitrogen surpluses on higher risk and larger acreage crops and crops that receive applications of commercial fertilizer, manure, and compost combined;
    - research on manure nutrient content, manure application strategies, and the subsequent fate of nitrogen, other nutrients, and salts;
    - research to better understand organic matter in soils including plant nitrogen availability;
    - the long-term agronomic, environmental, and economic feasibility of available sustainable management practices.

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3. RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SOURCES

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Background

Yakima County GIS Department was tasked with evaluating the nitrogen loading potential from non-agricultural sources within the GWMA boundaries. For this this assessment, the analysis was divided into five distinct categories:

1. Residential Onsite Sewage Systems (ROSS)
2. Large Onsite Septic Systems (LOSS)
3. Commercial Onsite Septic Systems (COSS)
4. Residential Lawn Fertilizers
5. Hobby Farms

This also includes a separate analysis for migrant worker impacts within the ROSS category.

Residential On-Site Sewage Systems

The Yakima County GIS Department developed a model to determine the nitrogen loading from individual residential on-site sewage systems located within the GWMA.

Methods

The Yakima County GIS Department incorporated all data sources having a geographical or spatial aspect into the county's GIS. The following was determined using geospatial analysis:

- There are 6,044 households within the GWMA that discharge wastewater to a ROSS. Figure 10 shows the location of each ROSS. The relative density of ROSS within the GWMA is shown in Figure 11.
- The average number of persons per household for each household discharging to a ROSS was obtained from census tract data provided by (OFM 2010). The household size used in the loading calculations for each ROSS is equal to the average household size for the census tract containing the household. The average household size for households discharging wastewater to a ROSS is 3.5 persons per household. The average household size ranges from 2.72 persons per household to 4.16 persons per household.
- The approximate location of each ROSS was determined. A ten foot buffer was graphically drawn around the building footprint to provide the best estimation of where a ROSS for each building would be located. If a parcel did not have a building footprint available, then a point was generated in the center of the parcel.
- The soil type underlying the approximate location of each ROSS was determined using (USDA NRCS 2014). Using GIS, the specific soil type was determined at each residential property within the GWMA and then each soil type was classified according to description to determine its corresponding maximum hydraulic loading rate based on Table VIII of

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WAC 246-272A-0234. Table 16 shows the soil classifications, infiltration rate for each soil classification, and the number of ROSS within each soil classification (On-Site…2005)

Table 16. Maximum hydraulic loading rate

Soil type	Soil textural classification description	Loading rate for residential effluent (gal/sq. ft-day)	Number of ROSS
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding soil types 5 & 6, all soil types with greater than or equal to 90% rock fragments.	1.0	
2	Coarse sands.	1.0	
3	Medium sands, loamy coarse sands, loamy medium sands.	0.8	
4	Fine sands, loamy fine sands, sandy loams, loams.	0.6	
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate structure or strong structure (excluding a platy structure).	0.4	5,961
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.	0.2	69
7	Sandy clay, clay, silty clay and strongly cemented firm soils, soil with a moderate or strong platy structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays1	Not suitable	14

- Using the approximate location of each ROSS, a land elevation was determined at each site using the GIS land elevation contours. It is important to note that the GIS land elevation model was derived by interpolating between 10 foot contours developed by aerial photogrammetry.
- The estimated depth to groundwater measured from the land surface at the approximate location of each ROSS. It is important to note that GIS groundwater elevation model was derived by interpolating between 25 foot contours developed by (Vaccaro et al. 2009).

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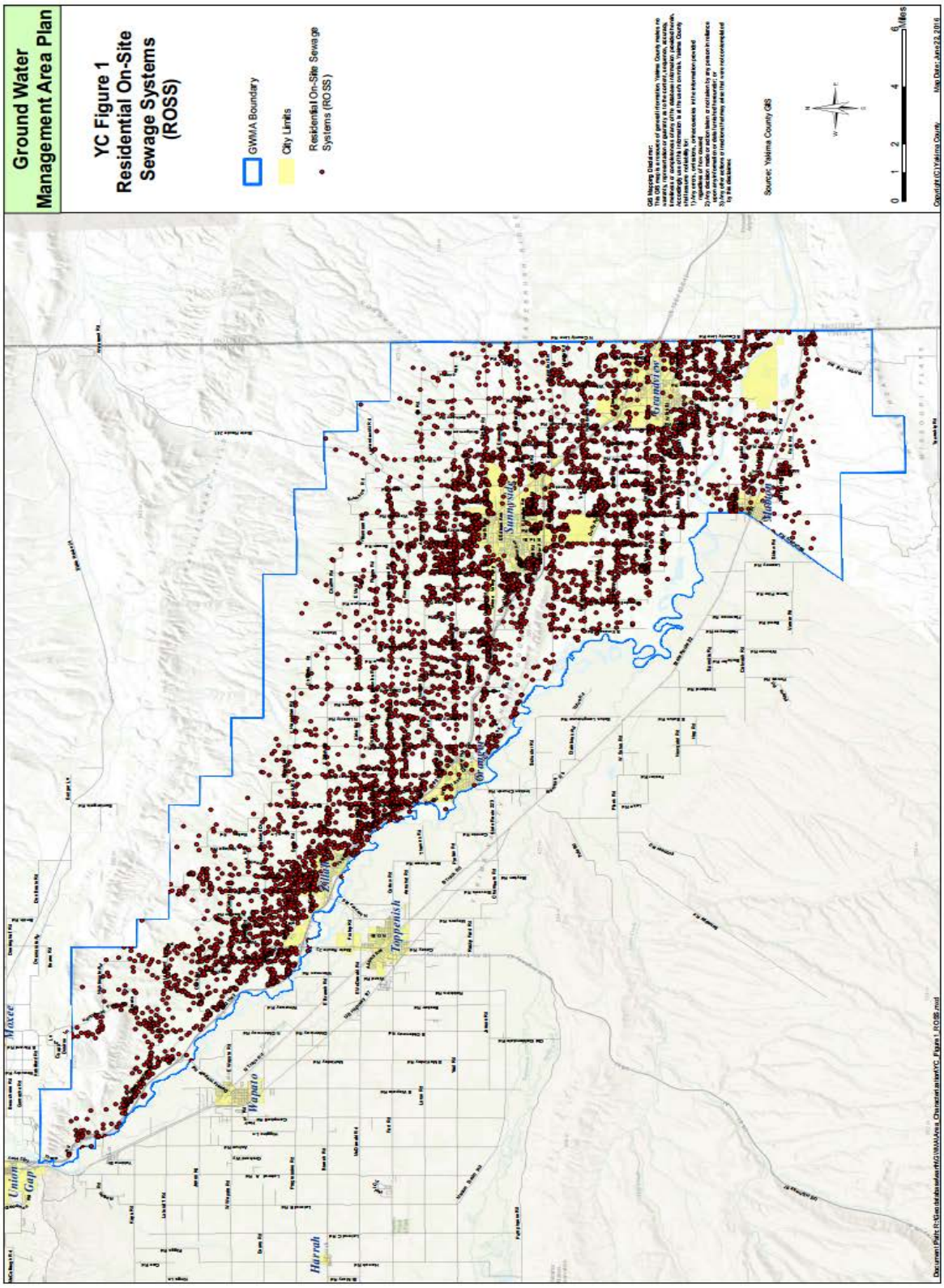

Figure 10: Residential on-site sewage systems

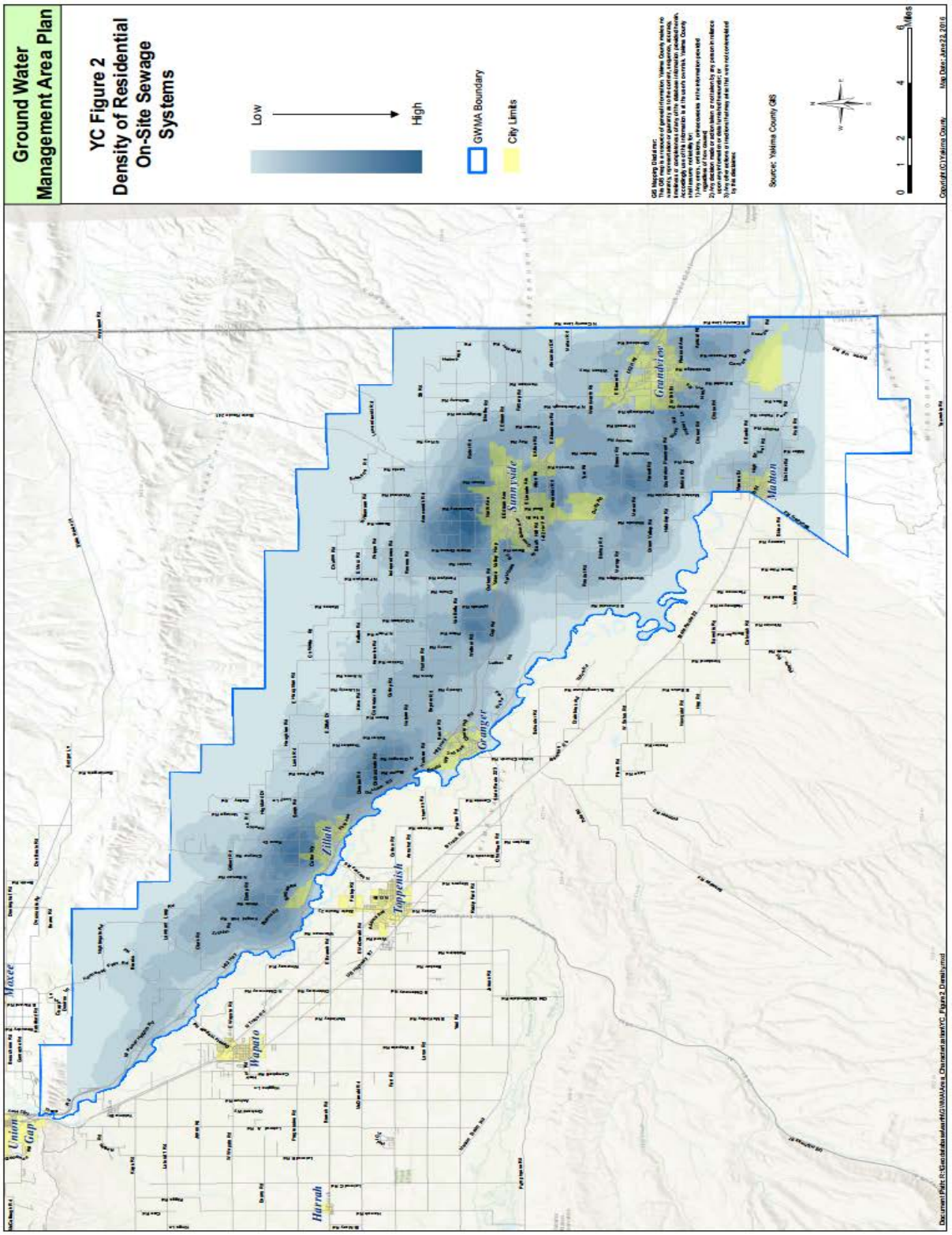

Figure 11. Density of residential on-site sewage systems

Nitrogen Loading to a ROSS

Nitrogen in residential wastewater is mainly generated from human body wastes and food materials from kitchen sinks and dishwashers. The amount of nitrogen present in the wastewater is typically expressed as a concentration in milligrams per liter (mg/L) and/or as a mass loading in grams/person/day. This assessment of nitrogen loading from on-site sewage systems utilizes the mass loading approach.

Table 3-7 of (EPA 2002a) reports that the total nitrogen (TN) loading to a ROSS ranges from six to seventeen grams per person per day and assumes a water use of 60 gallons/person/day (227 liters per person per day). Table 4.4 of (EPA 1992) reports the total nitrogen loading to a ROSS is approximately 11.2 grams per person per day. The nitrogen mass loading assessment for the residential on-site sewage systems within the GWMA utilizes a high, medium, and low approach. Accordingly, this ROSS assessment assumes a nitrogen loading of 17, 11.2, and 7 grams TN per person per day. These mass loading rates equate to TN concentrations of 26.4, 49.3, and 74.8 mg/L respectively assuming a water use of 227 liters/person/day Note: WAC 246-272A-0230 *Design Requirements-General* under section (2) (E) (ii) requires that designs for on-site systems, other than systems for single-family residences, be designed in accordance with (EPA 2002a) (On-Site…2005).

Nitrogen Removal by Denitrification

Wastewater discharged to a ROSS is subject to several biological processes including nitrification and denitrification. These processes can take place depending on the environmental conditions and occur most effectively when the soil is unsaturated because the wastewater is forced to percolate over the soil particle surfaces where treatment can take place and air is able to diffuse through the soil. Whether these processes occur and their effectiveness in treatment depends on the physical characteristics of the soils and the environmental conditions of the soil through which the wastewater percolates. Wastewater parameters, such as levels of nitrogen are removed to varying degrees. Organic or ammonia nitrogen is readily and rapidly nitrified biochemically in aerobic soil and some biochemical denitrification can occur in the soil, but without plant uptake, 60 to 90 percent of the nitrate enters the ground water. Under anaerobic soil conditions, nitrification will not occur, but the positively charged ammonium ion is retained in the soil by adsorption onto the soil particles. The ammonium may be held until aerobic soil conditions return allowing nitrification to occur (EPA 1992).

Factors found to favor denitrification are fine-grained soils (silts and clays) and layered soils (alternating fine-grained and coarser-grained soils with distinct boundaries between the texturally different layers), particularly if the fine-grained soil layers contain organic material. However, it is difficult to predict removal rates for wastewater-borne nitrate or other nitrogen compounds in the soil matrix (EPA 2002a). Table 3-17 (EPA 2002a) provides examples from studies conducted in 1976 and 1977 that showed that 10 to 40 percent of the total nitrogen can be removed by denitrification by soil infiltration in a conventional drainfield. In 1990, Jenssen and Siegrist found in their review of several laboratory and field studies that approximately 20 percent of nitrogen is lost from wastewater percolating through soil (EPA 2002a).

The predominant soil type underlying the ROSS drainfields located within the GWMA are characterized as very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams

and silty clay loams with a moderate structure or strong structure (Table 16). The estimated depth to groundwater is equal to or greater than 10 feet at approximately 90% of the ROSS locations. When considered together, this information is useful to the extent that it is reasonable to assume that the environmental conditions underlying the drainfields are conducive to some level of denitrification. Accordingly, taking a conservative approach and relying on (EPA 2002a), this nitrogen mass loading assessment, in keeping with a high, medium, and low approach, uses denitrification percentages of 10, 15, and percent respectively. Plant uptake for this assessment is assumed to be zero.

Nitrogen Removal by Septage Pumping

WAC 246-272A-0010 defines a septic tank as "a watertight treatment receptacle receiving the discharge of sewage from a building sewer or sewers, designed and constructed to permit separation of settleable and floating solids from the liquid, detention and anaerobic digestion of the organic matter, prior to discharge of the liquid." "The mixture of solid wastes, scum, sludge, and liquids pumped from within septic tanks, pump chambers, holding tanks, and other OSS components." is defined as septage (On-Site…2005).

The total nitrogen content of septage generated in the GWMA is not available. However, Table 2-2 *Characteristics of Septage Conventional Parameters (1)* contained in (EPA 1994) reports that the average Kjeldahl nitrogen in septage is 588 mg/L with a range from 66 mg/L to 1060 mg/L. Accordingly, this assessment uses an average concentration in septage of 588 mg/L total nitrogen.

WAC 246-272A-0232 establishes the minimum liquid volume for a septic tank serving a single family residence as 900 gallons for a residence containing 3 or fewer bedrooms, 1,000 gallons for a four bedroom residence, and an additional 250 gallons per bedroom for each bedroom over four. The actual septic tank size at each OSS within the GWMA is unknown. For analysis purposes, this assessment assumes that the tank size at each ROSS meets, and is equal to, the minimum WAC requirements of 900 gallons (3,407 liters) (On-Site…2005).

The amount of nitrogen removed by pumping a 900 gallon tank when it is full using TN = 588 mg/L and a 900 gallon (3,407 liters) septic tank is 2.0 Kg (4.417 pounds). The effective annual rate of TN removal by septic tank pumping can be estimated by taking the TN removed by pumping and dividing by the length of time in years between pumping events. Similarly, the reduction in TN concentration in wastewater entering the septic tank compared to the wastewater leaving the septic tank can be estimated by taking the TN removed by pumping and dividing by the total water entering the septic tank during the time between pumping events. Doing so, using an average household size of 3.5 persons and a per capita water use of 60 gallons per day, results in TN concentration reductions of 2.3 mg/L, 1.4 mg/L, and 0.7 mg/L for 3,5, and 10 year pumping events respectively.

WAC 246-272A-0270 makes the owner of a ROSS responsible for operating, monitoring, and maintaining their ROSS including the requirement to employ an approved pumper to remove the septage from the tank when the level of solids and scum indicates that removal is necessary (On-Site…2005). The frequency of septic tank pumping at each ROSS in the GWMA is unknown. However, the Groundwater Advisory Committee for the GWMA initiated a "*Well Assessment Survey*" that was conducted by the Yakima Health District for 458 households within the GWMA. That

survey included the question "Have you had your septic tank pumped recently?" Of the 458 surveys completed, 82% of the respondents answered "yes" and 18% of the respondents answered "no" or "I don't know." This survey, though not a valid statistical sampling (survey respondents volunteered and were not necessarily geographically dispersed), does provide information that indicates that the majority of households within the GWMA are more than likely having their septic tanks pumped periodically. Typical maintenance guidelines recommend that a septic tank be pumped every 3 to 5 years (EPA 2002b). Accordingly, this nitrogen mass loading assessment, in keeping with a high, medium, and low approach, assumes septic tank pumping occurs every 10, 5, and 3 years respectively.

Model Input Summary

Table 17 summarizes the inputs used for estimating the nitrogen loading from residential septic tanks:

Table 17. Input parameters for estimating total nitrogen from ROSS

Parameter	Units	Low	Medium	High
Household Size	Persons / Household	Census Tract Average	Census Tract Average	Census Tract Average
TN Loading to ROSS	gm/person/day	7	11.2	17
Denitrification	Percent	20	15	10
Septic Tank Size	Liters	3,407	3,407	3,407
TN in Septage	gm/L	0.588	0.588	0.588
TN in Septic Tank When Pumped	gm	2,003	2,003	2,003
Septic Tank Pumping Frequency	Years	3	5	10

ROSS Results

Model Output Summary

The low, medium, and high estimated net nitrogen loads from all of the ROSS within the GWMA using the input factors contained in Table 17 are 43.7 tons, 79.2 tons, and 130.3 tons respectively. The estimated nitrogen loads are summarized in Table 18.

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Table 18. ROSS nitrogen loading estimate

	Units	TN Generated by 6,044 Households	Denitrification	Average Annual TN Removed by Pumping	Total N
LOW	Grams/Year	54,636,835	(10,927,367)	(4,035,377)	39,674,091
	Lbs/Year	120,454	(24,091)	(8,896)	87,466
	Tons/Year	60.23	(12.05)	(4.45)	43.73
MEDIUM	Grams/Year	87,418,937	(13,112,840)	(2,421,226)	71,884,870
	Lbs/Year	192,726	(28,909)	(5,338)	158,479
	Tons/Year	96.36	(14.45)	(2.67)	79.24
HIGH	Grams/Year	132,689,457	(13,268,946)	(1,210,613)	118,209,898
	Lbs/Year	292,530	(29,253)	(2,669)	260,608
	Tons/Year	146.27	(14.63)	(1.33)	130.30

About the Model

The model created for this assessment is maintained by the Yakima County Public Services Department. It has been designed such that it provides the ability to estimate the nitrogen loading from ROSS within the GWMA by changing any or all of the input parameters. As an example, using a denitrification rate of 15%, a TN Loading to a ROSS of 11.2 gm/person/day, and a septic tank pumping frequency of 4 years results in a TN of 78.3 tons.

Migrant Worker Effect on ROSS Nitrogen Loading

The number of persons living within the GWMA has a direct effect on the nitrogen loading from septic tanks and the above ROSS assessment only accounts for those persons living within the GWMA boundary on a permanent basis. Yakima County agricultural producers supplement their work force during peak periods by hiring migrant workers. A migrant worker is defined as a farm worker whose employment requires travel that prevented the worker from returning to his/her permanent place of residence the same day (USDA NASS 2014). In 2012 there were 9,598 migrant workers employed by agriculture throughout all of Yakima County (USDA NASS 2014). It is not known precisely where these migrant workers were employed or where they lived. However, it is possible to estimate the number of migrant workers working in the GWMA boundary by prorating the total number of migrant workers for the county by acres of crop land in Yakima County. This approach assumes that the estimated amount of migrant workers working within the GWMA also resided within the GWMA.

There are 360,906 acres of crops in Yakima County with 99,976 (28%) of those acres located within the GWMA (WSDA 2016). Prorating the number of migrant workers by crop acres results in a GWMA migrant worker population of 2,687 migrant workers (28% of 9,598). (USDA NASS 2014) does not provide information relative to the amount of time each migrant worker worked - a worker working just one day is recorded as one migrant worker and a worker working 30 days is also reported as one migrant worker. On the other hand, (ESD 2015), reports the total number of agricultural workers by month employed, but does not report the number of migrant workers. Nonetheless, by assuming that the monthly migrant workforce reported by (USDA NASS 2014)

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follows the same trending pattern as the total monthly agricultural workforce reported by (ESD 2015), an estimate of an annualized migrant population can be derived. Doing so results in an average annual migrant population within the GWMA of 224 persons (2,687 person months ÷12 months = 224 persons). Table 19 shows the calculations for the estimated migrant worker population. Consequently, employing the same methodology used for residential ROSS, the estimated additional TN loadings per year from migrant workers using the low, medium, and high format are 0.50 tons, 0.90 tons, and 1.40 tons respectively.

Table 19. Migrant workforce estimate

Month (A)	Total County Ag Workers / Month (B)	Monthly Distribution of Total County Ag Workers / month by % of Total ('C)	Prorated Migrant County Ag Workers / month = (B) X ('C) (D)	Prorated GWMA Migrant Ag Workers / yr = ('C) X 28% ÷ 12 (E)
Jan	20,120	0.058	555	13
Feb	22,540	0.065	622	15
Mar	23,220	0.067	640	15
Apr	25,540	0.073	704	16
May	26,410	0.076	728	17
Jun	38,550	0.111	1,063	25
Jul	39,920	0.115	1,101	26
Aug	33,080	0.095	912	21
Sep	38,440	0.110	1,060	25
Oct	35,720	0.103	985	23
Nov	24,320	0.070	671	16
Dec	20,130	0.058	555	13
Totals:	347,990	1	9,598	224

Nitrogen Loading from ROSS per Land Area

Nitrogen loading estimates per land area were determined using the OSS design requirements contained in WAC 246-272A-0230 as a means of comparing the nitrogen loading from ROSS with other potential nitrogen sources that are typically land area based. According to the WAC, the design flow for an OSS is determined by multiplying the number of bedrooms by 120 gpd based on an occupancy of 2 persons per bedroom. This results in a design load of 60 gpd per person per day. The design flow for each ROSS is estimated by multiplying the household size by 60 gpd (a household size of 4.16 persons would have a design flow of 250 gallons per day). It is important to note that the minimum design flow established by the WAC is 240 gallons per day0 (On-Site…2005).

The area of the drainfield for a ROSS is used to estimate the land area where nitrogen discharged from a septic tank is applied. The size of this area for each ROSS is estimated by first dividing the design flow for the ROSS by the infiltration rate for the soils underlying the drainfield. A household with a design flow of 250 gpd in a soil having an infiltration rate of 0.45 gallons/ft^2/day would have

an estimated infiltrative surface of 556 ft^2. Second, taking a simple approach, the size of the drainfield can be approximated by assuming that infiltration trenches are one foot wide and 60 feet long (60ft^2/ trench) and that the lateral separation between trenches is five feet resulting in the need for 10 trenches and a drainfield size of 60 feet by 45 feet or 2,700 ft^2 . Finally, the nitrogen loading per land area can then be estimated by dividing the annual nitrogen load for the ROSS by the area of the drainfield. If the above household has a TN discharge of 28 lbs/yr, then the annual nitrogen loading per land area is 0.01 lbs/ft^2 (436 lbs/acre).

The size of each ROSS drainfield was estimated using the above methodology resulting in a total drainfield area for all of the ROSS in the GWMA of 398 acres. Consequently, the TN loadings summarized in Table 20 result in low, medium, and high land application rates of 223 lbs/acre, 403 lbs/acre, and 662 lbs/acre respectively. Total loadings from ROSS drainfields are summarized in Table 20.

Table 20: Estimated Total Nitrogen Loadings from ROSS Drainfields

	Low	Medium	High
Loading (lb N/acre)	223	403	662
Loading (kg N/hectare)	249	452	743
Loading (ton N/year)	44.2	80.1	131.7
Loading (kg N/year)	40,131	72,663	119,461

Large On-site Septic Systems

Background

A Large Onsite Septic System is a septic system having a design volume over 3,500 gallons. The design and operation of LOSS are overseen by the Washington State Department of Health (WDOH). WDOH records show that there are 2 LOSS located within the GWMA. The design capacity, location, and times of use of both of the LOSS were provided to the GIS Department by WDOH.

LOSS Results

One LOSS site is located outside of Zillah (Zillah LOSS) with a design capacity of 5,000 gallons. This LOSS serves the employees of a large fruit packing operation and warehouse. The LOSS is used by employees throughout the year with peak use during the fruit packing season. It is presumed that the loading to the LOSS is predominantly human waste from toilet flushing. The average loading generated by toilet flushing is 16.2 gallons/capita/day with a nitrogen loading of 8.7 grams/capita/day (EPA 1992) at Tables 4-2 and 4-4. WAC 246-272 B 06450(4) (b) requires that the size of a LOSS septic tank be equal to 3 times the daily design flow (Large…2011). As such, the design flow for the 5,000 gallon tank is 1,667 gpd. Dividing the design flow by 16.2 g/cap/day equates to 103 persons per day. The annual nitrogen loading from 103 persons, using the ROSS methodology and substituting a TN loading of 8.7 grams/capita/day, is a low of 575 lbs/year, a medium of 612 lbs/year, and a high of 649 lbs/year or 0.29 tons/year, 0.31 tons/year, and 0.32 tons/year from the Zillah LOSS. Of note is that this estimate is based on the peak loading during the packing season and does not reflect a smaller work force during the remainder of the year.

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The second LOSS site is located outside of Granger (Granger LOSS) with a design capacity of 4,850 gallons. The design flow is 1,620 gpd (one third of the size of the tank). This LOSS serves migrant workers for approximately 30 days each year during the cherry harvest season. It is presumed that the migrant workers reside at this site and that the loading to the LOSS is typical of the loading to ROSS. Accordingly, the number of persons this LOSS was designed to serve is 27 persons. Using the same methodology used to calculate the total nitrogen load for ROSS, a nitrogen load for the LOSS was determined. This results in a low of 9 lbs/year, a medium of 16.0 lbs/yr and a high 27 lbs/year of total nitrogen from the Granger LOSS. Results from LOSS systems are summarized in Table 21.

Table 21: Estimated Loading from LOSS systems

	Low	Medium	High
Loading (lb N/acre)	195	209	225
Loading (kg N/hectare)	218	235	252
Total loading (ton N/year)	0.29	0.31	0.34
Total loading (kg N/year)	265	285	307

Commercial On-site Septic Systems

Background

The term "Commercial" Onsite Septic Systems, as used in this report, refers to septic systems that are used for employees working at agricultural businesses that operate year-round and are not classified as a LOSS by WDOH. The most likely location for these facilities within the GWMA are at confined animal feeding operations (CAFOs).

COSS Results

The Washington State Department of Agriculture reported that there were 52 operating CAFOs located within the GWMA in 2014. Each CAFO was classified by WSDA by herd size ranges as shown in Table 22. Presumably, each CAFO provides a restroom facility for its employees. It is not known if the facilities are a COSS or some type of portable facility. This nitrogen loading assessment for COSS assumes that there is a COSS at each CAFO location.

It is assumed that the loading to the COSS is predominantly human waste from toilet flushing. The number of employees at each CAFO is unknown but can be estimated using a paper published by the University of California in 2004 titled "*For Wages and Benefits, Bigger Dairies May be Better*" written by Barbara Reed (Reed 1994). The following is extracted from that paper:

Number of employees: Larger dairies had a higher cow-to-employee ratio than smaller dairies. Dairies of more than 700 cows averaged 151 cows per employee; dairies with fewer than 250 cows averaged 82 cows per employee. Dairies with fewer than 250 cows employed 3.5 workers on average; dairies with more than 700 cows employed 12 workers. The largest number of employees reported for any dairy was 31 (1,900 cows).

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This assessment uses a cow to employee ratio of 82 for CAFOs smaller than 700 cows and a cow to employee ratio of 151 for CAFOs larger than 700 cows. The number of cows is assumed to be the highest number in the range, with 8,000 cows used for the largest CAFOs. This methodology is represented in Table 22.

Table 22. GWMA CAFO herd size and employee estimate

Mature Herd Range (cows)	Number of CAFOS	Employees/ CAFO	Total Employees
200 to 699	14	9	126
700 to 1699	18	11	198
1700 to 2699	10	18	180
2700 to 3699	4	25	100
3700 to 4699	1	31	31
4700 to 5699	1	38	38
5700 to 6839	2	45	90
6840 and above	2	53	106
Total	52		869

The average loading generated by toilet flushing is 16.2 gallons/capita/day with a nitrogen loading of 8.7 grams/capita/day (EPA 1992) at Tables 4-2 and 4-4. The annual nitrogen loading from 869 persons, using the ROSS methodology and substituting a TN loading of 8.7 grams/capita/day, is a low of 4,865 lbs/year, a medium of 5,170 lbs/year, and a high of 5,475 lbs/year. Results from COSS are summarized in Table 23.

Table 23: Estimated Loading from COSS

	Low	Medium	High
Loading (lb N/acre)	163	173	183
Loading (kg N/hectare)	182	194	205
Total loading (ton N/year)	2.43	2.59	2.74
Total loading (kg N/year)	2207	2345	2483

Residential Lawn Fertilizer

Methods

The overall nitrogen loading assessment includes an estimate of nitrogen from fertilizers applied to residential lawns located within the GWMA. The GIS Department developed a method for approximating the area of maintained lawn areas. This method involved the use of ArcMap Spatial Analysis and color infrared orthophotography to determine "green" spaces within the residential areas of the GWMA. The infrared photography shows actively growing vegetation as variations of red on the orthophotography.

A classification tool in ArcGIS was "trained" to search for these red spots and identify them as grass, trees, or shrubs. These areas represent a "green" layer within the GIS and are considered areas where fertilizer may be applied. Using the green layer, four representative areas within the GWMA were examined to determine the percentages of land area that were green. Each of the areas were

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one square mile in size and the buildings and crop lands were subtracted from the green areas. The four areas examined were:

- An urban area located within the City of Sunnyside city limits (Urban) representing urban density properties. The average parcel size for this urban area is 0.28 acres and the amount of green area is 33.4% of the total acreage resulting in an average green area per parcel of 0.09 acres.
- A suburban area located outside the City of Sunnyside, but within the Sunnyside Urban Growth Boundary (Suburban), representing suburban density properties. The average parcel size for this suburban area is 4.95 acres and the amount of green area is 25.2% of the total acreage resulting in an average green area per parcel of 1.25 acres.
- A rural area that encompasses the unincorporated community of Outlook (Rural High) representing rural properties within the GWMA that are relatively small in size. The average parcel size for this suburban area is 4.90 acres and the amount of green area is 13.0% of the total acreage resulting in an average green area per parcel of 0.64 acres.
- A rural area within the County (Rural Low) representing rural properties within the GWMA that are relatively large in size. The average parcel size for this rural area is 23.7 acres and the amount of green area is 3.1% of the total acreage resulting in an average green area per parcel of 0.73 acres.

Table 24 summarizes the representative areas.

Table 24. Representative lawn areas in the GWMA

Representative Area	Average Parcel Size (acres)	Green Area (acres)	Percent Green	Green Area per parcel (acres)	Green Area per parcel (sf)
Urban	0.28	20.04	33.4%	0.09	4,074
Suburban	4.95	161.28	25.2%	1.25	54,337
Rural High Density	4.9	83.2	13.0%	0.64	27,748
Rural Low Density	23.7	19.84	3.1%	0.73	32,004

Residential lawn areas for the entire GWMA were approximated using Table 24 values and the following criteria:

- Each residential parcel located within an incorporated City was given a lawn area of 0.09 acres.
- Each residential parcel located within an urban growth boundary and outside of an incorporated city was given a lawn area of 1.25 acres.
- Each residential rural parcel (outside of an urban growth boundary) that had a total parcel area equal to or less than 5.0 acres was given a lawn area of 0.64 acres.
- Each residential rural parcel (outside of an urban growth boundary) that had a total parcel area greater than 5.0 acres was given a lawn area of 0.73 acres.

Table 25 summarizes the approximated total lawn area within the GWMA using the above criteria:

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Table 25. Residential lawn areas

Representative Area	Application	Green Area per Parcel (acres)	Number of Parcels	Green Area in GWMA (acres)
Urban	All parcels located in incorporated cities	0.09	7,180	646
Suburban	All parcels located in UGA outside of cities	1.25	892	1115
Rural high density	All rural parcels <= 5 acres	0.64	3,285	2102
Rural low density	All rural parcels > 5 acres	0.73	709	518
Totals			12,066	4,381

The lawn care practices used by residents within the GWMA are unknown relative to the amount of nitrogen applied to their lawns each year. Anecdotal evidence indicates that some residents fertilize their lawns regularly and some do not fertilize their lawns at all. Consequently, this estimate for the amount of nitrogen used on lawns within the GWMA is entirely based upon the assumption that residents that do fertilize their lawns do so once each year using a typical commercial lawn fertilizer such as Scotts® Turf Builder. This product's application guidelines equate to the application of 23.3 pounds of nitrogen per acre for each application. (13.35 lb. bag, 20-0-8 analysis, covers 5,000 sf).

Residential Fertilizer Use Results

In keeping with the high, medium, and low approach, it is assumed that the percent of residents who fertilize are 80, 50, and 20 percent respectively. Accordingly, the high nitrogen loading estimate is 40.8 tons, the medium estimate is 25.5 tons, and the low estimate is 10.2 tons. It is important to note that this lawn loading assessment does not take into consideration any nitrogen lost to plant uptake, denitrification, and volatilization as is normal practice. Given the coarseness of the assumptions contained in the assessment already, it is believed that any further refinement is unjustified. Table 26 shows the low, medium, and high estimated loading from residential fertilizer use.

Table 26: Estimated N loading from Residential Fertilizer

	Low	Medium	High
Loading (lb N/acre)	4.7	11.7	18.6
Loading (kg N/hectare)	5.2	13	20.9
Total loading (ton N/year)	10.2	25.5	40.8
Total loading (kg N/year)	9,260	23,152	37,043

Small-Scale Commercial and Hobby Farms

Background

"Small-scale commercial and hobby farms" is a term used in this report to represent residential land uses other than lawns that may contribute nitrogen to the GWMA area. These land uses are

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attributable to relatively small parcels that that are not included in the Washington State Department of Agriculture's Crop inventory. Nitrogen contributions on these parcels may come from individual gardens, pastures, pets, and other animals.

Methods

The GIS Department developed an ArcGIS model to determine the potential number of hobby farms in the GWMA. To do so, using the GWMA parcel information, all parcels located within the city limits were removed, all parcels greater than 10 acres were removed, non-residential properties were removed, and parcels that overlapped with the WSDA's Cropland Data Layer were removed. The remaining parcels were then categorized into 3 size categories - (1) Acres 0 ≤ 2.5, (2) Acres ≥ 2.51 and Acres ≤ 5.00, and (3) Acres ≥ 5.01 and Acres ≤ 10.0. Once the parcels were categorized, the parcels were matched to the residential lawn data in order to remove the lawn area from the parcel area and to eliminate double counting of nitrogen loading. In addition, a building allowance of 2,000 ft^2 for each parcel was also deducted from the parcel area to arrive at an effective area for hobby farms.

Small-Scale Commercial and Hobby Farms Results

The analysis yielded the results shown in Table 27.

Table 27. Parcel size and total acres

Parcel Size Range of Small-Scale Farm (acres)	Number of Parcels	Total Parcel Area (acres)	Lawn Area (acres)	Building Allowance @ 2,000 sf/parcel (acres)	Effective Area (acres)
0 to 2.5	2335	2,481.5	1,804.1	107.2	570.2
2.51 to 5.0	311	1,075.6	223.0	14.3	838.4
5.1 to 10.0	110	776.1	83.3	5.1	687.7
Totals	2756	4,333.2	2,110.4	126.5	2,096.3

The recommended amount of fertilizer applied to each of these groups as proposed by the GWMA's RCIM Work Group is shown in Table 28. In keeping with the high, medium, and low approach, it is assumed that the percent of residents who fertilize are 80, 50, and 20 percent respectively similar to the assumption for residential lawn fertilizer.

Table 28. Percent of fertilizer application by hobby farm size

Parcel Size of Small-Scale Farm (acres)	Nitrogen Fertilizer Application (lb/acre/yr)	Nitrogen Fertilizer Application (kg/hectare/year)
0 ≤ 2.5	14	15.7
2.51 ≤ 5.0	21	23.5
5.01 < 10.0	28	31.4

The loading rate was then applied to the corresponding Small-Scale Farm size using the effective area. The results are shown in Table 29.

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Table 29. Total nitrogen loading for hobby farms

Parcel Size of Small-Scale Farm	Small-Scale Farm Effective Area (acres)	Application (lbs)	TN Low at 20% (tons)	TN Medium at 50% (tons)	High at 80% (tons)
0 ≤ 2.5 Acres	570.2	14	0.80	2.00	3.19
2.51 Acres ≤ 5.0 Acres	838.4	21	1.76	4.40	7.04
5.01 Acres ≤ 10.0 Acres	687.7	28	1.93	4.81	7.70
Total (ton N/year)			**4.48**	**11.21**	**17.94**
Total (kg N/year)			**4,068**	**10,171**	**16,273**

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4. ATMOSPHERIC DEPOSITION

WSDA author: Kelly McLain

Background

Atmospheric deposition is the process by which aerosol particles collect or deposit themselves on the earth's surfaces. It can be divided into two general sub-processes: dry and wet deposition. Nitrogen emissions in the Pacific Northwest may come from transportation, agriculture, power plants, industrial, and natural sources. In coastal areas, transport of nitrogen due to emissions in Southeast Asia may also be a source. In urban areas, emissions will mainly be in the form of oxidized sulfur compounds (NO_x) while in agricultural areas emissions from fertilized cropland and CAFOs will be largely in reduced forms (ammonia and ammonium). In general, emissions of both oxidized and reduced nitrogen have been increasing in recent decades (Fenn 2003). Emissions may travel distances ranging from meters to thousands of kilometers before subsequent wet (through precipitation) or dry redeposition takes place (Viers et al. 2012). Monitoring of deposition is conducted by the National Atmospheric Deposition Program, which conducts both monitoring of and modeling of N species emissions concentrations and deposition throughout the United States. Monitoring is conducted mainly at fairly remote sites; there are 5 wet deposition monitoring stations in Western Washington and 1 in Eastern Washington (in Whitman County) (NADP 2017). In conjunction with this wet deposition modeling, EPA uses emissions and ambient concentration data to model dry deposition based on emissions and one dry deposition station in Mt. Rainier National Park (now discontinued) (EPA 2015, EPA 2016).

WSDA reviewed similar studies to assess what, if any, atmospheric deposition information was available from other agricultural areas on the west coast. A significant nitrogen loading study by the University of California at Davis (Viers et al. 2012) includes atmospheric deposition data for California's Central Valley. EPA modeling in the Tulare Lake Basin and Salinas Valley was reviewed for that study to identify atmospheric deposition levels of 9 and 5 lb N/ac-yr, respectively. These numbers greatly exceed atmospheric deposition estimates for this study area. There are a few reasons why the levels seen in the Tulare Lake Basin and the Salinas Valley are not comparable to those estimated in Yakima. The first major difference between the regions is proximity to major urban areas; a significant source of deposition in California's Central Valley is the San Francisco Bay area transportation corridor. The Yakima Valley does not have a transportation or population hub of similar magnitude and proximity. In addition, the scale of animal agriculture in the Central Valley is an order of magnitude greater than that found in Yakima County (approximately 640 dairies compared to about 50 in the GWMA). Finally, the numbers in the Tulare Lake Basin and Salinas Valley are likely higher due to the effect of the Sierra Nevada – winds travelling from heavily populated areas meet the Sierra Nevada and deposit atmospheric pollutants in the adjacent valleys (Viers et al. 2012). Again, this is not a scenario seen in the Yakima Valley where winds travel mostly away from the mountains towards the Columbia River Basin. It is not surprising that the nitrogen deposition estimates from would be much higher in the UC Davis study than in the Lower Yakima Valley GWMA.

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Methods, Limitations, and Assumptions

Limitations

The lower Yakima Valley has low annual rainfall (6.8 inches) and moderate winter snowfall (12.4 inches per year), from mean yearly records kept from 1894 – 2012 at Sunnyside, WA (Western Regional Climate Center 2017). As mentioned above, Washington State has 5 wet deposition monitoring stations in the National Atmospheric Deposition Program but only 1 located on the eastern side of the Cascade Mountains (NADP 2017). One limitation of this study is the very small amount of deposition data collected in the study area. The location of the eastern Washington NADP station (in Whitman County, NADP 2017) is similar in precipitation but not in geography or land use practice (Whitman County produces dryland crops such as wheat, barley, and dry peas) (WSDA 2016). There is also a limited amount of development and only small transportation corridors located in Whitman County, as compared to our study area in the lower Yakima Valley, surrounded by mountains, reasonably sized cities and towns, and bisected by a major interstate. In addition, the Yakima Valley is largely planted in irrigated cropland and a large number of concentrated animal feeding operations (none of which are found in Whitman County) (WSDA 2016). Use of the wet deposition data from the Whitman County station would likely underestimate the influence of atmospheric deposition on the geographic footprint of the lower Yakima Groundwater Management Area. This limitation makes it more difficult to use Washington measurements in the analysis.

Another limitation of this estimate is categorization of ecosystems and development types that may result in deposited atmospheric nitrogen available for transport to groundwater. It is expected that in most urban areas (with a high percentage of impervious surface), any atmospheric deposition would likely be retained in the natural ecosystem through turfgrass sequestration or make its way to surface water via stormwater runoff. Natural areas are often nitrogen limited and atmospheric deposition in those regions may be used in the production of increased biomass and not available for leaching (Viers et al. 2012). It is assumed that atmospheric deposition does not contribute significantly to groundwater loading in these systems. However, this study does not include a refined analysis to exclude these areas.

Methods

The mechanism for nitrogen loading through atmospheric deposition to cropland is mobilization to groundwater through irrigation; atmospheric deposition to cropland is included as an input in the mass balance conducted in Section **2.** IRRIGATED AGRICULTURE. As a result, this section of the report excludes the acreage from the irrigated agriculture section. In addition, the known areas of pens and lagoons are excluded (both of these estimates already account for atmospheric nitrogen deposition).

In order to establish low, medium, and high estimated available nitrogen due to atmospheric deposition, WSDA relied on 2 main sources; a state atmospheric scientist with the Washington State Department of Ecology (Dr. Ranil Dhammapala[4]) and the data available for wet and dry deposition from the NADP-managed Mt. Rainier station.

[4] Medium and high deposition values were recommended by Dr. Dhammapala during a meeting on November 3, 2016.

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The lowest number used is the combination of the most recently available annual wet and dry deposition data from the NADP Mt. Rainier station. Deposition reported includes dry nitric acid, dry ammonium, dry nitrate, wet ammonium, and wet nitrate (EPA 2016). This is believed to be a good surrogate for low deposition due to the considerable transportation corridor along I-5 in western Washington mimicking farm-related emissions and deposition seen in eastern Washington.

The average estimate provided by Dr. Dhammapala takes into account modeled deposition in the lower Yakima Valley over a 5-day period during December, when stagnant air and regular inversions result in poor regional air quality. For the highest rate estimate, WSDA again relied on feedback from Dr. Dhammapala to include a multiplier of 3 times the average rate to generate an expected upper limit for atmospheric deposition.

An underlying assumption included in this analysis is that deposition within the design surface area of each lagoon is conveyed to the lagoon liquid and accounted for as lagoon nitrogen concentration in the lagoon seepage calculation.

The total area used in the final annual calculations excludes 210 acres of lagoons, 2,096 acres of dairy and non-dairy livestock pens, and 98,881 acres of irrigated agricultural land. Atmospheric deposition on these areas was incorporated into calculations elsewhere in this report. The total remaining acreage used in the calculation below is 73,976 acres (ton N/yr calculation) or 29,937.05 hectares (kg N/yr calculation).

Results

The low, medium, and high atmospheric deposition rates are listed in the table below (Table 30).

Table 30. Low, medium, and high atmospheric deposition rates

	Deposition rate (kg N/ha)	Deposition rate (lb N/ac)
Low	1.69	1.53
Medium	2.30	2.05
High	6.89	6.15

The low rate of 1.53 lb/acre is the result of the most recently reported year (2012) of wet and dry atmospheric nitrogen deposition at the Mt. Rainier station (EPA 2016).

The medium rate, as mentioned above, is the result of a 5-day modeled average from December 2015. The final estimate of 2.05 lb/acre was provided by state atmospheric scientist Dr. Ranil Dhammapala.

The high rate multiplies the medium rate by a safety factor of 3, accounting for transient atmospheric conditions retaining local emissions in the valley when air quality is already poor. This high rate of 6.15 lb/acre is also in the range of values used in the UC Davis study of the Salinas Valley and Tulare Lake Basin (Viers et al. 2012).

Conclusions and Recommendations

The total estimated deposition across the entire GWMA (excluding irrigated agricultural lands, animal pens and manure lagoons) is shown in Table 31.

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Table 31. Estimated atmospheric nitrogen deposition in the GWMA

	Total Deposition (kg N/yr)	Total Deposition (tons N/yr)
Low	51,000	57
Medium	69,000	76
High	206,000	227

These estimates likely represent a significant overestimate of loading potential from atmospheric deposition. The number used as the rate is the amount of nitrogen deposited on the landscape, but the amount of nitrogen that subsequently is available for transport to groundwater is very different. Deposited nitrogen may be used by the ecosystem or be transported with precipitation to surface water before it leaches to groundwater. There are likely environments in the GWMA where very little or none of the deposited nitrogen reaches groundwater. A more detailed literature review and GIS analysis of regions likely and unlikely to result in leaching of deposited nitrogen to groundwater would result in a large improvement of the accuracy of this estimate. This would not have to involve additional modeling or monitoring work. However, the deposition numbers used are also estimates based on best professional judgment and evaluation of limited data. In the future, the GWAC may benefit from additional model runs and collection of local wet and dry deposition information to refine this estimate of the potential impacts of atmospheric deposition on the system.

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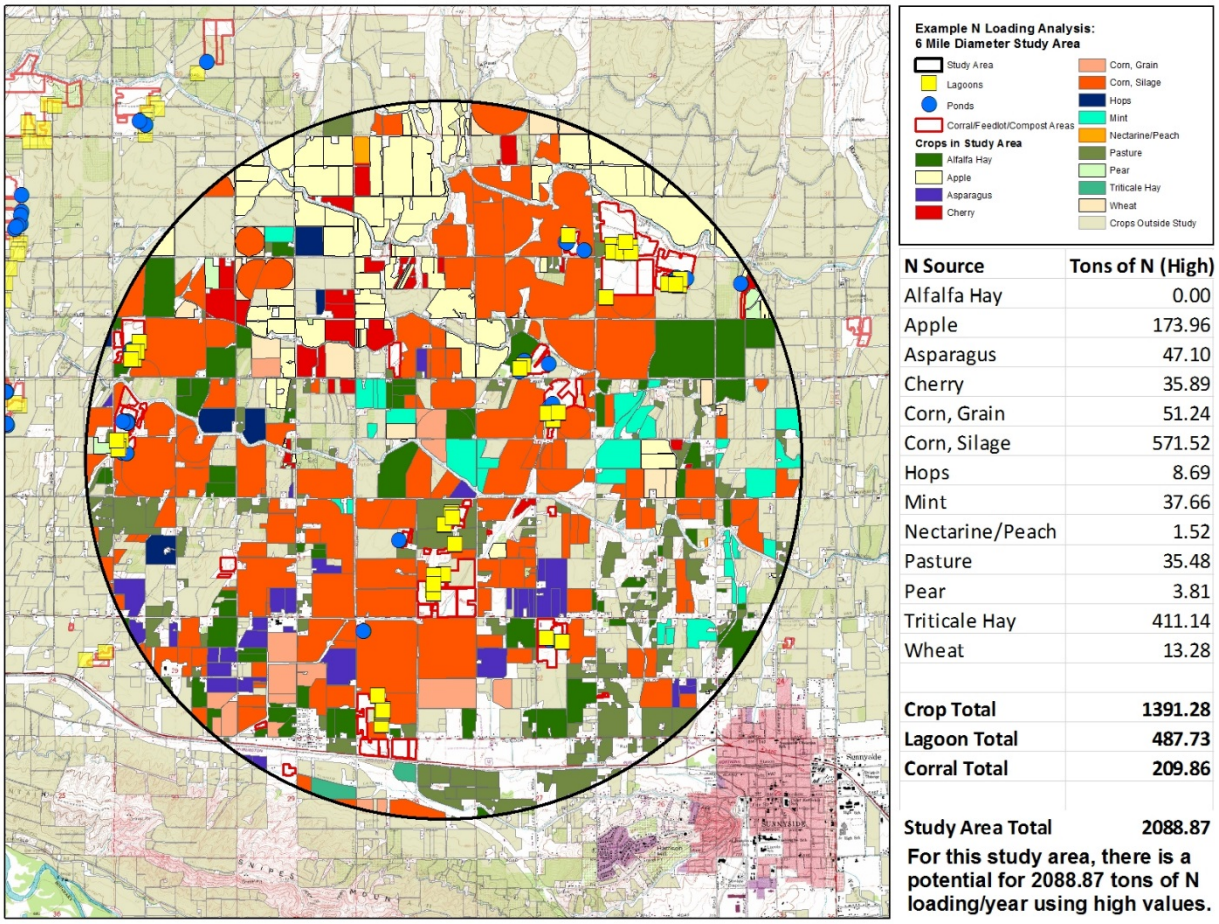
Conclusions and Recommendations

Usage Example

To demonstrate how the nitrogen estimates could be used, an example area was examined in detail (Figure 12). An area with a 3-mile radius was assessed with the high rate nitrogen estimates for agricultural activities (irrigated agriculture and CAFO lagoons and pens), This area was chosen simply because it contains both a substantial acreage of irrigated agriculture as well as a number of CAFOs. This example contains 13 of the 15 crops assessed in the irrigated agricultural section. The high rate estimated available nitrogen from this region is over 2,000 ton N/year, of which 67% came from irrigated agriculture, 23% came from CAFO lagoons, and 10% came from CAFO pens.



N Source	Tons of N (High)
Alfalfa Hay	0.00
Apple	173.96
Asparagus	47.10
Cherry	35.89
Corn, Grain	51.24
Corn, Silage	571.52
Hops	8.69
Mint	37.66
Nectarine/Peach	1.52
Pasture	35.48
Pear	3.81
Triticale Hay	411.14
Wheat	13.28
Crop Total	**1391.28**
Lagoon Total	**487.73**
Corral Total	**209.86**
Study Area Total	**2088.87**

For this study area, there is a potential for 2088.87 tons of N loading/year using high values.

Figure 12. Example assessment of available nitrogen in ton N/year for an area located near Sunnyside, Washington

Similar to the irrigated agriculture assessment over the entire GWMA, the top 3 crops with nitrogen surpluses were silage corn, triticale, and apples. The large acreage of silage corn is shown in orange throughout the assessed area, and apple fields are shown in cream in the top part of the circle. Several fields with triticale are visible in the bottom part of the map, but most triticale on this graph is double cropped with silage corn; those fields are represented as silage corn. This example

demonstrates the importance of evaluating contributions from different nitrogen sources at an appropriate scale; different regions in the GWMA will have very different nitrogen sources.

Conclusions

The ranges calculated (between low and high evaluation points) were very large for irrigated agriculture, lagoons, and pens (an entire order of magnitude). For RCIM sources, the ranges were much smaller. For this reason, agricultural activities (both irrigated agriculture and activities at CAFOs) should be the first candidate for additional research to narrow the range of estimated available nitrogen.

In all scenarios (low, medium, and high), evaluated over the entire acreage of the GWMA, the largest nitrogen contributors are irrigated agriculture, CAFO lagoons, and then CAFO pens. These activities account for 86, 95, and 96% of the available nitrogen in low, medium, and high scenarios, respectively (Figure 13). However, the large contribution to available nitrogen from irrigated agriculture is largely due to the high acreage of irrigated agriculture, with about 99,000 acres of irrigated land in the GWMA. The nitrogen from different land uses was also evaluated on a per-acre basis (Table 32). In this analysis, the top contributor to estimated available nitrogen at all evaluation levels was CAFO lagoons. With per-acre nitrogen losses 1-2 orders of magnitude above any other contributor, in an area with large a number of lagoons, based on these calculations, the lagoons will supply the most nitrogen. Additional top contributors on a per-acre basis vary in the low, medium, and high scenarios. In the low rate scenario, the top 3 are CAFO lagoons, ROSS, and LOSS. In the medium and high rate scenarios, the top 3 are CAFO lagoons, CAFO pens, and ROSS. This variability in per-acre available nitrogen estimates suggests that evaluating small geographic areas individually based on the activities present will be very important to identify management needs in different regions. An example of this approach was shown in Figure 12 and more work of this type could be conducted by the county.

Table 32. Estimated nitrogen available per acre from all sources at low, medium, and high range

Source		Area (acres)	Low (lb/acre-year)	Medium (lb/acre-year)	High (lb/acre-year)
Irrigated Agriculture		96,186	11	60	181
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential Fertilizer	4,381	4.7	11.7	18.6
	Small Scale Farms	2,096	4.3	10.7	17.1
Atmospheric Deposition		73,976	1.53	2.05	6.15

Blue shading indicates top 3 contributors in each range (low. medium, high).

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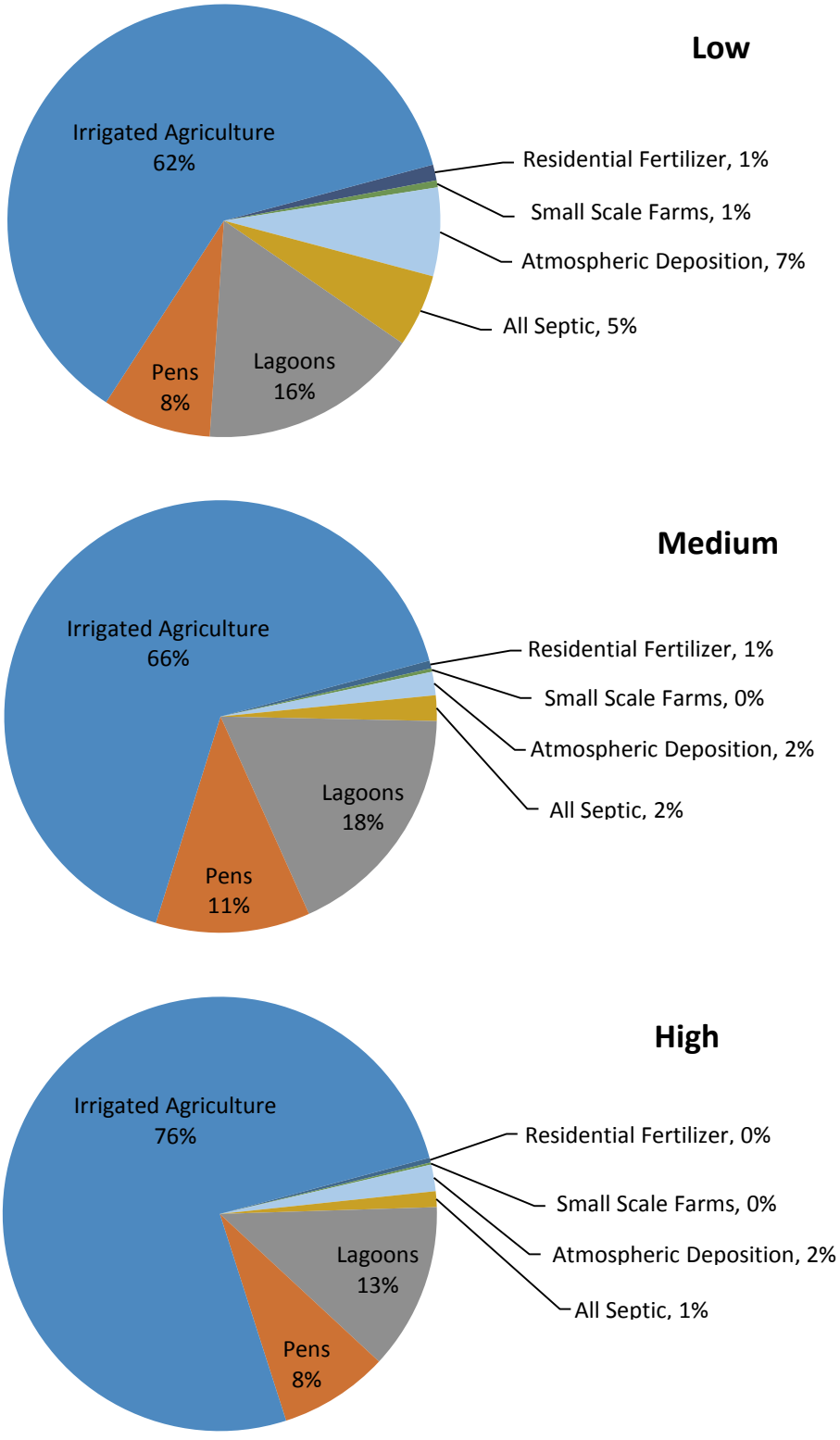

Figure 13. Low, medium, and high estimates from all sources, with percentage of total for each category

Recommendations

WSDA has identified top priorities for improving the estimates made in this study. These items were chosen because they relate to land uses with large acreages, large estimates of available nitrogen, or they would provide calibration for modeled estimates.

- Update all calculations as and when new information becomes available (for example, if information on lagoon liner condition ratings or seepage rates becomes available, that information should be incorporated into these estimates).
- Compare irrigated agriculture mass balance predictions to the deep soil sampling results to calibrate the model.
- Conduct a statistically-based study of lagoon seepage rates in the GWMA to improve seepage estimates.
- Conduct a statistically-based study of soil nitrogen concentrations beneath pens to provide local data for pen nitrogen loss estimates.
- Conduct a statistically-based study of lagoon nitrogen concentrations to confirm lagoon nitrogen concentrations used in this study.

In addition to these recommendations, there are other steps that could be taken to improve these estimates. These additional options are lower priority because WSDA believes they are less likely to result in changes to the estimates.

- A sensitivity analysis over all inputs to identify which inputs have the largest effect on the estimates; those inputs should be the top priority for additional study.
- Categorize impoundments by primary use, and use-specific parameters could be included in the estimate (for example, main or flush lagoons vs secondary lagoons).
- Research construction dates of existing lagoons, pair with liner condition ratings and historic NRCS recommendations, and generate effective permeabilities for each lagoon.
- Conduct a statistically-based study of soil nitrogen concentrations beneath lagoons to estimate nitrogen loss rates and storage in the soil.
- Identify impoundments are used as settling basins or ponds and review construction techniques to determine whether additional analysis for settling basins is needed.
- Conduct a statistically-based study of soil beneath composting areas to provide data for compost area nitrogen loss estimates.
- Review literature on the fate of deposited nitrogen for different ecosystems and land uses; pair with GIS analysis to determine the fate of deposited nitrogen for different land uses.

During this project WSDA has also identified some critical information gaps affecting growers.

- Most Washington State University Extension fertilizer guides currently available date to the 1970's. Updating these would provide crop growers with valuable information to use in decision making.
- Synthesis of existing data and new research on several topics would also help: soil organic matter mineralization, organic fertilizer composition and breakdown rates, and the interactions and effects when fertilizers of different types (for example, manure and commercial fertilizer) are applied during the same growing season.

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These study results can be used in several different ways to aid the GWAC as they choose how to allocate limited resources.

- Review contributions from all sources simultaneously, spatially throughout the GWMA, to identify areas where available nitrogen is high or where contributions from several sources overlap.
- Review nitrogen availability data in conjunction with other data layers (depth to groundwater, soil type, documented groundwater nitrogen concentrations, deep soil sampling results, proximity to drinking water supply wells, or proximity to vulnerable or marginalized communities) to identify areas with elevated risk of nitrogen moving to groundwater and areas where elevated groundwater nitrogen concentrations will be particularly harmful.

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Appendix A: Data Sources, Uses, and Potential Concerns

Section	Data	Source	Use	Concerns
CAFO: Pens and compost areas	Pen locations and dimensions	2014 dairy registration locations USDA National Agricultural Imagery Program 2013, 2015 imagery	Pen calculation	Potential for human error. Changes in operation since data collection.
CAFO: Pens and compost areas	Pen location QA	WSDA NRAS QA procedure (Beale and Baker 2009)	Pen calculation	Entire data set not ground truthed.
CAFO: Pens and compost areas	Dairy CAFO pens	NAIP 2013, 2015 imagery WSDA DNMP WSDA Animal Services	Pen calculation	Potential for human error. Changes in operation since data collection.
CAFO: Pens and compost areas	Non-Dairy CAFO pens	NAIP 2013, 2015 imagery WSDA DNMP WSDA Animal Services	Pen calculation	Potential for human error. Changes in operation since data collection.
CAFO: Pens and compost areas	Compost locations	NAIP 2013, 2015 imagery 2014 dairy registration locations	Pen calculation	Potential for human error. Changes in operation since data collection. Potential misidentification of silage storage as compost area.
CAFO: Pens and compost areas	High rate for pens	Viers et al. 2012	Pen calculation	Data is not specific to Yakima Valley. Research conducted in California's San Joaquin Valley and in Kansas where meteorological conditions are very different from Yakima.
CAFO: Pens and compost areas	Low rate for pens	Viers et al. 2012	Pen calculation	Data is not specific to Yakima Valley. Research conducted in California's Tulare Lake Basin where meteorological conditions are similar to Yakima.

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Section	Data	Source	Use	Concerns
CAFO: Lagoons	All lagoon locations	WSDA DNMP staff NAIP 2013, 2015 Google Earth	Lagoon calculation	Potential for human error. Potential misidentification of irrigation pond or settling pond as lagoon and vice versa.
CAFO: Lagoons	Lagoon location QA	WSDA NRAS QA procedure (Beale and Baker 2009)	Lagoon calculation	Entire data set not ground truthed.
CAFO: Lagoons	Lagoon capacity	DNMP lagoon assessment project	Lagoon calculation	Provides an average snapshot in time. Lagoon capacity varies throughout year.
CAFO: Lagoons	Length and width of lagoons	Nutrient management plans DNMP staff onsite data collection using ArcGIS Collector	Lagoon calculation	Potential for human error.
CAFO: Lagoons	Individual lagoon design depth	DNMP lagoon assessment Average from DNMP lagoon assessment	Lagoon calculation	All lagoons do not have recorded design depth.
CAFO: Lagoons	Lagoon total nitrogen concentration	EPA 2013a Self-reported data to SYCD	Lagoon calculation	Potential bias in both sources. EPA data set: small sample size, not statistically selected. SYCD data set: voluntarily self-reported, not statistically selected.
CAFO: Lagoons	Lagoon liner permeability and thickness	USDA NRCS 2009, USDA NRCS 2016a, USDA NRCS 2016b	Lagoon calculation	Unknown what percentage of lagoons were constructed to NRCS standards. Permeability and liner thickness chosen may not accurately represent range of lagoon construction.
Irrigated Agriculture	Acreage of crops in GWMA	WSDA crop mapping	Irrigated agriculture mass balance	Potential for human error.
Irrigated Agriculture	Fertilizer application data	Telephone survey	Irrigated agriculture mass balance	Potential bias from self-reported data, only a subset of each commodity represented in data.
Irrigated Agriculture	Atmospheric Deposition	Dr Ranil Dhammapala EPA 2016	Irrigated agriculture mass balance	Few deposition monitoring stations: may not accurately reflect deposition in GWMA

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Section	Data	Source	Use	Concerns
Irrigated Agriculture	Irrigation water nitrogen concentration	Lower Yakima River nitrogen levels at USGS Yakima River station at Kiona (USGS 2012) Washington State Irrigation Guide precipitation data	Irrigated agriculture mass balance	Located downstream of irrigation districts serving the GWMA. Does not account for potential increase in nitrogen concentration if water is used by successive growers.
Irrigated Agriculture	Crop residue left in fields and incorporated	Irrigated Agriculture Work Group "Estimated Nitrogen Usage for Agricultural Production in the GWMA"	Irrigated agriculture mass balance	Potential bias from IAWG.
Irrigated Agriculture	Crop uptake	Irrigated Agriculture Work Group "Estimated Nitrogen Usage for Agricultural Production in the GWMA"	Irrigated agriculture mass balance	Potential bias from IAWG.
Irrigated Agriculture	Nitrogen loss to atmosphere	Potter et al. 2009	Irrigated agriculture mass balance	
Irrigated Agriculture	Soil organic matter conversion to nitrate-nitrogen	Virginia Prest, WSDA DNMP SYCS deep soil sampling 2015 results	Irrigated agriculture mass balance	Changing assumptions based on new information; not yet established science.
RCIM	Number of households and number of people per household	Census 2010	Residential on-site sewage system calculation	Information is outdated.
RCIM	Soil type, soil classification, infiltration rate	USDA NRCS 2014	Residential on-site sewage system calculation	
RCIM	Total nitrogen per person per day	EPA 2002a	Residential on-site sewage system calculation	

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Section	Data	Source	Use	Concerns
RCIM	Denitrification in septic	EPA 2002a	Residential on-site sewage system calculation	
RCIM	Total nitrogen content of septage	EPA 1994	Residential on-site sewage system calculation	
RCIM	Average size of septic tank	WAC 246-272A-0232 (On-site…2005)	Residential on-site sewage system calculation	Actual sizes of septic tanks are unknown, the assumption that each tank meets or is equal to the minimum requirement may not be valid.
RCIM	Septic tank pumping frequency	GWMA Survey "Well Assessment Survey" EPA 2002b	Residential on-site sewage system calculation	Survey of GWMA residents is voluntary and not necessarily geographically dispersed.
RCIM	Number of migrant workers	USDA NASS 2014 Prorated total Yakima County number by crop acres within GWMA ESD 2015	Residential on-site sewage system calculation	Proration of migrant workers by crop acres may not be valid, some crops require migrant workers and others do not.
RCIM	Design capacity, location, and times of use for LOSS	Washington Department of Health GIS Department	Large on-site septic system calculation	
RCIM	Average loading generated by toilet flushing	EPA 1992	Large on-site septic system calculation	Value may be outdated considering new technology.
RCIM	Design flow for LOSS	WAC 246-272B 06450(4) (b) (Large…2011)	Large on-site septic system calculation	No actual measurements of flow from LOSS system.
RCIM	Locations of COSS	WSDA DNMP number of CAFOs in GWMA	Commercial on-site septic systems calculation	Assumes all COSS are on CAFOs and that every CAFO has a COSS.

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Section	Data	Source	Use	Concerns
RCIM	Number of employees using COSS	Reed 2004	Commercial on-site septic systems calculation	Assumes COSS at CAFOs in Yakima Valley will be the same as those in California.
RCIM	Area of maintained lawn areas	ArcMap Spatial Analysis by Yakima County	Residential lawn fertilizer calculation	Tool may misidentify some areas as lawn and miss other areas.
RCIM	Lawn fertilization frequency and rate	Scott's Turf Builder	Residential lawn fertilizer calculation	Assumes proportion of residents who fertilize Assumes that residents who fertilize follow fertilizer guidelines.
RCIM	Number of hobby farms	ArcGIS model developed by Yakima County	Small-scale commercial and hobby farms calculation	Potential for model error.
RCIM	Fertilizer application for hobby farms	RCIM Work Group	Small-scale commercial and hobby farms calculation	Potential bias in data from RCIM workgroup.
Atmospheric Deposition	Atmospheric Deposition	Dr Ranil Dhammapala EPA 2016	Atmospheric deposition estimates over GWMA	Few deposition monitoring stations: may not accurately reflect deposition in GWMA

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Appendix B: Lagoon Nitrogen Concentration Statistical Analysis

Descriptive statistics were calculated for the two datasets for comparison purposes; a summary of these statistics is displayed in Table 33. With the exception of the maximum, standard deviation, and sample size all values in the EPA data set were higher than those in the SYCD data.

Table 33. Comparison of EPA and SYCD lagoon N concentration (mg N/L)

	EPA	SYCD	Combined
Sample Size	15	23	38
Minimum	290	180	180
Q1	1000	355	455
Median	1400	768	1028
Mean	1212	949	1054
Mode	1200	336	1200
Q3	1600	1092	1401
Maximum	1800	3633	3632
Standard Deviation	492	802	702

Figure 14 displays the data from both sources on one boxplot. Two measurements in the SYCD data set are classified as outliers because they exceed 1.5 times the interquartile range (the difference between the 1st and 3rd quartile). These measurements are displayed as small circles in the figure.

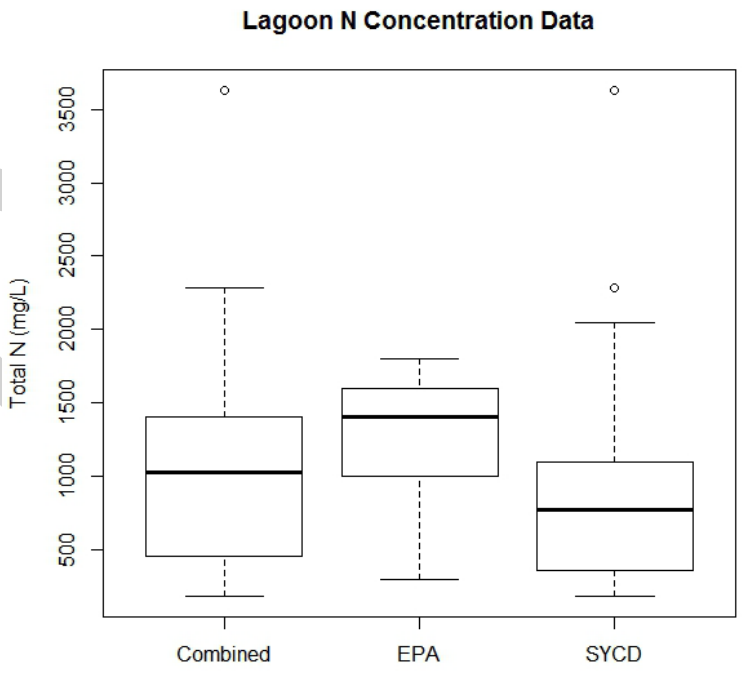

Figure 14. Boxplots of EPA and SYCD lagoon N concentration data

Appendix C: Lagoon Surface Area Reduction Methodology

Manure storage lagoons are constructed with sloping interior and exterior sides. As a result, a change in the liquid level within the lagoon changes the liquid surface area. Since liquid surface area was used as an input in the Darcy's law calculations in the CAFO section, it was necessary to calculate the needed adjustment to surface area based on the average lagoon capacity that was used to adjust the lagoon design depths. When DNMP conducted the lagoon assessment, the site information recorded was surface area, based on delineation of the lagoon perimeter, and side slope for lagoons where the liquid level was low enough to allow determination of side slope. The following diagram (Figure 15) shows a profile (side) view of a typical manure storage lagoon. In this diagram (which is not drawn to scale) the vertical dimension has been increased to show the liquid level and side slopes, which were used to adjust the surface area. The excavation depth H is used with the liquid depth D to determine what reduction in surface dimensions (length, width, and surface area) is necessary based on the side slope X. The interior side slope (often written as a proportion, X:1) determines the amount of lateral shift (X) for every 1-unit change in height. This determines the total reduction in a horizontal dimension; the difference between the excavation depth H and the liquid level D (H-D) is multiplied by the horizontal translation in side slope for every 1-unit reduction in height, which would be multiplied by two to find the total reduction in one horizontal dimension (length or width):

$$(H - D)X$$



Figure 15. Profile view of typical manure storage lagoon construction. Not drawn to scale; the vertical scale on this diagram is exaggerated to show the side slopes and liquid level clearly.

This surface area adjustment depends on the typical liquid depth, the interior side slope, and also on the lagoon shape in plan view (from the top). Reducing the depth of a round lagoon from the full design depth to 43% of the full design depth would reduce the full surface area by a different proportion than the same reduction for a rectangular lagoon, for example. In order to estimate this surface area reduction it was necessary to generally characterize the range of lagoon shapes represented. The GIS data was informally reviewed; the vast majority of dairy lagoons had plan outlines ranging from a square to a rectangle with length equal to twice the width (L = 2W). Other shapes represented were largely regular rectangles with proportions of length greater than twice the width (from L = 3W to L = 5W). Less than 5 lagoons were triangular; these other shapes (long rectangles and triangles) were an estimated less than 10% of the lagoons in the study. Because of this relative uniformity in shape, surface area reductions were calculated for only two shapes: square and L = 2W rectangle. These calculations provided enough information about the trend that the surface area reduction would follow to make a conservative estimate. In order to do these

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sample calculations it was necessary to determine an example depth, surface area, and side slope to work with. The values used were derived from the field measurements taken during the DNMP's lagoon assessment process. Note that numbers are reported in these examples to 4 decimal places and rounded at the end, corresponding to the method used for the actual calculations in which all digits were retained during the calculation.

Average surface area at full capacity: 70659.7289 ft^2 (n = 90)

Average depth at full capacity: 11.3029 ft (n = 105)

Average side slope: 3:1 (n = 99)

Average depth at reduced capacity:

$$0.4326 \times 11.3029\ ft = 4.8896\ ft$$

A typical square lagoon with these average values is used for a sample calculation. The following diagram (Figure 16) shows the parameters needed for the calculation: surface area at full capacity is used to calculate side length. Side length at full capacity is then used to calculate side length at reduced capacity, which is used to calculate surface area at reduced capacity. The percent reduction is based on the surface area at full capacity and the surface area at reduced capacity.

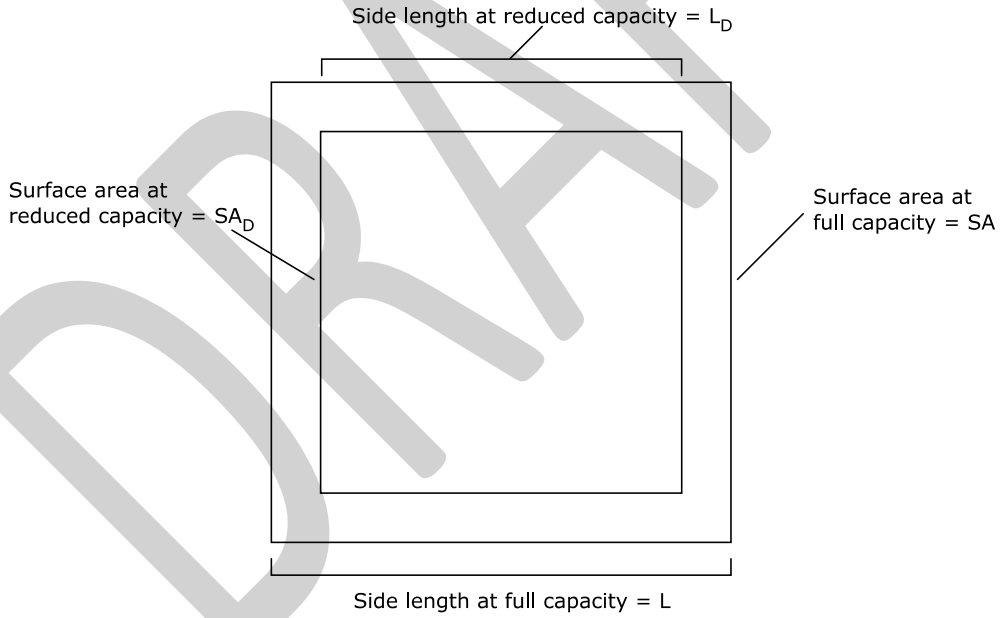

Figure 16. A typical square manure storage lagoon, with side length and surface area shown at both full and reduced capacities

$$SA = 70{,}659.7289\ ft^2, surface\ area\ at\ full\ capacity$$

$$SA_D = Surface\ area\ at\ reduced\ capacity, unknown$$

$$L = \sqrt{SA} = 265.8190\ ft$$

$$L_D = L - 2(H - D) = 265.8190\ ft - 2((11.3029\ ft - 4.8896\ ft)3) = 227.3395\ ft$$

$$SA_D = L_D^2 = 51{,}683.2623\ ft^2$$

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$$\frac{SA_D}{SA} = 0.7314; 73\%\ reduction$$

A typical rectangular lagoon (L = 2W) with the same average values for surface area at full capacity, depth at full capacity, reduced depth, and side slope was used for the same calculation (Figure 17).

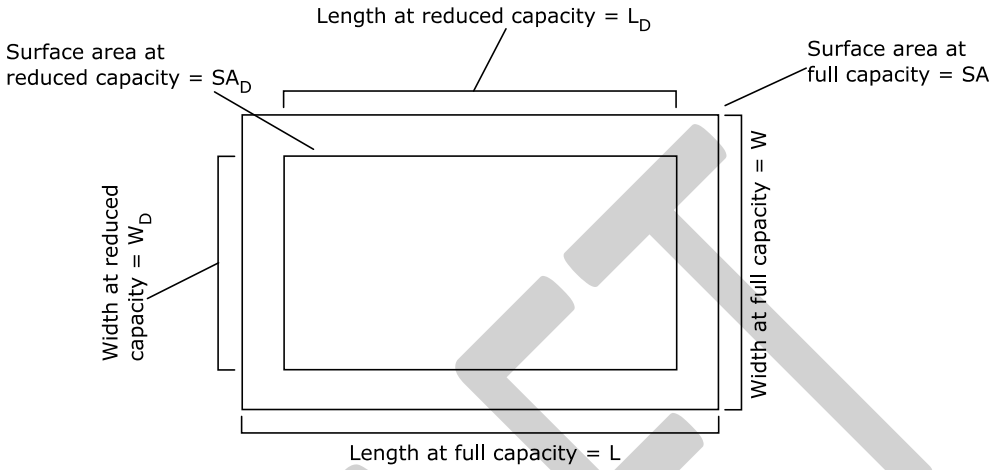

Figure 17. A typical rectangular manure storage lagoon, showing length, width, and surface area at full and reduced capacities

$$SA = 70{,}660\ ft^2, surface\ area\ at\ full\ capacity$$

$$SA_D = Surface\ area\ at\ reduced\ capacity, unknown$$

$$W = \sqrt{\frac{SA}{2}} = 187.9624\ ft$$

$$L = 2 \times W = 375.9248\ ft$$

$$W_D = W - 2(H - D)X = 187.9624\ ft - 2((11.3028\ ft - 4.8896\ ft)3) = 149.4830\ ft$$

$$L_D = L - 2(H - D)X = 375.9248\ ft - 2((11.3028\ ft - 4.8896\ ft)3) = 337.4453\ ft$$

$$SA_D = W_D \times L_D = 50{,}442.3290\ ft^2$$

$$\frac{SA_D}{SA} = 0.7139; 71\%\ reduction$$

Based on the preceding calculations, the surface area reduction due to the depth reduction used to adjust the depths for the Darcy's law calculation is 73% for a square lagoon and 71% for a rectangular lagoon. Additional longer, thinner rectangular lagoons would continue the same trend, with a larger surface area reduction due to the depth reduction. As a result, the 73% reduction was chosen to adjust the surface areas for Darcy's law in order to use the most conservative value available.

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Appendix D: Darcy's Law Example Calculation

Darcy's Law

$$Q = k * \frac{(H + d)}{d} * A$$

Where:

Q = the calculated volumetric flow rate (L^3/T)

k = coefficient of permeability (hydraulic conductivity, either $1x10^{-7}$ or $1x10^{-6}$ cm/s) ($L^3/L^2/T$)

d = thickness of soil liner (estimated at 1 foot) (L)

H = vertical distance between top of liner and top of liquid storage (L)

A = lagoon area (L^2)

L=length

T=time

$$N\ Loading = Q * C$$

Q = volumetric flow rate calculated using Darcy's Law (L^3/T)

C = Total N concentration, 1053 mg N/L

Example Calculation

Inputs:

k= $1x10^{-7}$ cm/s= $1x10^{-9}$ m/s (low range hydraulic conductivity)

d= 1 ft = 0.3048 m

H= 11.3028 ft = 3.4451 m * 0.4326 = 1.4903 m

A= 70659.7289 ft^2 = 6467.5036* 0.7314 = 4801.5322 m^2

C= 1052.6965 mg N/L = $10.526965x10^{-4}$ kg N/L

Darcy's Law:

$$Q = 1x\ 10^{-9} \text{m/s} * \frac{(1.4903\ \text{m} + .3048\ \text{m})}{.3048\ \text{m}} * 4801.5322\ \text{m}^2$$

$$Q = 2.8279 \times 10^5\ \text{m}^3/\text{s}$$

$$Q = 2.8279 \times 10^5\ \text{m}^3/\text{s} * \frac{86400\ \text{s}}{\text{day}} * \frac{365\ \text{day}}{\text{year}} = \mathbf{891.8085\ m^3/year}$$

Potential N Loss:

$$\text{N Loss} = 891.8085\ \text{m}^3/\text{year} * 10.526965x10^{-4}\ \text{kg N/L} * \frac{1000\ \text{L}}{\text{m}^3}$$

N Loss = 938.8037 kg N/year **= 939 kg N/year**

N Loss = 938.8037 kg N/year * 1 ton/907.1848 kg =1.0348 tons N.year = **1 ton N/year**

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Appendix E: Sensitivity Analysis on Darcy's Law

In order to identify which inputs to the Darcy's law calculation would have the greatest influence on the calculation's result, WSDA conducted a sensitivity analysis. Each input parameters was evaluated (keeping all other parameters constant) at a range of values Figure 18). Average parameters were used for this analysis, and then the outcome flow was evaluated for variation in each parameter individually (while the other parameters were held constant). Each parameter was evaluated for a range from 75% of the average to 125% of the average, with step sizes of 5%.

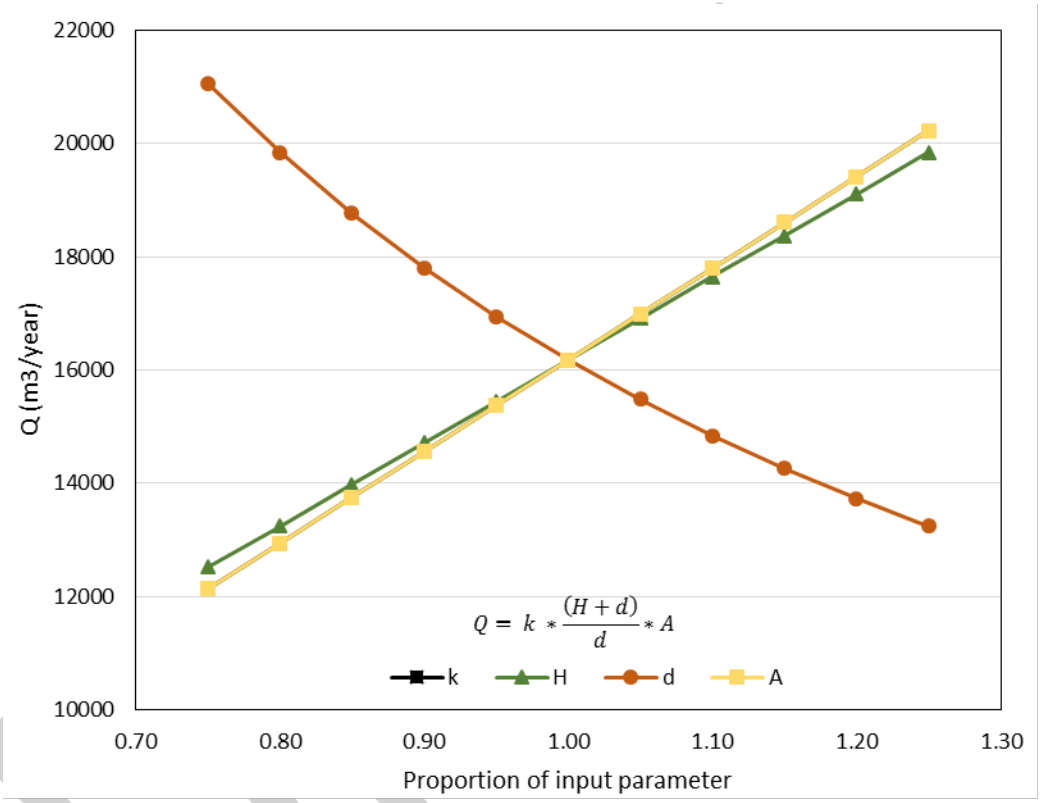

Figure 18. Results of sensitivity analysis on Darcy's law

As a result, NRAS concluded that the flow resulting from Darcy's law, calculated for an individual lagoon, is equally sensitive to all inputs. Permeability (k), surface area (A), and depth (H) are directly proportional to flow. K is invisible because it is hidden by one of the other parameters. Liner thickness (d) is inversely proportional to flow.

Appendix F: Irrigation Water Use

Source: Jim Davenport, Stuart Turner								
	Water Duty (in/acre)	Water Duty (in/acre)	Water Duty (in/acre)	**Water Duty (in/acre)**	**Water Duty (in/acre)**	**Water Duty (ac-ft/ac)**	**Water use (liters/ac)**	**Irrig water lb N/ac (based on 0.809 mg N/L, USGS 2012)**
Location	Yakima	Sunnyside	Prosser	**Average**	**Stu's #'s***	**Average**		
Total Precip (in)	7.98	6.70	7.74	7.47				
Effective Precip (in)	3.04	3.00	3.40	3.15				
Crop Type								
Silage Corn	28.20	29.31	28.13	28.55		2.38	2934316.238	5.23
Field Corn (Grain)	28.20	29.31	28.13	28.55		2.38	2934316.238	5.23
Triticale				28.55		2.38	2934658.872	5.23
Apple	42.42	44.37	42.42	43.07	30.00	2.50	3083704.594	5.50
Grape, Juice	26.14	27.35	26.04	26.51		2.21	2724966.959	4.86
Alfalfa Hay	35.31	37.01	35.30	35.87		2.99	3687425.426	6.58
Pasture	37.29	39.07	37.30	37.89		3.16	3894376.268	6.95
Cherry	42.94	44.94	42.92	43.60	30.00	2.50	3083704.594	5.50
Grape, Wine	26.14	27.35	26.04	26.51		2.21	2724966.959	4.86
Hops	29.52	30.76	29.39	29.89		2.49	3072397.677	5.48
Pear	39.25	41.09	39.21	39.85		3.32	4096187.602	7.31
Wheat	22.67	24.35	22.85	23.29		1.94	2393982.666	4.27
Mint	34.35	35.93	34.32	34.87		2.91	3583950.006	6.39
Asparagus**				0.00		0.00	0	0.00
Nectarine/Peach***	39.81	41.70	39.76	40.42		3.37	4155120.623	7.41

Washington State Irrigation Guide, Appendix A, Climatic Stations for Consumptive Use, WA210-VI-October 1985

*Stu Turner best professional judgement numbers are used for water duty for apples and cherries.

**No data

***Washington State Irrigation Guide, Appendix A, Climatic Stations for Consumptive Use, WA210-VI-October 1985 (added by WSDA)

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Appendix G: Nitrogen Uptake Estimates

Source: Jim Trull, SVID, Scott Stephens

ESTIMATE OF NITROGEN USAGE FOR AGRICULTURAL PRODUCTION IN THE GWMA

Crop	Typical Yield[1]/Acre	Yield (Scott)[4]	Nitrogen Removed in Harvested Portion of the Crop - (lbs/acre)	Removal (Scott)[4]	Reference[3]	Nitrogen Uptake in Plant in Growing Cycle (lb./acre)	Uptake (Scott)[4]	Estimate of Nitrogen Applied[2] (lbs/acre)	Range		Scott's opinion[4]	Yield parameters[4]
									Production	Application		
Silage Corn	30 tons	30	250	270	A		250-290	250	25-40	12-592	22-40	Tons at 68% moisture
Grain Corn	4-8 tons	6-6.5	186	170-190	A	214	290-325	250	2.5-8.0	90-375	5.5-8	Tons Grain weight
Triticale	8 tons	7.5-8	455	190-210	B		200-225	0-100	5.0-15	0-575	6-10	Tons at 50% moisture
Apples	20 tons	20	120	40-60	A		80-120	50-100			15-40	
Grapes, Juice	10 tons	10	125	20-40	A		80-100	80			8-16	
Alfalfa Hay	8 tons	8	448	400	A	449	480				7-11	Tons at 15% moisture
Pasture	6 tons	6	300	270	A		270+				5-7	Tons at 15% moisture
Cherries	5 tons	5-6	95	25-40	A		60-100		4-8	30-50	4-8	
Grapes, Wine	6 tons	6	100	15-30	A		50-65	83	2.5-5.0	0	4-8	
Hops	1 ton	1.25	180	150-250	A		200-300		0.3-1.5	150-175	1-1.8	
Pears	20 tons	25	85	40-60	A		80-160		20-27.5	150	18-35	
Wheat	120 bu	125	175	187	A	226	275		65-120	90-213	115-140	

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Crop	Typical Yield[1]/Acre	Scott's opinion	Nitrogen Removed in Harvested Portion of the Crop - (lbs/acre)	Removal (Scott) See References below	Reference[3]	Nitrogen Uptake in Plant in Growing Cycle (lb./acre)	Uptake (Scott) See references below	Estimate of Nitrogen Applied[2] (lbs/acre)	Range		Scott's opinion	Yield parameters
									Production	Application		
Mint	160 lb	160	160	280	D		280-320		68-70	0-275	140-180	
Asparagus	3000 lb	3500	95	20	A		50				?	
Nectarine/Peach	15 tons	15	95	50	A		95				?	

[1]. SYCD and IAWG

[2]. Various sources

[3]. References: A-Western Fertilizer Handbook; B - NRCS Crop Nutrient Tool; C-SYCD; D- WSU Fertilizer Guides

[4]. Reference from the following resources:

International Plant Nutrition Institute (ipni.net)

USDA Crop Nutrient Tool

Potash Corp (http://potashcorp-ekonomics.com/)

(wfsag.com) Potach and Phosphate Institute-Agriliance

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January 4, 2017

Mark Clark
Executive Director Washington Conservation Commission
PO Box 47721
Olympia, WA 98504-7721

mclark@scc.wa.gov

Dear Director Clark,

Friends of Toppenish Creek is a 501 C(3) non-profit group in the Yakima Valley with a focus on the environmental and public health impacts from abuses by mis-managed industrial agriculture. We address air and water quality issues in our community and actively participate in the Lower Yakima Valley Groundwater Management Area (GWMA) advisory committee.

In that capacity we interact with the South Yakima Conservation District on a monthly basis. SYCD states, "Our primary goal is to promote the wise use, development, and conservation of our renewable natural resources in our district by providing assistance to local landowners to solve conservation resource problems."

This is a letter of complaint against the Director for the SYCD, Laurie Crowe. Ms. Crowe has repeatedly told members of the GWMA that manure composting operations in the valley do not leach pollutants to the groundwater because the heavy equipment that is involved in composting compacts the soil. As recently as December 1, 2016, at a meeting of the GWMA CAFO/Livestock Work Group, she stated that there is a "manure seal" that prevents leaching from compost yards.

Steve George tells us, and Ms. Crowe concurs, that Yakima dairy composting operations have pipes and drains that direct leachate to lagoons. This is simply not true. Many, many composting operations are located far from lagoons and ponds.

Since last summer FOTC has been aware of deep soil testing that demonstrates leaching of nitrates, ammonia, and total nitrogen well below the bare soils that make up the "floors" of the compost yards. However, we recently learned of more egregious pollution on a 15 year old compost yard where nitrogen readings are as high as 256 ppm at 12 feet of soil depth. The results are attached.

Because the SYCD is funded by taxpayers, this organization has the statutory obligation to know the most current results of soil testing and research. Sadly, the SYCD, although closely involved in discussions and analyses of manure management, seems to be unaware of this important information.

Nevertheless, Laure Crowe has sat at the GWMA table and consistently given inaccurate information to meeting members. We relied on her, as a nutrient management expert, to give us the facts. If she did not know about this data, she was not doing her job. If Ms. Crowe did know and chose to give incorrect information, then her behavior is borderline criminal and unethical.

With this evidence in hand, we assert that Ms. Crowe does not act in good faith, that she has "hijacked" the conservation goals of the SYCD, and has used her position of authority to shield polluting dairies and promote pollution of the groundwater in the Yakima Valley.

We respectfully ask the Washington State Conservation Commission to investigate, discipline Ms. Crowe and take measures that ensure honest and ethical actions from the South Yakima Conservation District that promote conservation of natural resources including soil, air and water. We are prepared to talk about this issue in greater depth.

Sincerely,

Jean Mendoza

Executive Director, Friends of Toppenish Creek

3142 Signal Peak Road
White Swan, WA 98952

509-874-2798

STATE OF WASHINGTON
CONSERVATION COMMISSION
PO Box 47721 • Olympia, Washington 98504-7721 • (360) 407-6200 • FAX (360) 407-6215

February 21, 2017

Jean Mendoza
Executive Director, Friends of Toppenish Creek
3142 Signal Peak Road
White Swan, WA 98952

Dear Jean:

As you requested in your letter of January 4, 2017, Conservation Commission staff investigated the discussions occurring at the December 1st, 2016 meeting of the GWMA CAFO/Livestock Work Group regarding your concerns about representations made by South Yakima Conservation District staff. We also obtained and reviewed the notes from the meeting you reference.

The conversations with meeting participants and review of the meeting notes corroborate your disagreement at the meeting with Laurie Crowe's statements regarding "manure seal" that prevents leaching from compost yards. However participants did not agree with your assertions of misconduct on the part of Ms. Crowe that would require discipline by her board of supervisors as you suggest.

Disagreements and productive discussion over data, research, and technical standards are not foreign to working groups engaging with land owners on complex natural resource issues. Other members of the working group mentioned they previously received letters of complaint against them by your organization regarding technical standards and data used at previous meetings. This suggests disagreements have occurred at prior meetings and points to the challenges on these issues. Be assured that conservation districts utilize scientifically developed and peer reviewed standards and specifications of the USDA Natural Resources Conservation Service and rely on the research related to the development of those standards. This information can be provided to your organization if you wish.

Concerning your request to discipline Ms. Crowe, it might be helpful for me to describe the relationship between the Conservation Commission and conservation districts. Each of the 45 conservation districts are independent political subdivisions of the State of Washington and operate from policies and procedures that are developed in each district. As such, the Conservation Commission has no disciplinary authority over conservation district staff. I have instructed Conservation Commission staff to share your complaint and background information to the Board of Supervisors of the South Yakima Conservation District for any further action they deem appropriate.

I also offer facilitation assistance from Conservation Commission staff if the Friends of Toppenish Creek board members would desire a meeting with the South Yakima Conservation District to discuss this or other issues that need attention between the two organizations. Please contact me if we may be of assistance.

Sincerely,

Mark Clark,
Executive Director

STATE OF WASHINGTON
CONSERVATION COMMISSION
PO Box 47721 • Olympia, Washington 98504-7721 • (360) 407-6200 • FAX (360) 407-6215

March 17, 2017

Jean Mendoza, Executive Director
Friends of the Toppenish Creek
3142 Signal Peak Road
White Swan, WA 98952

Dear Jean,

The Commission has received your letter dated March 5, 2017. Your letter requested the names of members from the Lower Yakima Valley Groundwater Management Area (GWMA) CAFO/Livestock work group who were consulted during our investigation. The following members were interviewed: Steven George – Farm Bureau, David Bowen – Ecology & Chair of GWMA CAFO/Livestock Work Group, Gary Bahr – WSDA, and Elizabeth Sanchey – Yakima Tribe.

We are aware of the complaint raised several years ago by the FOTC regarding South Yakima. As noted in my February 21, 2017 letter, we have shared your complaint and your willingness to meet with the Board of Supervisors of the South Yakima Conservation District. They will contact you for any further action they may deem appropriate.

For questions regarding NRCS standards and specifications, I suggest a contact with the NRCS State Office staff specializing in the practices you or the GWMA committee have questions about.

Sincerely,

Mark Clark
Executive Director

Confined Animal Feeding Operations (CAFOs)

Water Quality Requirements:

What laws or rules apply to DAFOs in regard to water quality, specifically groundwater protection?

Federal and State regulators and local Conservation Districts have a zero water discharge policy for dairies:

- Federal Clean Water Act
- Washington State Dairy Nutrient Management Plan (DNMP)
- Washington State water Quality Standards for surface and Groundwater; and
- Washington State Solid Waste Handling Requirements

Federal Clean Water Act:

40 CFR part 122 – defines CAFOs, any size operation that confines animals for more than 45 days on non-growing surface. Facility has to have a permit if they have a discharge or propose discharge to surface waters of the state. The proposed combined permit will encompass groundwater. Discharges must meet criteria and cannot be excessive.

Washington State DNMA:

(WSDA) All dairies must comply (RCW 15.36). In place to protect surface and ground waters (RCW 90.64.026) Dairy producers that have a grade A license to sell milk must develop an DNMP that is approved and certified by conservation district. BMPs must follow NRCS specs. RCW 90.48 does not allow discharge to surface or groundwater

and is much more restrictive than the federal CWA. Dairies must keep application records, perform soil testing and adhere to maximum N levels in their fields.

Washington State Water Quality Standards for Surface and Groundwaters: (Ecology)

Applies to everyone regardless of industry.

Washington State Solid Waste Handling Requirements: (Ecology)

The current solid waste rules are in the process of being updated and may have some impact to dairies and others who generate manure. Currently, ag inputs are exempt from this statute. Ag inputs must be used at agronomic rates.

Practices pertaining to water quality protection in Yakima County:

The following are practices that dairy producers employee to prevent surface or groundwater contamination on the dairy foot print:

1. Sites engineered to have slope to a central collection site location

2. Catch basins for effluent at low spot on dairy

3. Manage effluent in catch basins or piped to lagoon – liquid evaporates, periodic removal of solid materials

4. Corral management: Packed and groomed

A) Grooming to prevent low spots that could accumulate water; fill holes to keep pen surface integrity

B) Haul bulk materials away as needed, generally composted

C) Clean solid material from under fence lines as needed

D) Animals fed on impervious surfaces

5. Feed management: Most feed that has excess moisture is kept on impervious surfaces such as concrete silage bunkers. Any excess moisture fed into catch basins or lagoon. Rations balanced by professional nutrition specialist that prevents excessive intake that reduces animal waste.

6. Lagoon Management: Solids reduction to limit volume and N and P concentrations going into lagoon. New technology includes centrifuge and floating filtration separation that takes out over 90% of solids. Concrete settling basins used in-line with this technology. Better separation reduces lagoon volume that translates into the dairy needing less lagoon space. Lagoons are engineered and most have clay liners. A few newer ones have put in synthetic liners. New permit will require testing of all existing lagoons. After solid separation, left over liquid is pumped or trucked to ag fields. This material generally runs less than 1% N per volume. Bio filter is new technology in testing that would add additional extraction of solids leaving 99% pure water.

7. Compost Areas: 75% of manure generated is composted which reduces the volume by 50%. Over 50% of this compost is exported out of Yakima County. (Information from WSDA, SYCD and Organix). Compost yards are placed on packed surfaces and are continually repacked by the use of large trucks and tractors running over them while hauling material in, out and turning compost. Compost areas do not generate moisture and during the summer must have moisture added to operate properly. Areas are kept smooth and flat to prevent ponding. Water is not applied that ponds up or runs off the compost area, but if water were to run off, it would be captured with the rest of the dairy's water.

This is a verbatim copy of a document that was prepared and shared by Steve George and Laurie Crowe with the Lower Yakima Valley Groundwater Management Area in November 2016.

EPO's Accomplishments Timeline
2012-2017

2012

1. EPO develops the Education and Public Outreach (EPO) Plan as required under WAC 173-100-090 (1) Groundwater advisory committee.
2. December 12, 2012 - GWAC approves the outreach plan; Yakima County submits it to the Department of Ecology.

***2013 - EPO Implements Education and Outreach Plan**

3. EPO creates GWAC logo options for GWAC consideration.
4. March 13, 2013 - GWAC approves a GWMA logo, which is used for all subsequent outreach materials, including but not limited to the website, letterhead, news releases, outreach flyers, program banner, and billboards.
5. **Public Awareness Survey.** GWAC contracts with Heritage University to conduct bilingual door-to-door surveys in the GWMA. EPO designs survey to gauge the public's awareness of the nitrate issue and its potential health impacts. (Work included but was not limited to creating the survey content and packets, mapping the areas to be surveyed, training 16 Heritage University students to conduct the survey, troubleshooting issues, conducting quality control of the survey methods, and entering data into a spreadsheet.)
    a. **Outreach results:** 300 Direct Bilingual Contacts (direct mail, in person, flyers) to households in the GWMA.
    b. 136 surveys completed
    c. Spanish/English news releases issued to media (pre-and post-survey).
    d. EPO issues survey results and posts to the website.
6. **Health provider outreach.** Over 200 healthcare providers receive nitrate-related health information and a survey asking them if they have observed symptoms of methemoglobinemia in their maternal or infant patients (English).
7. July 18- Commissioner Rand Elliott and Andy Cervantes make a presentation to the Central Family Medicine Residency Program on the GWMA and nitrates.
8. September - EPO creates script for—and GWAC/EPO member Andy Cervantes participates in—an Hispanic Affairs Commission "Connect with Your Government" Spanish-language statewide radio talk show to increase awareness about the GWMA

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9. **December -** Commissioner Elliott gives a presentation on the GWMA, and seeks support of the upcoming well assessment survey, to the Community Advisory Board for El Proyeto Bienestar
10. **December-High Risk Well Assessment Survey Phase I** EPO Creates a survey instrument and develops an outreach campaign for a well assessment survey in the target area. (Wrote and released bilingual materials including PSA's, a direct mail piece, GWAC Chair letter to area newspapers; explored ministerial outreach to churches)
11. **GWMA website.** EPO develops and launches a community website that offers information about the committee, its meetings and information on nitrate-related topics.

***2014-**

12. January-EPO issues a news release announcing the GWAC's accomplishments
13. EPO updates the website and maintains it in "real time" from its inception to the present (English)
14. EPO continues outreach for High Risk Well Assessment Survey Phase I
    April 7 - issues a news release announcing that the survey deadline has been extended
15. **New Mom Campaign**
    a. EPO develops and obtains GWAC approval for new mom messages to be distributed in hospitals and clinics.
    b. EPO prints and distributes over 2000 English/Spanish new mom flyers to hospitals, clinicians and at health fairs and community events (including but not limited to Zillah Days and Granger Agricultural bilingual event)
    c. **EPO seeks and obtains partnership with the University of Washington's** Pediatric Environmental Health Specialty Unit (PEHSU) to collaborate on the New Mom campaign
        i. PEHSU conducts clinician trainings in Yakima and Lower Valley to raise clinician awareness of nitrate issue, resources and treatment
        ii. PEHSU obtains authorization to offer Continuing Education Units (CEU) to participating healthcare providers.
        iii. PEHSU creates and distributes Clinician Training video
        iv. Nitrate/new mom materials posted to PEHSU's national website
16. **GWAC educational materials**: EPO creates and obtains GWAC approval of GWAC slide deck (GWAC background information and nitrate education series); posted to website

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17. **May - Deep Soil Sampling Launched.** EPO partners with Irrigated Ag working group to promote program.
18. May 2 - EPO issues a bilingual news release reminding households of the May 31 deadline to participate in Phase I Free Well Testing.

19. **Phase I of the High Risk Well Assessment Sampling Surveys is completed** (172 Total)

    a. **Outreach:** Bilingual outreach included multiple presentations to Sunnyside Workforce clients, talk show participation on Spanish and English radio stations, paid advertisement on Spanish and English-language radio, 600 Spanish-English direct mail pieces, and GWAC Chair editorial outreach published in area English and Spanish papers.

20. GWAC approves a two-year outreach budget developed by the EPO

TOTAL $267,000:

o Abandoned Wells and Septic System Maintenance	$76,000
o Educational Outreach Campaigns	$54,000
o Wellhead Risk Assessment Surveys-Phase 2	$100,000
o Redesign and Maintain GWMA Website	$12,000
o Community Outreach Surveys	$25,000

21. EPO releases the High Risk Well Assessment results.

22. EPO prints and distributes 2000 double-sided English/Spanish New Mom Flyers at health fairs in Prosser, Yakima and other outlets.

***2015 –**

23. **EPO rebuilds and launches the new GWMA website**
24. **High Risk Well Assessment Follow-up** EPO communicates test results, prevention messages and GWAC information to high risk well assessment participants (171 unique mail pieces in English and Spanish)
25. EPO evaluates and reports back to the GWAC regarding the Phase I High Risk Well Assessment results. They agree that the data show a great need for well owners to be familiar with their wells, and to test their wells more frequently.
26. EPO announces Phase II Well Assessment survey. EPO's goal is to complete 200 sampling surveys.

DRAFT

EPO agrees to use Phase I methodology for messaging in Phase II. Targets: areas of known high nitrate, areas where little nitrate data exists. Direct mail list is increased from 600 (Phase I) to 1000 in Phase II.

27. Phase II outreach continues. December-EPO evaluates its outreach methods (direct mail, radio advertising, flyers and newspaper coverage.) Response from survey participants indicates that direct mail is the most cost-effective method of eliciting participation. Accordingly, EPO plans a second direct-mail release in January 2016.

***2016**

28. County sends 115 results letters to recent well assessment participants with their certified lab results and educational materials. January-350 additional household invitation letters are sent.

29. January and March-news releases inviting well assessment participation are released.

30. March 31-Phase II high risk well assessment survey closes.

31. April-the County mails the last round of results letters to the Phase II well assessment participants with their certified lab results and educational materials. The letters included handouts on nitrate, coliform, and private well and septic system maintenance.

32. EPO Completes Phase II of the High Risk Well Assessment Sampling Surveys (289) for a total of 466 completed surveys (Phase I-177 + Phase II-289).

a. **Outreach:** Bilingual outreach included multiple presentations to Sunnyside Workforce clients, talk show participation on Spanish and English radio stations, paid advertisement on Spanish and English-language radio, 600 Spanish-English direct mail pieces, and GWAC Chair editorial outreach published in area English and Spanish papers.

b. **Follow-up** County communicates test results, prevention messages, septic system maintenance and GWAC information to high risk well assessment participants (289 unique mail pieces in English and Spanish)

33. *GWAC/EPO participate in five Fred Hutch-sponsored health fairs (Sunnyside, Mabton, Zillah, Granger and Toppenish) between May and August 2016.

Volunteers make bilingual, one-on-one contact with approximately 250 lower Valley residents.

Information on private wells, nitrate in groundwater, new mom flyers is distributed to visitors.

Visitors are also asked to complete the GWAC's public survey.

DRAFT

Residents on private wells are offered nitrate test step strips for a "do-it-yourself" drinking water test. Self-addressed stamped envelopes are included with the test strips so people can return their test results directly to Yakima County.

34. EPO develops, presents and receives GWAC approval to launch a "Test Your Well" English/Spanish billboard campaign in the Lower Yakima Valley.

35. December - first billboard goes live in the LYV GWMA.

***2017**

36. January - Second of two "Test Your Well" Billboards Goes Live

37. EPO creates, translates and posts five "**What You Can Do**" flyers to the GWMA website.

38. EPO Launches a "What You Can Do to Protect Well Water" (English/Spanish) Campaign
(in response to wide-spread local flooding, especially in the unincorporated community of Outlook) March & April 2017

- "What You Can Do to Protect Well Water" flyers "(English/Spanish) and test trips distributed door-To-door in Outlook (Yakima Health District).
- 12,000 What You Can Do to Protect Well Water flyers inserted in the Sunnyside Daily Sun News on March 29, 2017
- 10,700 flyers inserted in the Spanish-language *El Sol* weekly publication on March 30, 2017
- KDNA news show participation – April 4, 2017 (Andy Cervantes and Ignacio Marquez)
- KIT interview-March 30, 2017 (Commissioner Rand Elliott)
- April 29- flyers distributed at the Sunnyside Walmart store

39. PEHSU New Mom Flyers
200 flyers are distributed to the Toppenish Community Hospital (restock order)

40. EPO Requests Working Groups to Complete an EPO Questionnaire
EPO asks all working groups to answer EPO's questions related to their mission, accomplishments, discoveries, target audiences and messages.

DRAFT

The purpose of this exercise is to help the EPO develop a short-and long-term (post adoption) Communications and Outreach Plan for the GWAC's consideration.
This information is compiled in a summary distributed to the GWAC.

41. June - EPO begins to develop its alternatives recommendations for the GWMA program.

- EPO requests GWAC assistance to identify specific messages and outreach it would like conducted.

DRAFT

CONDITIONAL USE PERMIT
FORM

FINAL
Revised 10/1/15

Yakima County Public Services
128 North Second Street · Fourth Floor Courthouse · Yakima, Washington 98901
(509) 574-2300 · 1-800 572-7354 · FAX (509) 574-2301 · www.co.yakima.wa.us

Please Answer the Following Questions *(Please attach a separate sheet if needed)*:

1. Are you applying for a: ☐ Type 1 ☒ Type 2 ☐ Type 3 ☐ Type 4
2. What is the proposed use, as listed in YCC Table 19.14-1? CAFO
3. What is the size of the subject property? (Amount of acreage or square feet): 73.3 A
4. What is the size and use of structures currently located on the property? SEE SITE PLAN
5. What is the size, height and use of structures proposed to be placed or constructed? SEE SITE PLAN
6. List other permits and approvals that will be required. BLDG Permits
7. Will the project be conducted entirely within a structure? ☐ Yes ☒ No
   If no, explain what outdoor activities would occur: CATTLE CORRALS
8. Total number of employees? about 25
9. How many parking spaces are you proposing? Existing: 25 Proposed: 25 Surface Type: gravel
10. Will you have a sign? ☐ Yes (if yes, please answer the following questions.) ☒ No
    a. How many signs are proposed? _____
    b. What is the square footage of the sign? _____
    c. What is the height of the sign? _____
    d. Will the sign be illuminated? ☐ Yes ☐ No
    e. If the sign is illuminated, how will it be illuminated? ☐ Internally ☐ Externally
    f. Where will it be located? _____
11. What is the name of the road that the proposed/existing access is located on? West Wapato Road
    a. Is the road a: ☒ County Road ☐ State Highway ☐ Private Road
       If the road is a private road, is there an existing Road Maintenance Agreement? ☐ Yes ☐ No
       (If yes, please provide a copy)
    b. Is the road constructed out of: ☒ Pavement ☐ Gravel ☐ Dirt
    c. How wide is the Right-of-Way/Easement? 50 ft
    d. How wide is the surface of the road? 28 ft
12. How will you manage storm water runoff? Retain on Site

13. Fencing (If applicable check both)? ☐ New ☐ Existing

a. Fence Material: DRILL STEM + SUCKER ROD

b. Will the fence be view obscuring fence? ☐ Yes ☒ No

c. Will you be placing barbed wire on the top of the fence? ☐ Yes ☒ No

d. What is the total height of the fence (including the barbed wire if proposed)? 60"

14. Are you proposing any site screening or landscaping? ☐ Yes ☒ No

If yes, what type and what is the location? _____

15. What is the proposed source of irrigation water? WAPATO Irrigation District.

16. What are the days & hours of operation? Days: 7 Hours: 24

17. Will the operation be seasonal? If so list months of operation: NO

18. Is any outdoor lighting proposed? ☒ Yes ☐ No

If yes, what is the proposed location(s)? Corral Lighting

19. What is the proposed source of domestic water?

a. ☐ Public Water: Name of provider: _____

b. ☐ Community Well: What is the well number: _____

i. Where is the well located? _____

ii. Is there an existing Well Maintenance Agreement? ☐ Yes ☐ No

(If yes, please provide a copy)

c. ☒ Individual Well

20. What is the proposed method of sewage disposal?

a. ☐ Public Sewer: Name of provider: _____

b. ☐ Community Septic System: Where is the septic system located? _____

c. ☒ Individual Septic System

d. ☒ Other explain: portable toilets

ANIMAL FEEDING OPERATION
FORM

FINAL
Revised: 10/1/15

Yakima County Public Services
128 North Second Street · Fourth Floor Courthouse · Yakima, Washington 98901
(509) 574-2300 · 1-800 572-7354 · FAX (509) 574-2301 · www.co.yakima.wa.us

Please Answer the Following Questions:

1. Are you proposing an:
   - ☐ Animal Feeding Operation (AFO)
   - ☒ Concentrated Animal Feeding Operation (CAFO)
   - ☐ Dairy
2. When was your Dairy Nutrient Management Plan last updated and approved? 2013
3. How many employees: Full Time: 25 Part Time: _____
4. Describe the type of deliveries to and from the property: Cattle, Feed, Milk Waste, Employees
5. What type of vehicles will be visiting the site? Passenger Vehicles, Trucks tractors
6. How many vehicle trips will be made to the property per day? about 40
7. What sign(s) are planned to be installed on the site? NONE
8. Where will the sign(s) be located? NA
9. Are you proposing any off-site sign(s) ☐ Yes ☒ No If yes, describe their location:

   _____
10. How many parking spaces are: Existing: 25 Proposed: 0
11. What is the existing/proposed surface type for the parking spaces? ☐ Paved ☒ Gravel
12. Where will the loading zone be located? ON THE FARM
13. How will storm water runoff be managed? retained on site
14. What type of fencing, screening or landscaping is proposed? Drill Stem + Sucker rod
15. Is any outdoor lighting proposed? ☒ Yes ☐ No

    If yes, describe the type and location: Corral Lighting, operations Lighting
16. Indicate the source of irrigation: WAPATO ID

17. What is the proposed source of domestic water?

- ☐ Public Water System (City, Nob Hill Water, County)
- ☒ On-site individual well
- ☐ On-site shared or community well Name: _____
  ID#: _____
  Location: _____
- ☐ Other: _____

18. What is the proposed method of domestic sewage disposal?

- ☐ Public Sewer System (City, County)
- ☒ On-site individual septic system
- ☐ On-site shared or community septic system Location: _____
- ☒ Other: portable toilets

19. How many gallons of water are expected to be used per day? 90,000

Please provide the following information in your attached narrative:

- ☒ Proposed methods of waste management
- ☒ Odor Control
- ☒ Vector Control
- ☒ Silage Management
- ☒ Track-Out Control
- ☒ Howe the waste water systems/lagoons are lined

CUP16-26

Public Services (BSR

APR 06 2016

Vern Gary Don Lynn
Dave Lisa Carmen

Castle Grove Dairy
Capital Improvements

Type II Review Submittal

Prepared by: B7 Engineering
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B7 job number 14109

Castle Grove Dairy
Capital Improvements

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Attention

Dairies and Feedlots are subject to the following RCW regarding sharing of information. If you are providing information to a member of the public make sure you are in compliance.

RCW42.56.610

Certain information from dairies and feedlots limited-rules.

The following information plans, records, and reports obtained by state and local agencies from dairies, animal feeding operations, and concentrated animal feeding operations, not required to apply for a national pollutant discharge elimination system permit is disclosable only in ranges that provide meaningful information to the public while ensuring confidentiality of business information regarding: (1) Number of animals; (2) volume of livestock nutrients generated; (3) number of acres covered by the plan or used for land application of livestock nutrients; (4) livestock nutrients transferred to other persons; (5) crop yields. The department of agriculture shall adopt rules to implement this section in consultation with affected state and local agencies.

[2005 c 510 § 5. Formerly REC 42.17.31923.]

Castle Grove Dairy
Capital Improvements

Introduction

The Castle Grove Dairy is owned by Case Vandenberg. The farm property is owned by CCC Farms LLC which is also controlled by Case Vandenberg as a land holding company which rents the farm property to the dairy. The main dairy is located on deeded parcels within the Yakima Indian Reservation bringing it under the jurisdiction of Yakima County regarding land use and building permits. The dairy is located about 8 miles west of Wapato, at 8053 West Wapato Road. The dairy operation affects five parcels totaling about 200 acres. The actual dairy operation occupies about 72.0 acres most of which occupies Parcels 181108-31001 and 32001.

The Castle Grove Dairy wants to add cow shades to new corrals, and waste management facilities. This not an expansion because the current milk production contract penalized excess production. These corrals and shelters are intended to improve herd health by reducing crowding. The benefits of the project includes better herd health.

The castle grove dairy is a concentrated animal feeding operation (CAFO) in the AG land use zone. Chapter 15 of YCC requires a Type II review and a conditional use permit. Prior to this set of capital improvements, castle grove has not needed to obtain these land use permits.

It is not uncommon for dairies in Yakima Valley to be operating without the proper land use permits. Many dairies began as small operations and grew to a CAFO status without trigging a review by the Yakima County Planning Department. But when capital improvement require building permits, the building permits force the land use permits.

This submittal describes the Castle Grove Dairy operation and the intended capital improvements as part of the information needed to do this land use review and obtain the required conditional use permit.

These capital improvements planned for the dairy will add the following structures and facilities to the dairy operation as soon as permits can be obtained:

1. Three 12,300 SF Cow shades and one 9730 SF Cow shade to be built inside four new corrals.
2. 900 SF manure separator building.
3. Install synthetic liner in existing lagoons.

The proposed new roof area is about 46,630 SF. The Washington State Environmental Protection Act requires that all projects that exceed 30,000 SF of impervious surface undergo a SEPA review to minimize environmental damage due to land development.

This submittal is intended to provide the necessary information to satisfy both the land use authorization and the SEPA review.

Authorizations

This section discusses regulatory authorizations for Castle Grove Dairy to exist and operate as a Dairy. Independent verification of these authorizations is left to the reviewer.

Water Source

Dairies have exempt water rights for stock watering. There are two wells registered with Washington Department of Ecology, AFE-062 and BCF-024. Both wells are 6" diameter, well AFE-062 is 130 feet deep with static head near 26 feet below the surface and well BCF-024 is 165 feet deep with static head near 42 feet below the surface. Both wells are located in the Toppenish Hydrogeological unit. A review of the well logs indicate that both wells pull from the aquifer on top of the Saddle Mountain basalt layer. Daily withdrawal to operate the dairy is near 90,000 gallons per day.

Milk Producer Licenses

Castle Grove Dairy is licensed as a Milk Producer by the Washington Department of Agriculture, Food Safety and Animal Health Division, license number 9910.

Dairy Nutrient Management Plan

The dairy manages manure waste in accordance with an approved Dairy Nutrient Management Plan (DNMP). The DNMP was prepared by the South Yakima Conservation District and originally approved and certified in 1995 and most recently updated in 2013.

The DNMP is a confidential document protected from general public dissemination by RCW42.56.610, Certain information from dairies and feedlots limited-rules.

The DNMP is based on the number of animal units on the dairy at the time the DNMP was prepared. Language in the DNMP required that it be amended if the total animal units exceed 110% of the animal units when the DNMP was prepared.

The DNMP describes manure quantities, lagoon storage requirements, and field application methods at agronomic rates. Total waste quantities are calculated based on the following factors: herd size, cow wash water volume, and storm water runoff including runoff from a 24-hour, 25- year storm event.

The DNMP addresses three principle nutrients: nitrogen, phosphorus, and potassium. Generally, phosphorus and potassium will precipitate in the soil and become relatively immobile. Potassium is generally not considered a pollutant. Phosphorus pollution is controlled by controlling soil erosion.

Nitrogen sourced from the dairy nutrients is primarily in the form of Organic Matter. Organic nitrogen is a natural slow release material. The second form of nitrogen is Ammonia in the ion form (NH_4^+) which can bond with multiple soil components rendering it immobile. The third form of nitrogen and the minority component is Nitrate ion (NO_3^-) which is water soluble. It does not bond readily with soil components and with excessive soil moisture will migrate with the moisture below the root capture zone.

Nitrate Nitrogen is the nutrient of most concern, due to its ability to migrate into ground water aquifers. Concentrations of all three macronutrients are tested at the application fields and these records are inspected by WSDA along with the entire facility on an annual basis. Applications of nutrients are timed to match crop growth and rates to match plant needs, at agronomic rates. Many dairy fields are double cropped in a system with winter triticale as the fall/winter crop, and silage corn or Sudan grass as the spring/summer crop to maximize feed production, nutrient efficiency and nutrient removal.

Specific nutrient tests required include: nitrate-N, ammonia-N, phosphorus (P_2O_2), and potassium (K_2O). Soil testing is conducted bi-annually on all fields, generally in the spring and fall.

The total nitrogen available in the liquid waste depends upon feed mixtures, cleaning water used, and the weather. Testing of the nitrogen concentration in the pond is taken in accordance with the DNMP. Liquid waste is applied to application fields via irrigation or by shanking (direct soil injection) at agronomic rates as specified by the DNMP. Solid wastes are hauled to nearby fields where it is applied at agronomic rates.

The use of solid animal manure as a nutrient source, generally, benefits the soil better than inorganic salt fertilizers. Manure ads organic matter to the soil, which improves soil structure, air and water infiltration, and general tilth. Soil erosion is reduced and the moisture holding capacity is increased. Another benefit is that nitrogen and phosphorus are released slowly by action of microorganisms. This benefit conserves these elements and makes them available throughout the year as they are needed for plant growth.

The DNMP includes a listing of land areas designated for application of solid and liquid manure at agronomic rates.

Operations

This section discusses normal operations and efforts to mitigate nuisances generally associated with dairy operations.

Open Corrals

The dairy herd is currently housed in open corrals. Cows wander freely within their corral and move to the feed lockups as desired. Cows are directed to the milking parlors along paved walkways.

Manure is deposited throughout the corral area, paved walkways and milking parlor. Most of the manure is deposited in the feeding alleys where cows stand to feed. These areas are cleaned as needed to remove the accumulated solids. Cleaning is typically done with tractor pulling a three-point rubber scraper.

Cows spend most of their time in the corrals. During the summer, dairy workers pile manure in the center of the corral so that it can dry in the sun. As needed the manure piles are collected and spread over fields or stock piled for composting.

Milking Parlor

The dairy herd is milked three times per day. Parlor size and milk storage capacity typically define the maximum herd size.

The parlor holds 60 head and is described as a double 32 parallel. This type of parlor has two sets of 32 milking stalls, one set on each side of the milking platform. Cows ready for milking transit from their resident corral to a holding corral at the parlor via paved transit alleys. A group of 60 cows enter a transit alley leading the cows to one of 64 individual milking stalls. When the group of cows is positioned, gates close confining the cows with utters accessible to workmen on the milking platform. After proper cleaning and milking, gates open allowing the cows to transit to a holding corral for later return to their resident corral. The parlor can milk up to 320 cows per hour.

The parlor operates in three shifts, seven days per week to consistently milk two times daily. Milk storage capacity is about 150,000 pounds. Milk is shipped to processers by truck. Milk is picked up 2 to three a day.

Manure and Wastewater Management

The DNMP describes manure and wastewater management in detail. Waste water comes from four sources: the cleaning water from the parlor, urine from the herd, precipitation (storm water) falling on the dairy, and leachate from the silage bunkers.

All cleaning water from the parlor flows by gravity to a sump in the milking parlor. It is then pumped to a settling basin and then flows to the storage ponds. Liquids from the storage ponds are applied to on-site application fields at agronomic rates.

The waste water storage ponds were built to the standards prescribed for by the US Soil Conservation Service. These ponds were also lined with bentonite to reduce the potential for ground water contamination.

The storage pond is cleaned as needed.

Manure solids from corrals and feeding alleys are scraped and placed in dry stacks, then spread on application fields at agronomic rates as specified in the DNMP. Dried manure may also be used as bedding in the pen areas.

Runoff from application fields is unlikely due to farming practices and irrigation practices. To reduce runoff potential manure is typically incorporated into the soil. Berms are created around application fields that are sprinkled.

After pumping waste water, clean irrigation water is used to flush clean the irrigation piping and sprinklers. Clean irrigation water is also used to flush the waste water ponds several times during the irrigation season.

The new separator building will improve the ability to remove suspended solids from the waste water streams.

The existing lagoons are clay lined approved by the NRCS. Clay lined lagoons have been shown to be adequately water light to prevent pollution of ground water when there is at least 5 feet of vadose zone. The vadose zone for these lagoons is at least 15 feet. The effectiveness of the vadose zone is controversial. The new lagoon will be lined with a synthetic liner and the design will be approved by the NRSC.

Storm water Management

Most storm water falling on the dairy is absorbed by the exposed soil in the resident corrals and evaporated when the storm subsides. All areas potentially contaminated with dairy nutrients including corrals, roads, feed storage areas, and waste handling areas, are either: bermed, graded, or curbed to contain and appropriately treat storm water. On-site storm water from paved areas, building roofs, and corrals is collected and directed or transferred to waste water ponds. Dispersion fields are graded and have berms to guard against release of storm water.

Off-site storm water is generally not a concern. The topography is flat enough to effectively hold storm water at its source. Fence boundaries are bermed to ensure storm water is confined and ensure off site sources are controlled.

Employee Training

Employees receive training appropriate to their assigned tasks. Employees involved in manure and wastewater management are trained in the relevant procedures and requirements of the Dairy Nutrient Management Plan.

All employees are trained to correct or notify the owner if they observe conditions requiring corrective action. Areas emphasized in training include storm water management controls, manure and wastewater management controls, fly control, noise control, vehicle track-out prevention, work place safety, and spill prevention control and countermeasures plan.

Nuisance Mitigations

This section addresses perceived nuisances and methods used to mitigate these nuisances.

Odor Control

Some odor is a natural part of any dairy operation. Manure production and land application involves manure handling at the storage site, hauling to the application site, and land application. These processes can lead to potential sources of odor. For controlling odors during manure application the following practices to minimize odor are used:

- Corrals are kept as dry as possible to provide the least favorable environment for odors and fly pupae (eggs)
- The disposition of dead animals is accomplished in a sanitary manner and in accordance with all state and local laws.
- Feed spillage around feed bunks is kept to a minimum, especially under moist conditions.
- All animal holding areas are kept clean of excess manure. This provides a less desirable environment for disease organisms to thrive and proliferate.
- Manure is only applied on days when the wind is relatively calm so that the aerosols and odors are minimized from drifting onto neighboring areas

Wastewater from the storage ponds is diluted with clean irrigation water to reduce the smell during field applications. Clean irrigation water is pumped through the field wastewater piping system periodically to flush out any accumulated sediment and remove odor generating material. Clean irrigation water is also applied to fields after liquid manure application to further reduce odor generated from the fields.

Storage pond odor is controlled in several ways. The waste water pond is flushed frequently with clean water to reduce the nutrient concentrations and the waste water ponds are positioned to provide a stand-off distance from residences. This feature reduces the intensity of the odor sensed at the property boundaries due to dilution with moving air.

Silage is stored in a silage pit and covered with plastic to reduce excess moisture and fermentation and minimize emissions of odors. Silage leachate is collected and routed or

transferred to the wastewater storage pond. The area that the silage is stored on is paved with asphalt to prevent leachate from reaching ground water.

Vector Control

Castle Grove Dairy employs biological fly management which uses Trichogramma Wasps as predatory insects to destroy fly eggs. Weekly shipments of the wasps are released in areas that will likely harbor fly larva. These tiny wasps are about the sizes of a gnat and lay their eggs in fly eggs. The resultant wasp larva eats the fly egg. To force the biological equilibrium between the flys and the wasp to a low fly population, the population of the wasp is restocked regularly. The systems has proven to be effective, visitors to the dairy will quickly notice a very low fly population.

Another method of vector control reduces the potential larvae nurseries in the waste handling area. Because weeds along the edge of the lagoons can create pockets ideal for fly larvae, weeds are controlled at the surface interface zone of the storage ponds.

Manure solids are maintained in as dry as possible to reduce the suitability of manure as growth medium for larval development. This also promotes good habitat for fly predator reproduction.

Dust Control

The most frequently traveled roadways and cattle walks on the property are paved with concrete, asphalt, or gravel. Other roadways are gravel-surfaced with lignite binders to reduce dust generation.

Fields are irrigated and usually have some type of ground cover to prevent wind erosion.

Vehicle Parking

Vehicle parking is provided on-site for all employees and visitors. Visitors park in front of the milk barn. Employees park near where they work. About 5 parking places are marked. Other employee parking places are not marked but chosen as a matter of convenience. There are over 25 places in which employees can park their personal vehicles. Trucks picking up or delivering products park at the appropriate facility until they are loaded or unloaded. Although very informal, parking at the dairy has not proven to be a problem, and when it becomes a problem, a more formal parking policy can and will be executed.

Vehicle Track-out

Dairy operations are currently supported by a system of gravel-surfaced roadways within the dairy operation area. Use of these internal roadways substantially reduces the frequency of dairy operation vehicles entering onto the public roads from the dairy. The most frequently used internal roadways are gravel and inaccessible to livestock. This minimizes mud or manure from being carried onto surrounding public roads.

Manure trucks are loaded outside the pens and other areas manure is collected. When trucks spread manure in the fields they start at the far end of the field and work their way to the entrance to avoid driving on spread manure. If manure gets on the wheels or other parts of the truck where it could potentially fall onto the road it is cleaned prior to entering public roads.

Noise Control

Commodities delivered by truck are completed between the hours of 5:00 a.m. to 5:00 p.m., Monday through Saturday. No deliveries are made on Sunday.

Dairy vehicle equipment is well maintained, including repair and replacement of exhaust systems and mufflers as necessary. Backing up of equipment is minimized as much as possible to reduce noise from backup alarms.

The dairy does not have a public address system or other source of load outside noise. Employees communicate by radio or cell phone as necessary.

Glare

The dairy is equipped with a night lighting system consistent with practices at other dairies in the Yakima Valley. Any future lighting will include shields and lenses to prevent direct lighting trespass to off-site properties and public roads.

Reflective Glare from roofs is not generally a concern. The dairy does not use highly reflective metal finishes for roofing panels.

Communications and Complaint Resolution

Case Vandenberg, the owner, is responsible for communications with neighbors and regulatory agencies, and for responding to any inquiries or complaints.

Compatibility with Neighboring Land Uses and Critical Areas

This proposal is to provide facilities for a more efficient dairy operation by increasing storage capacity for cow feed, providing shade for the cows, and relieving herd pressure with new corrals.

The dairy is an existing facility and is compatible with neighboring land uses. The site has been in continuous use as a dairy for over 30 years. Land uses on surrounding parcels include row crops, horticulture, and some hobby farms.

The Yakima Critical Area Map (Yakima County GIS Mapping) identifies potential wetlands south of the corrals over the lagoons and the surrounding area, one potential wetland southeast of the property, and an undetermined stream along the southeast property line. See Site Map.

No construction is proposed within 200 feet of any identified critical areas.

Relevant sections of the zoning ordinance are quoted below, with notations as to the proposal's consistency.

The parcels that compose the dairy are zoned "Agricultural, (AG)":

> 15.2 1.01 Purpose. The Agriculture (AG) Zoning District is intended to preserve and maintain area for the continued practice of agriculture and to permit only those new uses that are compatible with agricultural activities. (The proposal expands the facilities of an existing agricultural operation, helping to ensure the continued practice of agriculture through use of more modern and productive dairying facilities and practices. It would not introduce any new use incompatible with other agricultural activities). The specific intent of this zoning it to:
>
> > (1) Implement the comprehensive plan which calls for the preservation of agricultural lands; (*The dairy's investment in the proposed facility upgrades will improve it survivability as a viable dairy and continue as an agriculture use*).
> >
> > (2) Provide a zoning district to protect, stabilize and enhance the land base devoted to, or important for, the long-term commercial production of agricultural goods in Yakima County and to protect the best agricultural areas from conflicting uses and influences; (*Although the proposal will not increase the land base devoted to agriculture production, it will help protect and stabilize agriculture practice of an existing land use*).
> >
> > (*The remaining intent provisions of the zoning ordinance do not pertain to the proposal.*)

The only Policy of the Comprehensive Plan that is relevant to the proposal is LU-ER-AG 1. "Encourage conservation of the County's high quality agricultural lands for productive agricultural use and protect the opportunity for these lands to support the widest variety of agricultural crops."

The proposal is consistent with this provision and other policies of Comprehensive Plan 2015 last amended 2007. The existing dairy is currently a productive agricultural land use, has many employees, and a multimillion dollar operating budget, thereby contributing significantly to the local economy. The proposed capital improvements will help the dairy achieve a greater level of efficiency, and reduce costs to the environment. Enhance efficiency with economic and environmental resources is consistent with the County's goals of preserving productive agricultural lands and protecting farmers from nuisance complaints and lawsuits.

Appendix M
Maps

CUP16-26

SITE PLAN - CASTLE GROVE DAIRY

Scale 1"=200 ft

(BASED ON ORTHOPHOTOGRAPHY)

NORTH

Public Services
APR 07 2016
Vern Gary Lynn
Dave Lisa Carmen
Tribal Lands

PARCEL 181108-22001
73.08 acres
Gasseling

PARCEL 181108-24001
39.16 acres
Gasseling

PARCEL 181108-32001
39.12 acres
OWNER: CCC Farms LLC (Castel Grove)
(Dimensional Data can be obtained by scaling)

Affected Area –	72.0 A
Roof Areas	
Hard Roofs –	122,465 SF
Cloth shades –	19,730 SF
New Roofs –	46,630 SF
Total Hard Roofs –	169,095 SF
Total covered –	188,825 SF
Paving (estimated)	120,113 SF
Impervious Surface	289,208 SF
% Impervious	9.2%

OSS – On-Site Sewer
Res – Residence
SF – Square Feet

PARCEL 181108-31001
39.16 acres
Castle Grove

PARCEL 181108-34001
18.82 acres
Castle Grove

PARCEL 181108-43001
18.82 acres
Castle Grove

NORTH BROWNSTOWN ROAD

BROWNSTOWN ROAD APPROACH

Tribal Lands

IRRIGATION PIVOT

NEW CORRAL

NEW SEPARATOR 900 SF

Sheet: 1
Drawn by: TWB

Revisions:
23 Sept 2014
22 Dec 2014
2 Mar 2015
2 Feb 2016
14 Mar 2016
4 APR 2016

CASTLE GROVE DAIRY

B7 Job 14109

B7 ENGINEERING
PO Box 487
1614 Eastway Drive
Sunnyside Wa,98944
(509) 837-8600

6 APR 2016
TIMOTHY W BARDELL
STATE OF WASHINGTON
23896
REGISTERED
PROFESSIONAL ENGINEER

SITE PLAN - CASTLE GROVE DAIRY

Scale 1"=300 ft
(BASED ON ORTHOPHOTOGRAPHY)
NORTH

PARCEL 181108-22001
73.08 acres
Gasseling

PARCEL 181108-24001
39.16 acres
Gasseling

PARCEL 181108-32001
39.12 acres
OWNER: Castle Grove

PARCEL 181108-31001
39.16 acres
Castle Grove

PARCEL 181108-34001
18.82 acres
Castle Grove

PARCEL 181108-43001
18.82 acres
Castle Grove

Tribal Lands

Well House 120 SF
WELL
OSS
Res 1150 SF

OSS – On-Site Sewer
Res – Residence
SF – Square Feet

Affected Area –	72.0 A
Roof Areas	
Hard Roofs –	122,465 SF
Cloth shades –	19,730 SF
New Roofs –	46,630 SF
Total Hard Roofs –	189,095 SF
Total covered –	188,825 SF
Paving (estimated)	120,113 SF
Impervious Surfaces	236,208 SF
% Impervious	8.2%

1276'-1⅛"
520'
520'
1319'-3½"
508'-8⅞"
307'-6⅛"
516'-11⅞"
520'-8½"
520'-11⅛"
87'-5⅛"
303'-4⅛"
400'
294'-11⅛"
12'-8¼"

NEW Cow Shade 12,300 SF
NEW CORRAL
NEW Cow Shade 9750 SF
NEW Cow Shade 12,300 SF

NORTH BROWNSTOWN ROAD
BROWNSTOWN ROAD APPROACH
WEST WAPATO ROAD
WEST WAPATO ROAD APPROACH

Waste Lagoon 40,000 SF
Cloth Cow Shade 3200 SF
Cow Shade 9750 SF
Cow Shade 8400 SF
Cow Shade 10000 SF
Cow Shade 3400 SF
Cloth Cow Shade 3000 SF
Calf Barn 8700 SF
Cow Shade 7200 SF
Cow Shade 9750 SF
Cloth Cow Shade 3010 SF
Cow Shade 9750 SF
Cow Shade 24000 SF
Feed 12,300 SF
Silage Bunker
Silage Bunker
Silage Bunker
Commodity Shed 9800 SF
Tanks

Waste Water Lagoon 87,000 SF
Cloth Cow Shade 3360 SF
Cow Shade 1360 SF
Cow Shade 1360 SF
Cloth Cow Shade 1540 SF
Waste Water Lagoon 6000 SF
Waste Water Lagoon 15,000 SF
Shade 1460 SF
Cow Shade 1360 SF
Cloth Cow Shade 1540 SF
Cow Hosp 6000 SF
Feed Trailer 2100 SF
Cow Shade 2400 SF
Silage Bunker
Shed 720 SF
Office 300 SF
Tanks
Scale 100 SF

Tribal Lands
NEW SEPARATOR 900 SF
Heifer Corrals
Cloth Cow Shade 2000 SF
Shed 400 SF
CALF HUTCHES
Decorative Shed
Shed 100 SF
IRRIGATION PIVOT
Water Lateral

Res 1400 SF
Shed 100 SF
Garage 1800 SF

NEW Farm Shop 11520 SF
120'
96'
60'
Shed 1000 SF
Garage 750 SF
OSS
Res 2000 SF

Two Approaches
1. West Wapato Road
2. North Brownstown Road

Sheet: 2
Drawn by: TWB

Revisions:
23 Sept 2014
22 Dec 2014
2 Mar 2015
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14 Mar 2016
4 Apr 2016

CASTLE GROVE DAIRY

B7 Job 14109

B7 ENGINEERING
PO Box 487
1614 Eastway Drive
Sunnyside Wa.98944
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6 April 2016
TIMOTHY W BARDELL
STATE OF WASHINGTON
29896
REGISTERED
PROFESSIONAL ENGINEER

SEPA
ENVIRONMENTAL CHECKLIST
SUBMITTAL SUPPLEMENTAL

Form # PLN ENR 003-SS1-A
Revised: 8/12/14

Public Services

SEP 16-012

APR 06 2016

Yakima County Public Services
128 North Second Street · Fourth Floor Courthouse · Yakima, Washington 98901
(509) 574-2300 · 1-800 572-7354 · FAX (509) 574-2301 · www.co.yakima.wa.us

Vern Gary Don Lynn
~~Dave Lisa Carmen~~

(For Staff Use Only)
DATE:
REVIEWED BY:
PROJECT #:
CASE #: CUP 16-26
RELATED FILES:

WAC 197-11-960 Environmental checklist.

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

For nonproject proposals complete this checklist and the supplemental sheet for nonproject actions (Part D). The lead agency may exclude any question for the environmental elements (Part B) which they determine do not contribute meaningfully to the analysis of the proposal.

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

STAFF USE ONLY

A. BACKGROUND

1. Name of proposed project, if applicable:

Castle Grove Dairy Capital Improvements 2016

2. Name of applicant:

Castle Grove Dairy

3. Address and phone number of applicant and contact person:

Case Vandenberg
8053 W. Wapato Rd.
Wapato WA 98951
509 952-5547

4. Date checklist prepared:

2 Feb 2016

5. Agency requesting checklist:

Yakima County Planning Division

6. Proposed timing or schedule (including phasing, if applicable):

Construction Early 2016, to start when permits are secured

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

None

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

SEP 14-045, CUP 14-082 (expired)
SEP 15-001, CUP 15-001 (expired)
CUP 2015-063 (shop)

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

None

10. List any government approvals or permits that will be needed for your proposal, if known.

STAFF USE ONLY

Building Permits, modified Conditional Use Permit

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The proposed project consists of Two Parts:
Part 1: Add 900 SF separator building for waste management
Install synthetic liner to existing lagoons
Part 2: Add three 12,300 SF Cowshades, and one 9730 SF Cow shade

THIS PROJECT DOES NOT CONSTITUTE A DAIRY HERD EXPANSION, but provides shelter for existing herd, and benefits heard health.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

Parcels: 181108-34001
Address: 8053 W. Wapato Rd., Wapato WA 98951
Section 08, Township Range 18 East, 08 North
Located approximately 8 miles West of Wapato WA

B. ENVIRONMENTAL ELEMENTS

1. **Earth**

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other.

Generally flat with natural slope south.

b. What is the steepest slope on the site (approximate percent slope)?

About 1 percent to the south.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Two soil types identified by US Dept Ag Soil Conservation Service: Warden Silt Loam (about 71%), and Esquatzel Silt Loam, (about 29%), per websoilsurvey USDA.gov

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

None Identified

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Part 1: Lagoon clean out and adjustments about 800 Cu Yards and minor additional grade adjustments to prepare for separator building.

Part 2: No significant grade adjustments for cow shades.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

No

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Total Site Area: Dairy Occupies about 72.0 acres on five parcels

Existing Impervious Surfaces		
Roof surface	122,465 SF =	5.8%
Pavement surface	110,000 SF =	5.2%
TOTAL		**11.0%**

Proposed Improvements		
Added project area	23.92 A	+49.8%
Net added roof surface	46,630 SF =	+27.6%
Net added pavement	10,113 SF=	+11.0%
TOTAL		

Completed Project		
Project Area	72.0 A	
Total hard roof surface	169,095 SF	5.4%
Total pavement surface	120,113 SF	3.8%
TOTAL	**289,208 SF Impervious**	**9.2%**

STAFF USE ONLY

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

None, except for controls typically associated with, and used during, construction activities.

STAFF USE ONLY

2. **Air**

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

During construction equipment motor exhaust, limited fugitive soil dust.

During normal operations, some fugitive feed and soil dust, equipment motor exhaust, and emissions associated with animals. No identified changes from previous facility activities.

b. Are there any offsite sources of emissions or odor that may affect your proposal? If so, generally describe.

None

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Liquid waste dispersion performed by shanking to reduce air emissions and apply water for dust control when needed.

3. WATER

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

None.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year flood plain? If so, note location on the site plan.

No

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No

STAFF USE ONLY

b. Ground:

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well? Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

Yes. Water for dairy operation is drawn from two wells. Currently, the facility uses the stock watering exemption. Daily draw about 90,000 gallons. Daily draws vary during the year according to temperature.

The Project will not result in any discharge of waste water to groundwater. The vadose zone is about 30 feet.. No significant net change to water use will occur as part of this improvement. Water is not discharged to ground water, waste water from the dairy is used for crop irrigation.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals...; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Human-source sewage is from employees, is collected in portable toilets, pumped and cleaned by service contract. Residential sewage is discharged to ground by an on-site sewer approved by Yakima District Health.

Raw dairy waste water is sometimes discharged directly to crop fields by shanking at agronomic rates.

Dairy waste water is mixed with irrigation water and dispersed on crop fields as irrigation water at agronomic rates

Dairy solid wastes are dispersed on crop fields at agronomic rates.

Dispersion fields are bermed to avoid runoff.

c. Water runoff (including storm water):

STAFF USE ONLY

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

All storm water is retained onsite as waste water. Storm water runoff from the dairy parcel is collected by natural contours and routed to the waste lagoons. Contents of these lagoons is added to irrigation water and dispersed on growing crops at agronomic rates.

2) Could waste material enter ground water or surface waters? If so, describe.

No, clay-lined lagoons with an adequate vadose zone have been shown to be highly effective at retaining dairy waste water.

The combination of expansive clay and the fine suspended solids in manure water results in a shallow seep depth and can be considered to be water tight.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No.

d. Proposed measures to reduce or control surface, ground, runoff water, and drainage pattern impacts, if any:

None.

4. **Plants**

a. Check the types of vegetation found on the site:

___ Deciduous tree: Alder, maple, aspen, other

___ Evergreen tree: Fir, cedar, pine, other

___ Shrubs

_x_ Grass

_X Pasture

_x Crop or grain

___ Orchards, vineyards or other permanent crops.

___ Wet soil plants: Cattail, buttercup, bullrush, skunk cabbage, other

___ Water plants: Water lily, eelgrass, milfoil, other

_x Other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

None, the buildings will be built on bare ground.

c. List threatened and endangered species known to be on or near the site.

None identified

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

None

e. List all noxious weeds and invasive species known to be on or near the site.

Typical for Yakima Valley, including Kosha, Tumble weed, and Wild Mustard, Milkweed, and others.

5. **Animals**

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site. Examples include:

Birds: Hawk, heron, eagle, songbirds, other:

Mammals: Deer, bear, elk, beaver, other: None Identified

Fish: Bass, salmon, trout, herring, shellfish, other: NONE

b. List any threatened and endangered species known to be on or near the site.

None Identified

c. Is the site part of a migration route? If so, explain.

No

d. Proposed measures to preserve or enhance wildlife, if any:

None judged necessary

e. List any invasive animal species known to be on or near the site.

None identified

6. **Energy and natural resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electric power for motors, lighting, and control. Conventional petroleum fueled internal combustion engines for equipment and vehicles. Propane for heating air and water.

STAFF USE ONLY

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

STAFF USE ONLY

No

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

High efficiency lighting, High efficiency motors and soft start motor controllers.

7. **Environmental health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, describe.

No. These new buildings will not present any new environmental health hazards. Other environmental concerns associated with the dairy are being handled as part of the current operations in accordance with regulations and best management practices.

1) Describe any known or possible contamination at the site from present or past uses.

None known

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

None known

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

Some corrosive materials are used for parlor cleaning. Numerous potentially hazardous materials are used for herd health management. These are being handled in accordance with regulations and best management practices.

4) Describe special emergency services that might be required.

No new services required.

5) Proposed measures to reduce or control environmental health hazards, if any:

None required as part of these improvements.

b. **Noise**

STAFF USE ONLY

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Animal noise. Equipment operation and motor noise. Traffic noise from deliveries, pickups and employee commutes.

3) Proposed measures to reduce or control noise impacts, if any:

Keep equipment and vehicle exhaust systems in good repair. Minimize operations during non-typical working hours.

8. **Land and shoreline use**

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The dairy operation affects 5 parcels totaling 200 acres. Actual land footprint of the dairy is about 72.0 acres. The remaining area of the 200 acres is crop land.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No active agriculture land will be taken from service as the result of this new building.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No

c. Describe any structures on the site.

Various buildings needed to support the dairy operations. See the Site Plan for details.

STAFF USE ONLY

d. Will any structures be demolished? If so, what?

No

e. What is the current zoning classification of the site?

AG

f. What is the current comprehensive plan designation of the site?

Agriculture resource

g. If applicable, what is the current shoreline master program designation of the site?

N/A

h. Has any part of the site been classified critical area by the city or county? If so, specify.

No.

i. Approximately how many people would reside or work in the completed project?

25 full time employees.

j. Approximately how many people would the completed project displace?

None

k. Proposed measures to avoid or reduce displacement impacts, if any:

None

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

None

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

None

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None

STAFF USE ONLY

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None

c. Proposed measures to reduce or control housing impacts, if any:

None

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

About 35 feet, structural rolled metal siding. Concrete and CMU walls.

b. What views in the immediate vicinity would be altered or obstructed?

None Identified

c. Proposed measures to reduce or control aesthetic impacts, if any:

None

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Night lighting, potential solar glare from large roof surfaces.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No

c. What existing offsite sources of light or glare may affect your proposal?

None

d. Proposed measures to reduce or control light and glare impacts, if any:

Select low-trespass, high-efficiency luminaires for night lighting.

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?

None Identified

STAFF USE ONLY

b. Would the proposed project displace any existing recreational uses? If so, describe.

No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

None

13. **Historic and cultural preservation**

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

No

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation. This may include human burials or old cemeteries. Is there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

None Identified

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

None

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

None

14. **Transportation**

a. Identify public streets and highways serving the site or affected geographic area, and describe proposed access to the existing street system. Show on site plans, if any.

Road access to the Dairy is provided from West Wapato Road. Traffic going east of West Wapato Road about 8 miles will intercept SR 97 with connections to Interstate 82.

STAFF USE ONLY

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

No

c. How many additional parking spaces would the completed project or nonproject proposal have? How many would the project or proposal eliminate?

This project will not change the supply of, or demand for, parking places at the dairy. Employee parking is provided on site alongside the parlors and other convenient locations about 25 spaces are provided on the dairy.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

No

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

No

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and non-passenger vehicles). What data or transportation models were used to make these estimates?

These new buildings will not affect the number of vehicle trips per day. The Dairy overall has about 40 vehicle trips per day including employee commutes, pick-ups and deliveries. During harvest of feed crops, the number of vehicle trips, mostly trucks, can triple. Most of these vehicle trips during the remainder of the year are passenger cars. About one third are trucks.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No

h. Proposed measures to reduce or control transportation impacts, if any:

None

STAFF USE ONLY

15. **Public services**

a. Would the project result in an increased need for public services (for example: Fire protection, police protection, public transit health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

None

16. **Utilities**

a. Circle utilities currently available at the site: Electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Electricity services provided by Pacific Power and Lighting

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: _____

Date Submitted: 6 APR 2016

CITY OF MABTON

YAKIMA COUNTY **WASHINGTON**

WATER SYSTEM PLAN

G&O #11064
SEPTEMBER 2013

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF MABTON

YAKIMA COUNTY **WASHINGTON**

WATER SYSTEM PLAN

JAMES P. BRICEL
STATE OF WASHINGTON
26894
REGISTERED
PROFESSIONAL ENGINEER
9/13/13

DAVID VAN CLEVE
STATE OF WASHINGTON
30789
REGISTERED
PROFESSIONAL ENGINEER
9/13/13

G&O #11064
SEPTEMBER 2013

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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EXECUTIVE SUMMARY

The objectives of this water system plan are to evaluate the performance and adequacy of Mabton's existing water supply and distribution system and to describe steps the City must take to meet the demands of its 6- and 20-year planning periods. This plan has been written to comply with WAC 246-290-100, the Washington State Department of Health's rules for developing a water system plan.

PLANNING

The City's residential population, estimated at 2,230 in 2012, is anticipated to grow at an annual rate of 1.5 percent to 3,004 by 2032. This growth will result in an increase in the City's water demands. The City's average day demand is expected to increase from an average of 364,000 gallons per day in 2012 to 443,000 gallons per day in 2032. Its maximum day requirement is expected to increase from 531 gpm in 2012 to 646 gpm in 2032.

CAPITAL IMPROVEMENTS

Improvements needed to meet the City's future demands are summarized below.

- *Source/Supply.* The City has three wells in service, Well No. 4 (currently in repair) and Well No. 5 that have estimated capacities of 200 gpm and 500 gpm, respectively. Well No. 3 is for emergency use only as it has elevated levels of nitrates which require the blending of this water with another source. With an approximate combined output of 700 gpm from Well Nos. 4 and 5, these wells marginally provide the City with sufficient supply capacity to meet its 2032 MDD. Consequently, for water system reliability, a new 1,000 gpm well (Well No. 6) is planned in the 6-year planning period.

  Well No. 4 failed in the summer of 2013 and is now being repaired. This required cleaning of the casing and replacement of the pump. The production of Well No. 4 has decreased to an estimated 200 gpm. The Well No. 4 flow meter is not functioning, and will be replaced, and a new water level sensor installed.

  The City plans to install an emergency generator at the new Well No. 6 in order to meet demands during an extended power outage.

- *Water Rights.* The City's instantaneous water rights, 1,000 gpm, are sufficient to allow the City to operate both its wells simultaneously. The two wells have an estimated combined capacity of 700 gpm. The City's annual withdrawal rights, 452.4 acre-feet per year, are sufficient to meet

its 6-year requirements of 431 acre-feet per year, but not the 20-year requirement of 496 acre-feet per year. Consequently, new water rights are needed for the 20-year planning period. It is noted that due to the uncertainty of the City's actual demands (due to the lack of source meter records), the City may require additional water rights sooner than projected.

- *Storage.* The City's single 800,000 gallon reservoir provides sufficient storage to meet the 20-year requirements of 340,000 gallons, assuming that the City constructs a new 1,000 gpm well (Well No. 6). However, due to the low elevation of the reservoir, the City must boost the pressure of the water system with the existing booster pumping station. The City plans to construct a new, higher reservoir in order to eliminate the need for the booster pumps which must run constantly. This will allow significant power cost savings.

- *Treatment.* The City provides chlorination for disinfection. The City plans to continue its efforts to provide a high level of water quality in its system with disinfection.

- *Telemetry.* The City's telemetry system meets its current needs and no improvements are currently planned. The system is old and changes may need to be made for operational efficiencies and safety.

- *Booster Pumping Station/Upper Pressure Zone.* The City operates a booster pumping station that serves the entire City of Mabton. No particular deficiencies were identified with this system, except that the system does not have the DOH recommended back-up power system. The City intends to construct a new, higher reservoir to eliminate the need for the constantly running booster pumps.

- *Transmission and Distribution.* The City plans to make several distribution system improvements within the 20-year planning period to improve fire flow and system operation. The City plans to initiate at least three of these projects within the next six years. With roughly 70 percent of the City's water mains over 70 years old and too small to provide adequate fire-flows, the City has made it a priority to begin replacing these old lines.

- *Operation and Maintenance.* The City plans to implement several operation and maintenance items, including repairing leaks discovered in a recent leak detection study, repair of the Well No. 4 source meter, maintenance of the booster pumping station screen, replacing in-operable

valves, replacing defective hydrants, replacing selected service meters, installing meters in the parks and replacing aging distribution lines.

The City's public works staff is working on re-establishing the City's institutional knowledge base, including the library of as-built plans, drawings, specifications, equipment operations and maintenance manuals, etc.

CAPITAL IMPROVEMENT PROGRAM

The City's 6-year capital improvement program is summarized in Table ES-1.

TABLE ES-1

Capital Improvement Program

Project	2013 Cost	Schedule
SOURCE		
Well No. 4 Repair	$130,000	2013
New Well No. 6	$1,850,000	2014
WATER RIGHTS		
Water Rights	$700,000	2014
STORAGE		
Reservoir	$1,300,000	2014
DISTRIBUTION (Fire Flow, Replacement)		
South St., Reservation St. to the Alley	$240,000	2014
Monroe St., Alley to 7th Ave.	$390,000	2014
Alley East of 1st Ave.	$270,000	2014
OPERATION & MAINTENANCE		
Source Meter Calibration	$1,000	2013
Distribution System Valves	$25,000/yr.	2013 & annually
Service Meters	$3,000/yr.	2013 & annually
Reservoir Cleaning	$5,000	2013
Hydrant Replacements	$4,000/yr	2013 & annually

FINANCING

The 6-year financial analysis performed for this plan was based on assumptions of a City growth of 1.5%, that its expenses would increase at an annual inflation rate of 3 percent, and that the there would be a one-time monthly rate increase to the base rate of $21 with annual increases of 3 percent to the base rate. Based upon those assumptions, the analysis indicates that the City has sufficient financing ability to complete the capital improvement program outlined in Table ES-1.

CHAPTER 1

DESCRIPTION OF WATER SYSTEM

CHAPTER 1

DESCRIPTION OF THE WATER SYSTEM

WATER SYSTEM OWNERSHIP AND MANAGEMENT

The City of Mabton owns and operates its domestic water system. A vicinity map showing the relationship to adjacent communities is presented on Figure 1-1. The Washington State Department of Health (DOH) water system identification number is 49650 R. A copy of the Water Facilities Inventory (WFI) form is included in Appendix A. The City is governed by a City Council and Mayor. The City's mailing address is:

City of Mabton
Post Office Box 655
Mabton, Washington 98935

The City's water system is operated by Mr. Chris Morris, who maintains a temporary operator certification while he works on a Water Distribution Manager (WDM) 1 certification. Ms. Myra Hartley is also employed by the City and operates the waste water treatment plant. Ms. Hartley is certified as a Water Distribution Manager (WDM) 2 and at times may assist with the duties of operating the water system.

The ownership is municipal with a council decision making process. The City Council sets the budget for the water department. The Mayor oversees the day to day operation of the City. The Mayor has discretionary control of the water system budget to make purchases and to have work performed. For situations where large expenses are required or long term decisions are needed, the Mayor and City Council confer to determine a course of action and method of funding. The Mayor consults the City's most recent planning documents to determine the number of connections the system can serve, and uses these documents to guide planning efforts and to plan short-term project phasing. Finally, the Mayor works with the contract City Engineer when large projects are necessary, when the City is seeking funding for a project, or if a developer should require above average fire flow.

SYSTEM BACKGROUND

HISTORY OF WATER SYSTEM DEVELOPMENT AND GROWTH

Settlement in the Mabton area began around 1884, which was approximately five years before Washington became a state in 1889. This town grew out of a Northern Pacific Railway rail stop where the company had built a water tower. It was in 1892 that

Sam P. Flower built a store and warehouse which was followed by several stores, a hotel, railroad depot and schoolhouse. The town incorporated in 1905.[1]

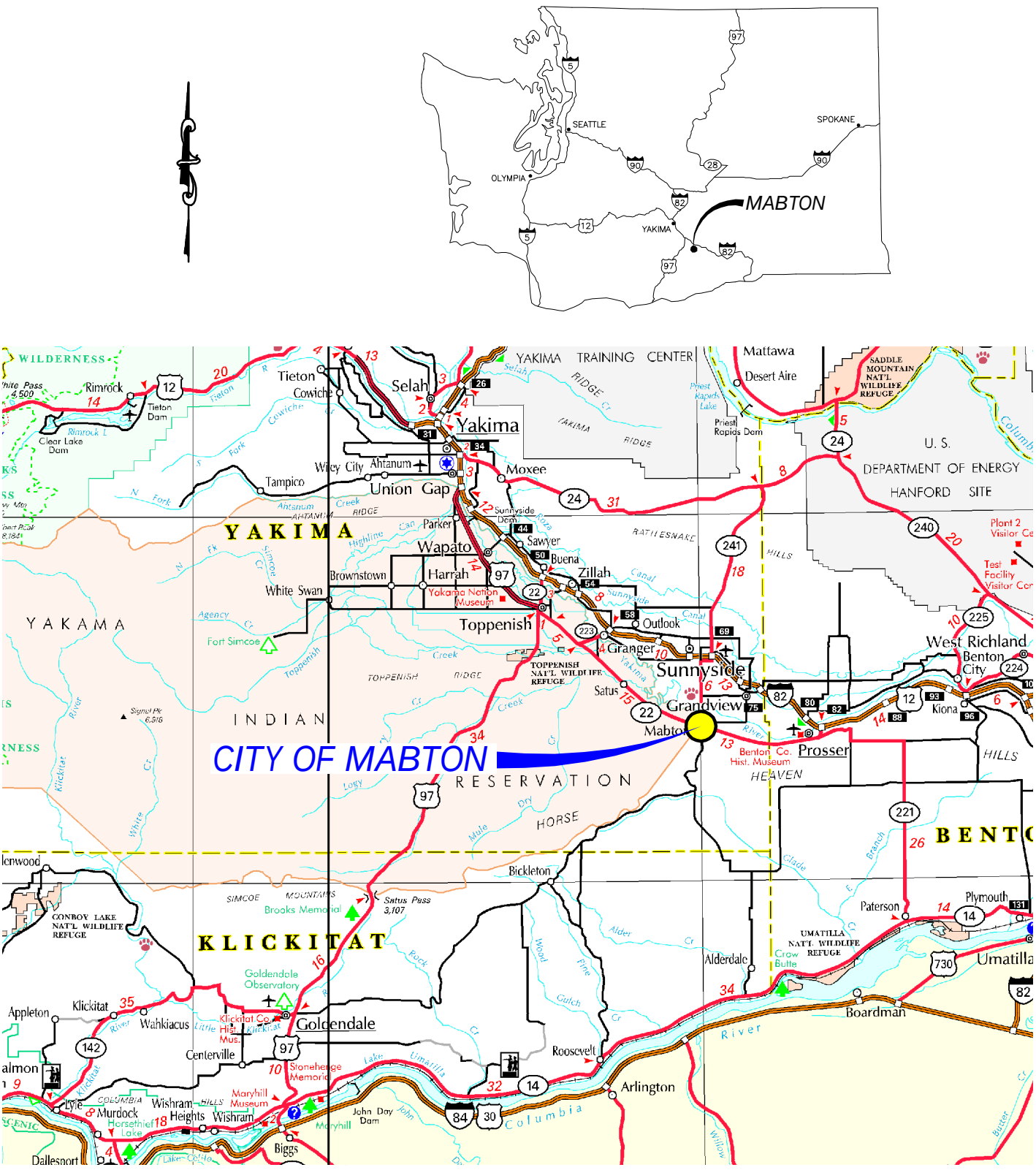
A history of the construction of major water system features for the City of Mabton is provided in Table 1-1.

TABLE 1-1

Water System History

Year	Event
1905	Town of Mabton is incorporated.
1908	Water system records show the system consisted of a well and tank located north of Pine Street, between 3rd and Main Streets. Distribution piping consisted of 4-inch, 6-inch and 8-inch wood stave and wrought iron piping, covering most of the town located north of the railroad and west of Main Street.
1922	Well No. 1 (located in the existing City park) is purchased from the original owner and tested with a 140 gpm pump.
1924	The original well house is constructed over Well No. 1 along with a 50,000 gallon steel tower and elevated tank.
1908-1930	Water main extensions are made to the south portion of the town, east of Main Street.
1933	Well No. 1 is tested by G.D. Hall of Yakima.
1933-35	Water system improvement plans are prepared including pipeline replacements, pump house for Well No. 1, pump house for Well No. 2, a gas separator and vault, and new 8-inch riser inlet and 36-inch outlet pipe to the existing 50,000 gallon steel tank.
1935	Well No. 2 is drilled by A. A. Durand of Walla Walla
1947	There is an explosion in pump house No. 2
1953	A 1,000 gpm, 60 HP vertical turbine pump is installed in pump house No. 2 and electrical improvements are performed on pump house No. 1.
1956	Use of Well No. 1 is discontinued.
1957	A 400 gpm vertical turbine pump is installed in Well No. 3.
1972	Pump in pump house No. 2 is raised to above floor level for sanitary protection.
1973-74	Gas explosion in pump house for Well No. 1 supposedly caused by light switch igniting a build-up of methane gas in a poorly ventilated pump house.
1974	Well No. 2 and No. 3 are flow tested.

[1] Katherine Trembley Wernex (1979), It Did Happen Here: A Living History of Old Mabton, Prosser, Washington: Perfect, p. 2



CITY OF MABTON
WATER SYSTEM PLAN

FIGURE 1-1
VICINITY MAP

Grey & Osborne, Inc.
CONSULTING ENGINEERS

M:\MABTON\11064 WSP\FIGURES\FIGURE 1-1

TABLE 1-1 (cont.)

Water System History

1975	800,000 gal. steel standpipe reservoir is constructed, along with gas separator vault and piping revisions at pump house No. 2, a pump house for Well No. 3 with chlorination room and facilities, in addition to new and larger motors with additional stages added to pumps in Well No. 2 and Well No. 3, flow meters electrical improvements and a new 8-inch transmission water main. The 50,000 gal. elevated tank is taken out of service.
1978	Gas explosion destroys roof of 800,000 gal. steel standpipe, supposedly caused by spark from ventilator fan motor. Roof is repaired, aeration trays are added (either in 1975 or 1978) and all electrical is removed from within the standpipe interior. Additional screened vents are installed in the stand pipe as well as mercury pressure controls on the outside of the standpipe.
1982	Vent screens on top of the 800,000 gal. steel standpipe are found to be corroded so they are replaced with stainless steel screens.
1987	Well No. 1 decommissioned per WAC 173-160.
1988	The booster pumping station is constructed and Well No. 4 is connected to the water system.
2001	City begins blending water from Well No. 3 and Well No. 4 due to high nitrates in Well No. 3.
2001	Pump intake of Well No. 4 is lowered (depth unknown).
2002	Pump intake of Well No. 3 is lowered (depth unknown).
2002	Utility Services Assoc. is hired to perform distribution system leak detection.
2003	City replaces Well No. 3 motor.
2005	Previous Water System Plan is approved.
2006	Well No. 5 is drilled.
2007	Well No. 5 is equipped and connected to the water system.
2010	DOH approves wellfield designation for Well No. 4 and Well No. 5 at a capacity of 950 gpm.
2012	American Leak Detection is hired to perform distribution system leak detection.

SURFACE WATER

The Yakima River is located approximately one mile to the north of the City and flows from west to east in the vicinity of the City. The Yakima River in the vicinity of the Mabton WWTF outfall is deep and slow moving. The Mabton West Lateral of the Sunnyside Irrigation District is located south of the City. The City is located in the Lower Yakima River Water Resource Inventory Area (WRIA) No. 37. Most of the City is out of the flood plain. A small portion of the south west corner of the City is in the flood plain; see Figure 1-2 for a map of the flood plain.

WATER SUPPLY

The City's potable water supply is provided by the City's ground water wellfield. The City's Wells Nos. 3, 4 and 5 are equipped with pumps and motors. The Well No. 2 pump, motor and equipment have been removed. The water from these wells is chlorinated to provide disinfection throughout the distribution system. See Table 1-3 for well information. The current water system operating permit is classified as "Green" by the DOH. Systems in this category are considered adequate for existing uses and adding new service connections up to the number of approved service connections. A copy of the Operating Permit from the DOH's Sentry website is included in Appendix A. There are no comments or Current Permit Conditions listed by the DOH.

GROUNDWATER

The ground water in the vicinity of the City has two discrete aquifer systems; an unconfined and/or semi-confined alluvial aquifer (Ellensburg), and deeper Columbia River basalt aquifers. The basalt aquifers include the Saddle Mountain, Wanapum and the Grande Ronde. The upper groundwater flow follows general topography with natural recharge occurring within the headlands and discharge occurring towards the Yakima River. In this area predominant groundwater flow is from the northwest toward the southeast.

Well No. 1 was removed from service on or prior to 1956 and was grout sealed in 1989. Based on data from the City of Mabton 1985 Water Study, Well No. 2 is drawing from the Wanapum formation. Based upon information contained in the Report of Examination (ROE) for G4-29212, Well No. 3 apparently draws from the Ellensburg formation. The ROE for G4-29212C indicates that Well No. 4 is open to aquifers hosted by the Umatilla Member of the Saddle Mountain Basalt of the Columbia River Group. Ecology expressed in a letter to the City (12-16-2004) that Well No. 5 was cased and sealed into the Saddle Mountain Basalt Formation, and as of November 3, 2010, the DOH approved the wellfield designation S05 for Well No. 4 and Well No. 5.

According to the Lower Yakima Valley Groundwater Quality Preliminary Assessment and Recommendations Document, the shallow aquifer in this area has high nitrate-nitrogen levels, with at least a third of the wells in the Lower Valley having greater than 5 mg/l nitrate-nitrogen. Nitrate-nitrogen levels of 10 mg/l are considered a potential health risk to the public.

WATERSHED PLANNING

The City of Mabton is located in the Lower Yakima Watershed Water Resource Inventory Area (WRIA) 37. Several studies and planning documents are available on the Department of Ecology's website for WRIA 37.

Per the Department of Ecology, WRIA 37 has completed phases 1, 2 and 3 and is in the process of completing phase 4 of the watershed planning process.

WWTF

CITY HALL

WELL 4

WELL 2

WELL 3

WELL 5

RESERVOIR

JACKSON ST

MONROE ST

ADAMS ST

JEFFERSON ST

WASHINGTON ST

NORTH ST

SOUTH ST

FERN ST

ROSE ST

CEDAR ST

PINE ST

MAPLE ST

1ST AVE

2ND AVE

3RD AVE

4TH AVE

5TH AVE

6TH AVE

7TH AVE

VANCE RD

C ST

B ST

SR 22

FERRY RD

ALLISON RD

GULDEN RD

BOUNDARY RD

1"=1000'

CITY LIMITS

URBAN GROWTH AREA

4" WATER MAIN

6" WATER MAIN

8" WATER MAIN

10" WATER MAIN

12" WATER MAIN

RESERVOIR

FIRE HYDRANT

WELL

BOOSTER

FLOOD PLAIN / FLOOD WAY

10' CONTOURS

* PIPING UNKNOWN. RECORDS UNAVAILABLE. POSSIBLE CONFIGURATION SHOWN

CITY OF MABTON

WATER SYSTEM PLAN

FIGURE 1-2
EXISTING WATER SYSTEM

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\MABTON\11064 WSP\FIGURES\FIGURE 1-2

CRITICAL WATER SUPPLY AREA

Mabton is not located in a Critical Water Supply Area.

INVENTORY OF EXISTING FACILITIES

The purpose of the water system inventory is to establish the amount, type, and capacities of the various components of the existing water system. The current potable water system components consist of five wells (of which two are no longer in use, one is for emergency use and two are in service), one storage reservoir, approximately 10 miles of water distribution lines, and one booster pumping station. The City's water system has a single pressure zone. Figure 1-2 shows an overview of the City's water system piping.

SOURCE OF SUPPLY

The source of supply for the City is ground water supplied by three wells. Well No. 4 and Well No. 5 are the City's active, permanent sources and have an estimated combined total pumping capacity of 700 gpm. The City also has two emergency status wells, Well No. 2 and Well No. 3. Well characteristics are summarized in Table 1-3 and shown in Figure 1-3.

The City's Well No. 1 was taken out of service in the 1950s and decommissioned with cement grout in accordance with WAC 173-160. During the sealing of the well, 320 feet of tremie pipe was inserted into the well and removed as the bore hole and casing was filled with cement grout.

Well No. 3 has tested to be high in nitrates (17 mg/l), so if this well is to be used, the City blends this water with the water of Well No. 4 or Well No. 5 in order to produce a combined stream of water that does not exceed the State's maximum contaminant level (MCL) of 10 mg/l.

The well house for Well No. 4 appears to be constructed with explosion proof –lighting. It is possible that this well may produce methane, however no records have been found to indicate that this is the case.

Copies of the City's well logs are included in Appendix B.

The City also has a small well used for wash down at the wastewater treatment plant. This well is a 3-inch diameter, 25-foot deep well located at the wastewater treatment plant. There is no well report available for this well. It is utilized solely for the operation of the wastewater treatment plant.

TABLE 1-2

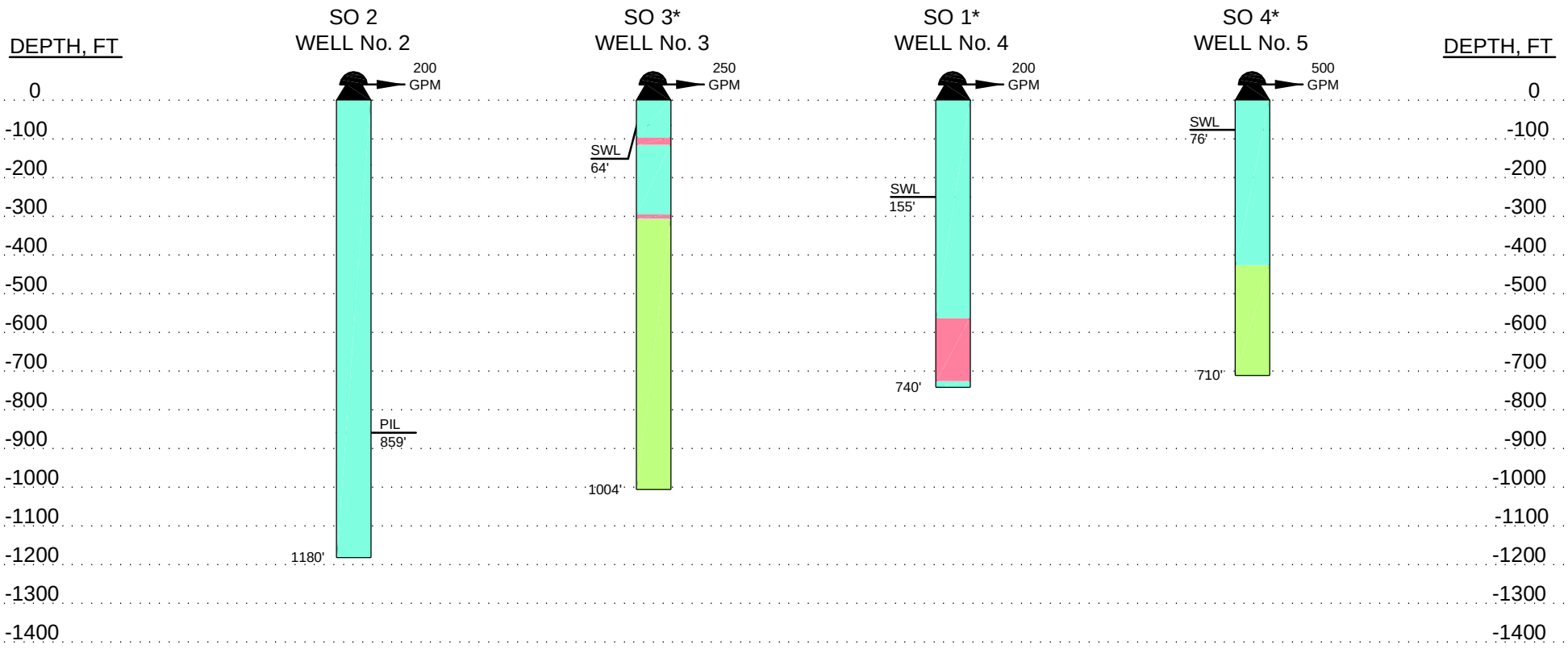
Mabton Water Well Characteristics

Characteristic	Well No. 2[(1)]	Well No. 3	Well No. 4	Well No. 5
DOH Source No.	SO2	SO3	SO1	SO4
Identifying No.	AFL768	AFL767	ABR606	ALF995
Status	Emergency	Emergency	Permanent	Permanent
Date Drilled	1935	1957	1987	2007
Wellhead Elevation (ft)	718 (+/-)	718	715 (+/-)	715 (+/-)
Pump Intake Level (bgs, ft)	n/a [(1)]	unknown	In repair. 500' (est.), to be determined.	250
Surface Seal	n/a	None indicated	Bentonite & Cement to 19'	Grout to 135', Grout strata seal at 425'
Casing Diameter (in) and depth (bgs, ft)	8"	16" (0'-130') 12" (120'-307')	16" (0,-134"), 12" (+18"-437.7'), 10" (411'-594'), 8"(563'-729')	16" (0-135'), 12" (72'-425')
Well Depth (bgs, ft)	1,180	1004	740.6	710
Well Casing Depth (bgs, ft)	n/a	307	729	425
Casing Perforations (ft)	n/a	96'-115', 295-305'	563'-726'	none
Open Interval (bgs, ft)	n/a	>307	>729	>425
Formation	Wanapum	Ellensburg	Saddle Mountain, (2)	Saddle Mountain[(2)]
Gas, Odor or Nitrate	Methane, Hydrogen Sulfide	Nitrate Level of 17 mg/l	Possible Methane	Hydrogen Sulfide
Rated Capacity (gpm)	800	250	1,000 (1987)[(3)]	500
Actual Capacity (gpm)	740	250	200 (2013) [(3)]	500
Pump Type	Line-Shaft	Submersible	Line-Shaft	Line-Shaft
Pump Manufacturer	Layne	-	Layne	
Pump Speed (RPM)	1760	-	-	1,775
Pump Column Diam. (in)	unknown	unknown	unknown	6
Motor Horsepower (HP)	75	40	125	60, US Motor
Static Water Level (bgs,ft)	82' (1989)	64' (2002)	155' (2013)	76'
Dynamic Water Level (bgs, ft)	118' (1989)	81' (1974)	411'	200' Estimated

(1) No well report is available for the well. The equipment for this well has been removed.

(2) Per the ROE for CG4-29212C, based upon geologic data, this well is "open to aquifers hosted by the Umatilla member of the Saddle Mountains Basalt of the Columbia River Basalt Group".

(3) SWL dropped from 76' in 1987 to 114' in 1999, and 155' in August of 2013 which has contributed to a reduced well output. Initial pump flow test after well cleaning indicate a capacity of approx. 240 gpm. Actual capacity will be determined once the well is re-equipped and source flow meter is installed.



LEGEND

CASING

PERFORATIONS

OPEN HOLE

SWL STATIC WATER LEVEL
PIL PUMP INTAKE LEVEL
* PUMP INTAKE LEVEL UNKNOWN

CITY OF MABTON
WATER SYSTEM PLAN

FIGURE 1-3
WELL CHARACTERISTICS

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M:\MABTON\11064 WSP\FIGURES\FIGURE 1-3

WATER RIGHTS

The City currently has certificates for an instantaneous (Qi) water right of 2,400 gpm and an annual withdrawal (Qa) water right of 452.4 acre-feet. The City also has a right for a well for use at the wastewater treatment facility for Qi of 15 gpm and Qa of 2 acre-feet per year. A copy of the records of examination (ROE) and certificates for these water rights is included in Chapter 10. A summary of the City's water rights is presented in Table 1-4 and a water rights self assessment form is included in Chapter 4.

TABLE 1-3

City of Mabton Water Rights

Source	Water Right Number	Type	Priority Date	Maximum Instantaneous Withdrawal (gpm)	Annual Withdrawal (Acre-Feet)
Well Nos. 2 & 3	G3-00027C	Certificate	3/3/1971	1,400	280(1)
Well No. 4	G4-29212C	Certificate	2/24/1987	1,000(2)	452.4(2)
Well Nos. 4 & 5	CG4-29212C	Change Cert./ROE(3)	4/27/2004	--	--
Subtotal (Sources used in City's water system)				1,000(2)	452.4(2)
Other:					
WWTF Well(4)	G3-00381C	Certificate	6/2/1972	15	2
Total				2,415	454.4

(1) Total Qa capped at 280 acre-ft. Originally this right was for Wells No. 1 and 2, but Well No. 1 has been decommissioned.

(2) 280 acre-feet of this right are alternate, non-additive to Ground Water Certificate No. G3-00027C. CG4-29212C limits Qi to 1,000 gpm and Qa to 452.4 acre-ft.

(3) Water Right Change Application is approved to allow Well No. 4 and Well No. 5 as the points of withdrawal for this water right.

(4) This well is used utilized solely for the operation of the wastewater treatment facility (WWTF).

STORAGE

The City has one reservoir in service which has a nominal volume of 800,000 gallons. This reservoir serves the City's single pressure zone. All functioning wells pump to this reservoir. A summary of the characteristics of the City's reservoir is presented in Table 1-5, the reservoir location is shown on Figure 1-2. The City also has an abandoned 50,000 gal. elevated steel reservoir located adjacent to the booster pumping station.

TABLE 1-4

City of Mabton Reservoir Characteristics

Characteristic	Reservoir No. 1
Date Constructed	1975
Nominal Storage Capacity (gallons)	800,000
Usable Storage Capacity (gallons)	611,500
Type of Construction	Welded Steel
Diameter	34' - 5"
Height (feet)	115 (+/-)
Base Elevation (feet above msl)	723 (+/-)
Aeration Tray Bottom (feet above bottom of reservoir)	113(+/-)(1)
Overflow Elevation, Max. W.S. elev. (feet above msl)	835 (+/-)
Overflow Height (feet)	112 (+/-)
Tank Crown Height (feet above msl)	838 (+/-)

(1) Per Preston Shepherd plans "Water System Improvement Project, Aeration Trays", 10-17-74, (note, these are not as-built drawing). City currently sets the operating water surface at approximately 27 feet below the aeration trays to facilitate aeration.

The reservoir was last cleaned in 1984. The water levels in the reservoirs are controlled by mercury pressure controls on the outside of the tank. The controls were removed from the interior of the tank after a methane gas explosion destroyed the top of the steel standpipe. The explosion was reportedly caused by a spark from a ventilator fan motor which has since been removed. As this tank was constructed in 1975, building codes for reservoirs such as this have been tightened for seismic concerns, and it is likely that the reservoir may require additional anchorage to meet the current code.

In either 1975 or 1978 (year unknown), the City had aeration trays constructed in the top of the reservoir. The reservoir inlet pipe is routed to discharge onto these trays. These trays consist of three tiered steel trays of 3/16" thick plate steel drilled with ½" diameter holes. In addition, a 1,000 cfm explosion proof blower fan was added just above the trays at the center of the tank roof. These components were added to assist in the removal of hydrogen sulfide and the methane gas buildup in the tank to reduce the chance of explosion.

A pressure gauge located in the BPS detects the water level in the reservoir. This pressure gauge is used to turn the wells on or off. The operating pressures are 34 psi for the "pump-on" level and 37 psi for the "pump-off" level. This corresponds to reservoir water levels of 78.5 feet and 85.4 feet. This indicates that 28 feet of the reservoir are dedicated to aeration and the aeration trays. Therefore the usable capacity of the reservoir is reduced by approximately 200,000 gallons due to the aeration. This lowered water surface reduces the pressure of the output from the reservoir by approximately 9 to 12 psi.

BOOSTER PUMPING STATION

The City's Booster Pump Station (BPS) was constructed in 1988 and is located in the center of Mabton City Park, southwest of the intersection of South Main Street and Fern Street. It was designed with one 5 HP booster pump (constantly on), two 15 HP booster pumps, and a 30 HP fire pump. It is now equipped with one 10 HP booster pump (constantly on), two 15 HP booster pumps and one 30 HP fire pump. Water is pumped from the reservoir through a 12-inch pipe with gate valve and flow meter to the distribution system. The BPS is necessary to boost water system pressures and fire flows, partly because the upper portion of the reservoir has been used for aeration and the aeration trays which have reduced the head available to the system. The characteristics of the BPS pumps are shown in Table 1-6.

TABLE 1-5

Booster Pumping Station Characteristics

Characteristic	Booster Pump No. 1[(1)]	Booster Pump No. 2	Booster Pump No. 3	Fire Pump No. 4
Status	Constant on	Lead	Lag	Fire
HP	10	15	15	30
Installed	1988	1988	1988	1988
Flow (gpm)	175	550	550	1,200
@ TDH (ft)	70	70	70	70
RPM	1,770	1,750	1,750	1,750
Size	2" x 2½"	4" x 5"	4" x 5"	6" x 6"
Phase, Voltage, Hz	3, 460, 60	3, 460, 60	3, 460, 60	3, 460, 60
Manufacturer	Paco Pumps	Paco Pumps	Paco Pumps	Paco Pumps
Model No.	10-20953-130001-1682	10-40957-140001-1822	10-40957-140001-1822	16-60957-140101-1882

(1) The original 5 HP jockey pump motor was replaced with a 10 HP motor (date unknown).

TRANSMISSION AND DISTRIBUTION SYSTEM

The existing water distribution system consists of approximately 9 miles of pipeline serving the City of Mabton.

The City's older water mains are comprised largely of cast iron (CI) (1936) and asbestos – cement (AC) (1975). PVC (AWWA C900) pipe is now used almost exclusively, whether for replacement or new installations. Table 1-7 lists the approximate length, diameter, and type of pipe in the system.

In December, 2012, the City had a leak detection study (Appendix C) performed on the distribution system. This study found two leaks in the distribution system, one in a

2-inch line (estimated at 5 to 10 gpm) and the other in the Well No. 5 check valve (estimated at 1 gpm). As check valves are re-seated each time they open and then close, it is possible that the flow rate of the check valve leak may vary significantly. The City intends to investigate these leaks and to repair them in order to reduce system losses.

TABLE 1-6

Length in Feet of Transmission and Distribution System Piping

Pipe Size	Cast Iron (1936)	PVC (age varies)	Asbestos-Cement (1975)	Total	Percent of Total
4-Inch	24,267	1,016	0	25,283	52%
6-Inch	10,245	341	0	10,586	22%
8-Inch	2,245	7,012	2,699	11,956	25%
12-Inch	0	0	633	633	1%
Total	36,757	8,369	3,332	48,458	100%
Percent of Total	76%	17%	7%	100%	-

SYSTEM CONTROL

The controls for City Wells Nos. 3 and 4 are located in the BPS building. Also reported at this location are the reservoir pressure, booster pressure and booster flow, as well as various high and low pressure alarms. This site also houses and records on circle charts flows from Well Nos. 2 and 4, the reservoir level, and booster pump flows. The start and stop settings for Well Nos. 2, 3 and 4 are set via hand dials located adjacent to the reservoir level indicator. The main electrical switching panels for this equipment are located in this building as well.

Signals from the BPS are displayed on the main panel board. From this location in the booster station, the operator can operate booster components in manual or automatic modes. Alarms are displayed, and key personnel are automatically dialed when an alarm occurs. Alarms for the majority of the sites include pump failure, power failure, and high/low reservoir water level.

The controls for Well No. 5 are located at the well house for Well No. 5.

A complete description of the operation and set points for the reservoirs is described in Chapter 6, Operation and Maintenance Program.

WATER TREATMENT

The City's sources are chlorinated. A discussion of water quality is described in Chapter 3, System Analysis.

All water is pumped to the aeration trays at the top of the City's reservoir where gases are vented away by a fan in order to prevent a buildup of the naturally occurring, potentially explosive, methane gas and to facilitate hydrogen sulfide removal. The City has previously had problems with gas buildups in the reservoir and well houses. The methane production is associated with Well No. 1, Well No. 2 and Well No. 4, while Well No. 2 and Well No. 5 produce hydrogen sulfide.

ADJACENT WATER PURVEYORS AND INTERTIES

There are no adjacent water purveyors. The City has no existing interties.

RELATED PLANNING DOCUMENTS

The following documents were consulted in the preparation of the Water System Plan Update:

City of Mabton, Wastewater Facility Plan, 2011.
City of Mabton, Comprehensive Plan Update, 2009. This plan represents the community's policy plan for growth over the twenty-year planning period. This report was used for determination of future population growth.
City of Mabton, Comprehensive Water System Plan, 2005.
Plan 2015, (The Yakima County Comprehensive Plan), amended 2007.

SERVICE AREA, ZONING AND SERVICE AREA POLICIES

The current City limits and UGA boundary are shown on Figure 1-4, as well as the Existing Service Area, Future Service Area, Retail Service Area, and the water rights place of use.

EXISTING LAND USE AND ZONING

In general, existing land uses correspond to the zoning presented in Figure 1-5. The businesses, professional offices, and industries are located along or near the main routes through the City. Table 1-8 summarizes the current zoning within the Mabton UGA. Yakima County zoning is also presented in Figure 1-6.

FUTURE SERVICE AREA

The City's future service area boundary is a portion of the area within the UGA boundary and is shown on Figure 1-4.

FUTURE LAND USE AND ZONING

Extensive zoning changes are not expected to the area in and around the City for the 20-year planning period as indicated in the City's 2009 Comprehensive Plan Update.

GROWTH MANAGEMENT ACT CONSIDERATIONS

The Growth Management Act was passed into law in 1990 with the intention to control uncoordinated and uncontrolled growth, which is considered to pose a threat to the quality of life and the environment within the State of Washington. It was determined by the State that it is in the public interest that citizens, communities, local governments, and the private sector cooperate and coordinate with one another in comprehensive land use planning. The City has adopted its 2009 Comprehensive Plan Update. Currently, land is zoned in five of the nine available zoning districts. These five zones are as listed in Table 1-7:

TABLE 1-7

City of Mabton Zoning

Land Use Designation	Brief Description[(1)]
Residential District (R-1)	Intended to establish residential development, with maximum of seven to eight units per acre. Allows single family, two-family, multifamily dwellings, mobile homes and parks. Building heights up to 35 feet.
High Density Residential District (R-2)	Density of up to 26 units per acre. Permitted uses are the same as in R-1. Building heights up to 40 feet.
Commercial District (C-1)	Intended to permit a wide range of commercial uses but generally prohibits residences except as accessory uses. Intended for areas with good access so that traffic impacts on residences are minimized.
Manufacturing (M-1)	The manufacturing district permits commercial uses, plus a range of light and heavy industrial uses, but generally prohibits residences except as accessory uses.
Park and Open Space District	Intended to provide open space for low-intensity public and private parks, etc.

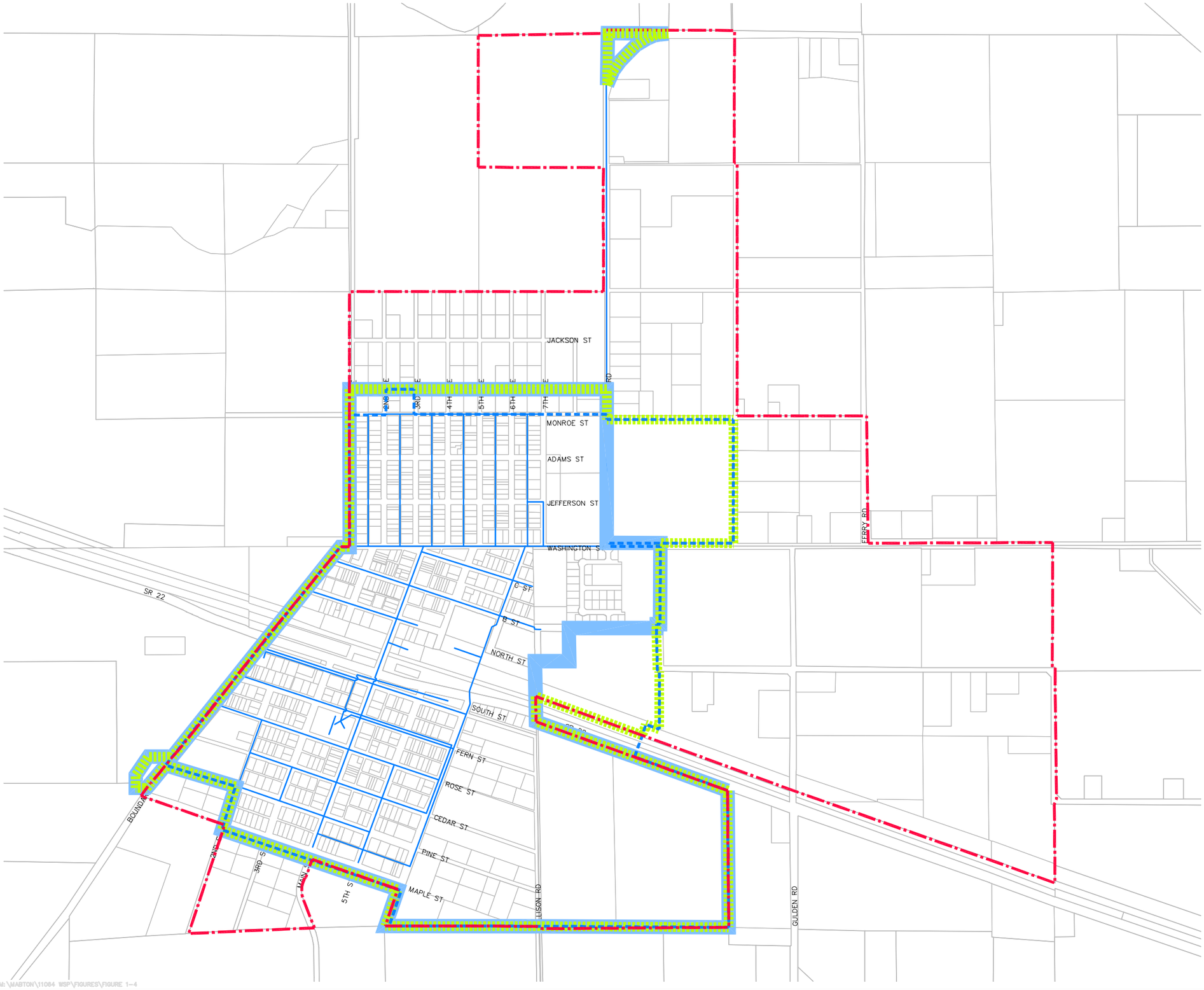
(1) For a more detailed description and definition, see the Mabton municipal code.

The City's zoning map is shown on Figure 1-5.

DUTY TO SERVE STATEMENT FOR THE RETAIL SERVICE AREA

Per RCW 43.20.260, the City has a duty to serve within its retail service area if a potential user approaches the City with a request for connection and the following threshold factors apply:

The municipal water supplier has sufficient **capacity** to serve water in a safe and reliable manner.



CITY OF MABTON
WATER SYSTEM PLAN

FIGURE 1-4
CITY LIMITS, UGA, & SERVICE AREAS

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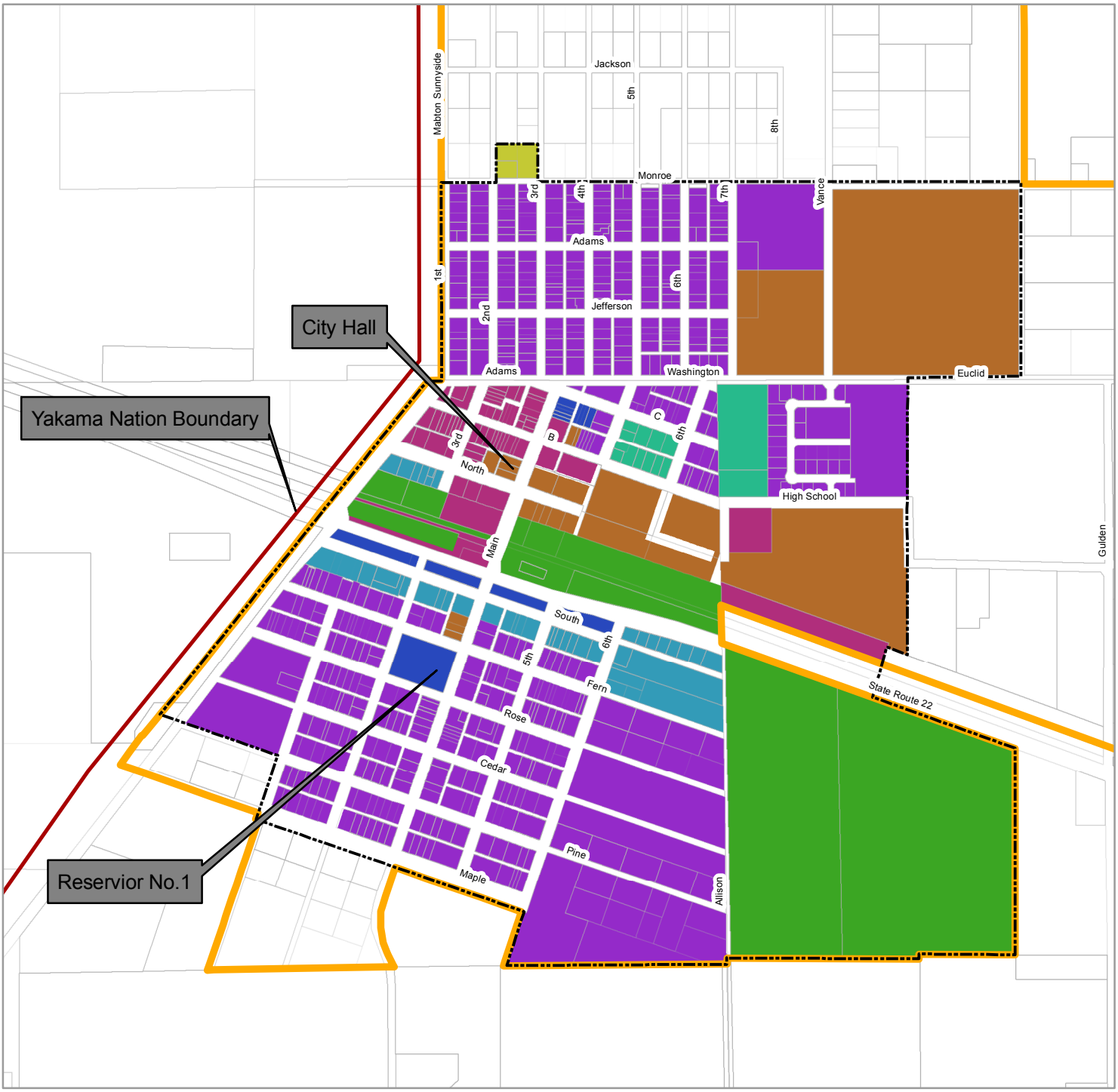

Legend:

- City Limits
- UGA
- C-1 Commercial
- M-1 Manufacturing
- MU Mixed Use
- PF Public Facilities
- PK Park/ Open Space
- R-1 Single-Family Residential
- R-2 Multi-Family Residential
- R-R Rural Residential

N
W E
S

0 500 1,000
Feet

CITY OF MABTON
Water System Plan Update
FIGURE 1-5
City Zoning Map

Gray & Osborne, Inc.
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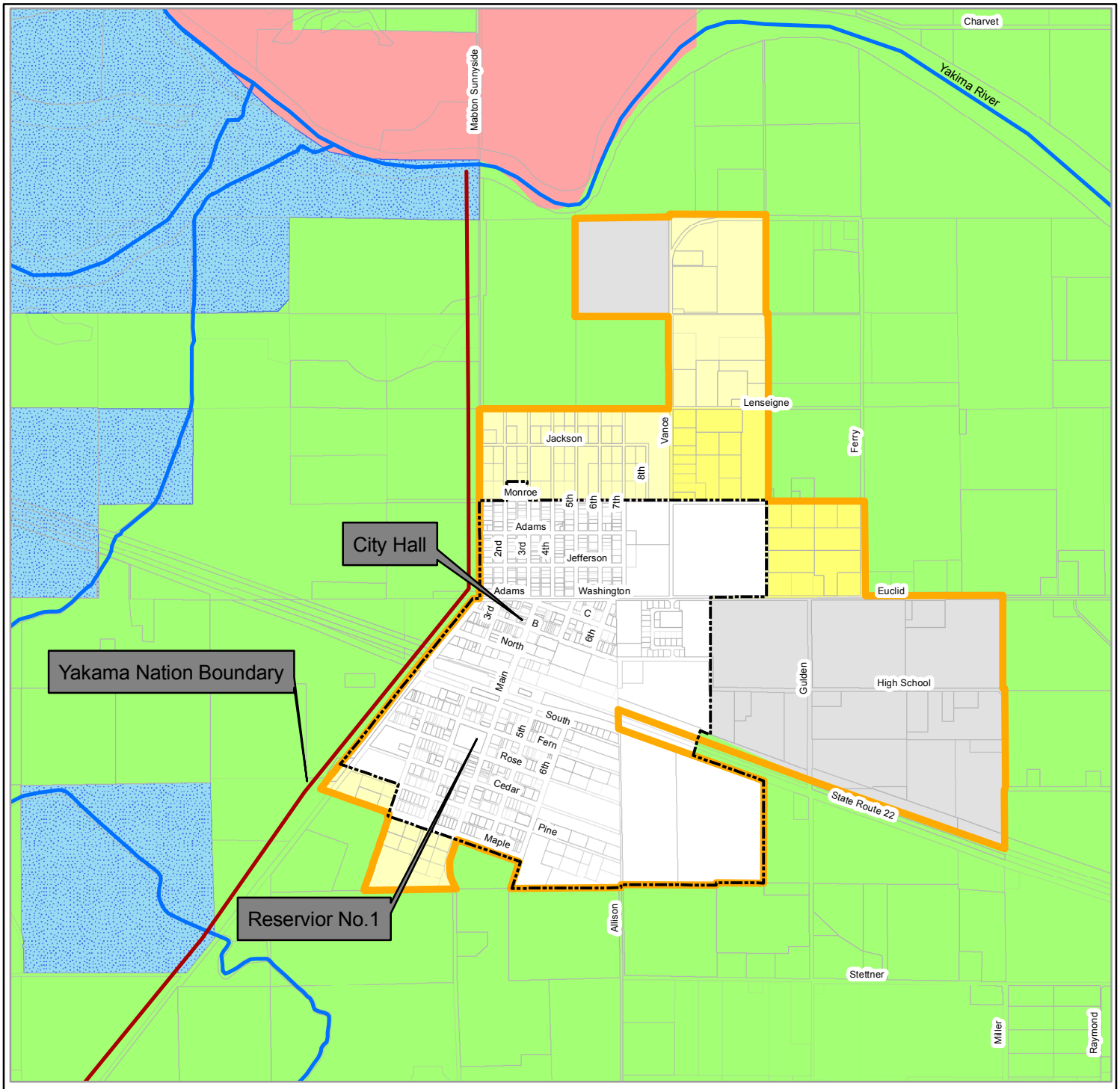
M:\Mabton\10064 WSP\GIS\Zoning City



Legend:

- City Limits
- UGA

County Zoning

- Agriculture
- TRIB
- Remote/Extremely Limited
- Industrial
- Agriculture
- Industrial
- Remote/Extremely Limited
- R-1 Single-Family Residential
- R-2 Multi-Family Residential

N

W E

S

0 1,000 2,000

Feet

CITY OF MABTON

Water System Plan Update

FIGURE 1-6

County Zoning Map

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\Mabton\10064 WSP\GIS\Zoning County

The service request is **consistent** with adopted local plans and development regulations.
The municipal water supplier has sufficient **water rights** to provide service.
The municipal water supplier can provide service in a **timely and reasonable** manner.

The Mayor and Clerk-Treasurer determine whether a request meets the above criteria, and present a recommendation to the City Council.

SERVICE AREA POLICIES AND CONDITIONS OF SERVICE

Table 1-8 summarizes the City of Mabton service area policies and their definitions.

TABLE 1-8

City of Mabton Service Area Policies

Policy Name	Policy Summary	City Municipal Code Reference
Wholesaling of Water	Will the purveyor provide water to other utilities on a wholesale basis?	Not applicable. Adjacent water utilities are not close.
Wheeling of Water	Will the purveyor allow the system's mains to be used to wheel water to another water system?	Not applicable. Adjacent water utilities are not close.
Design And Performance Policy	Policy establishing construction standards in accordance with the City's standards for all connections, extensions, and developments.	Section 13.04.050 (Note 1)
Connection Fee Policy	Establishes connection fees to be paid for new service connections.	Section 13.04.430
Cross Connection Control	Policy establishing the requirements for cross connection prevention devices.	Section 13.05
Growth Policy	Policy stating how growth of the system will be funded.	Section 13.04.560
Connection Mandatory Policy	Policy stating that connection to the water system by residents within the City Limits is mandatory.	Section 13.04.040
Over-sizing Policy	City provides funds to install larger than needed facilities to allow for future development, if necessary.	(Note 2)
Surcharge Policy	Policy determining that a surcharge will be assessed to water connections outside City limits.	New connections outside City limits are not allowed per Sec. 13.04.660.

Notes:

(1) Indirectly addressed in City's code. City performs all extensions.
(2) Not currently addressed in City's code.

TABLE 1-8 (cont.)

City of Mabton Service Area Policies

Policy Name	Policy Summary	Current City Policy Reference
Direct Extension Policy	Policy stating whether any new development shall be served through a direct line connection from the City's existing system.	(Note 2)
Extensions Policy Within City Limits	Policy establishing service extensions within City Limits, required design standards and how extensions and associated costs will be paid for.	Section 13.04.560 (Note 1)
Extensions Policy Outside City Limits	Policy establishing service extensions outside City limits but within the designated UGA. These extensions will be allowed provided certain conditions are met.	Section 13.40.560, New connections outside City limits are not allowed per Section 13.04.660.
Annexation Policy	Is annexation required in order to obtain water service?	(Note 2)
Late-Comer Agreement Policy	Policy establishing a Late-Comer agreement.	(Note 2)

Notes:

(1) Indirectly addressed in City's code. City performs all extensions.
(2) Not currently addressed in City's code.

CHAPTER 2

BASIC PLANNING DATA

CHAPTER 2

BASIC PLANNING DATA

This chapter presents the basic planning data used to estimate Mabton's future water demands. Water demand projections are used in Chapter 3 to evaluate the adequacy of the City's existing water system.

HISTORICAL POPULATION, NUMBER OF SERVICES, AND WATER USE

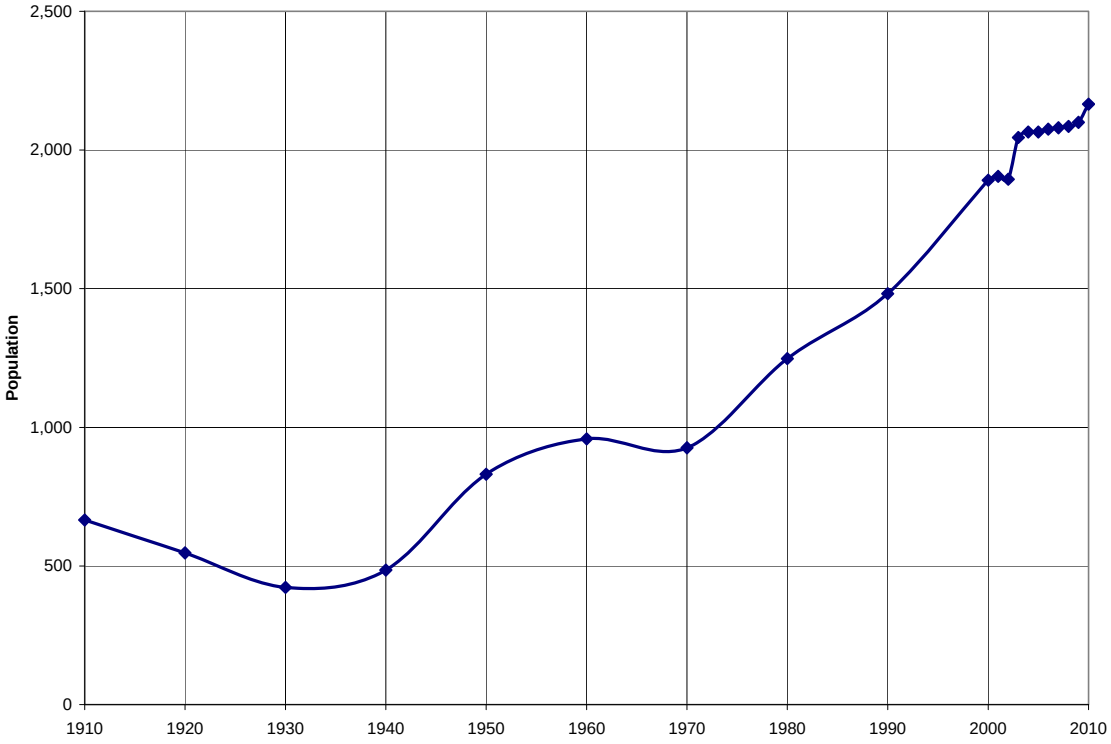
In this section historical population trends, number of services, and water production and consumption data are presented.

HISTORICAL POPULATION

As shown on Figure 2-1, the population within the City limits has grown steadily since 1930 and has more than doubled since 1970.

FIGURE 2-1

Historical Population[(1)]



(1) Source: Washington State Office of Financial Management.

SERVICE CONNECTIONS

The number of service connections for 2010 is summarized in Table 2-1. The City's classifications of service connections are consolidated here into the following customer classes: Residential (Residential and Mobile Homes), Commercial (includes Business and Churches), and Municipal (includes City/Other Buildings and Schools). As indicated in the table, the City had 532 billing connections in 2010. DOH has approved the City for 671 connections. The DOH currently shows 632 "Calculated Active Connections" on the City's Water Facilities Inventory (WFI) Form. Currently the City's water system DOH Operating Permit is color coded Green. Systems in this category are considered adequate for existing uses and adding new service connections up to the number of approved service connections.

TABLE 2-1

2010 Billing Accounts [(1)]

Customer Class (Bill Classifications)[(2)]	Number of Billing Accounts	% of Total Connections
Single Family Residential (1, 8, 10, 11)	457	86%
Multi Family Residential (3)	28	5%
Commercial (0, 2, 5)	33	6%
Municipal (4, 6)	14	3%
Total	**532**	**100%**

(1) Source: City records.

(2) The City's codes for the Bill Classifications indicated in parentheses are as follows: (0)=Water Only; (1)=Residential; (2)=Business; (3)=Apartments; (4)=City/Other Buildings; (5)=Churches; (6)=Schools; (7) is not used; (8)=Outside Water Only; (9) is not used; (10)Residential; (11)=Mobile Homes.

WATER USE

The City has started tracking the water production from Well No. 5 and has purchased a water meter for installation at Well No. 4 which is not currently functioning properly. This meter will be repaired or replaced. The City has been manually recording daily source meter reads for well No. 5, and once a functioning meter is installed at Well No. 4, will record these reads daily as well. After the City has gathered a year's worth of production records, water use efficiency can be determined in a more accurate manner.

For the purposes of this water system plan, however, water loss has been estimated by the following method:

> During a time of expected low water usage, calculate the volume of water pumped into the system by measuring the drop in the City's single reservoir and then subtract from this an estimate of the water use by authorized uses. The difference will be an estimate of the City's water losses to leakage and other unauthorized

uses (Distribution System Leakage or DSL). This test was performed on the evening of Thursday, April 26th, 2012, at approximately 10:10 pm to 11:10 pm. There had been a heavy rainfall event this day, which significantly reduced what little irrigation one might have expected at this time of the year. The drop in the reservoir height was determined from the associated pressure drop as reported by the digital pressure meter for the reservoir in the City's booster station. This difference was measured over the one-hour period. The results are summarized as follows:

During the one hour test:	
Volume of water drained from reservoir:	15,800 gal. per hour
Estimate of volume of water used(1):	10,400 gal. per hour
Approximate Distribution System Leakage (remainder)	5,400 gal. per hour

Annualized this water loss is estimated as 50,000,000 gal/yr. or 153 ac-ft/yr.

(1)Estimated uses for the hour as follows: (1) 7 gal. toilet flush per connection; (1) 50 gal. shower per 10 connections; (1) 5 gpm irrigation use per 40 connections, (2) 2 gpm commercial uses, (12) 3 gal. toilet flushes; (1) 2,000 gal. water use per Northwest Horticulture; 4 gpm for bar sprayer at WWTF.

While this type of test provides only a rough estimate of the distribution system leakage (DSL), it indicates that the leakage is quite substantial, which may be due to the fact that approximately 50 percent of the City's water mains are now over 70 years old. These flows out of the reservoir have been corroborated with the reservoir flow charts, which indicate an approximate water distribution leakage of 5,000 gallons per hour. Once the City has been able to track water production, a better estimate of the DSL can be made.

In December of 2012, the City had a leak detection survey (Appendix C) performed by American Leak Detection. This survey discovered only two leaks in the pipes that were surveyed with an estimate of 6 to 11 gpm of total leakage. Note that due to a lack of records of old pipes (which may still be connected to the system), there may be significant leaks that would not be detected by this survey. Only pipes with locations that are known can be surveyed for leaks.

Water consumption is recorded monthly at individual water service meters, except during those winter months when meters are snow-covered and inaccessible. During those months, customers are billed the base rate only and the first spring reading is averaged for the unread months. Customers are then charged accordingly for any overages.

We note here that the estimated 2012 peak hour demand (PHD) of 1,109 gpm (see Table 2-3) exceeds the estimated 700 gpm capacity of Wells No. 4 and No. 5. Therefore, during peak water usage, it is expected that the reservoir will be drawn down to supply these demands during this time when outflow exceeds inflow. The system is to some extent, self-adjusting as when the reservoir level drops, this slightly reduces the pressure which will be seen throughout the system and thereby reduce the water supply rate, water usage and water leakage.

However, it is a very real possibility and risk that the City's reservoir could potentially be emptied on high-demand days, especially if the reservoir level had not recovered overnight from the previous day's demands and sources (such as has happened to Well No. 4) are compromised.

The City has had experience with significant dropping of the reservoir levels in August 2013, when Well No. 4 failed. During this time, the City was forced to issue water-use reduction measures for customers. The City is aware of the risk of emptying the reservoir and by monitoring the reservoir water levels, and shutting off the booster station during selected times of the day (with DOH consent), the City has been able to manage system supply and demand in order to maintain water levels in the reservoir.

It is critical for the City to increase their source capacity by drilling and equipping a new well as soon as possible. This new well would help to eliminate the water storage problem, provide source redundancy should the City have another well failure, and provide the City with a more reliable source.

Average Day Demand (ADD)

Table 2-2 lists water consumption and estimated production between 2006 and 2010. The Annual production has been estimated by assuming a fixed amount of 50,000,000 gallons annually of DSL over the 5-year time period. Annual production, or demand, is commonly reduced to a daily value, and is referred to as the average daily demand (ADD). ADD is important in determining the adequacy of the City's annual withdrawal water right quantities.

The City's demands have been relatively consistent over the last several years, and an average ADD will be used to project future demands.

TABLE 2-2

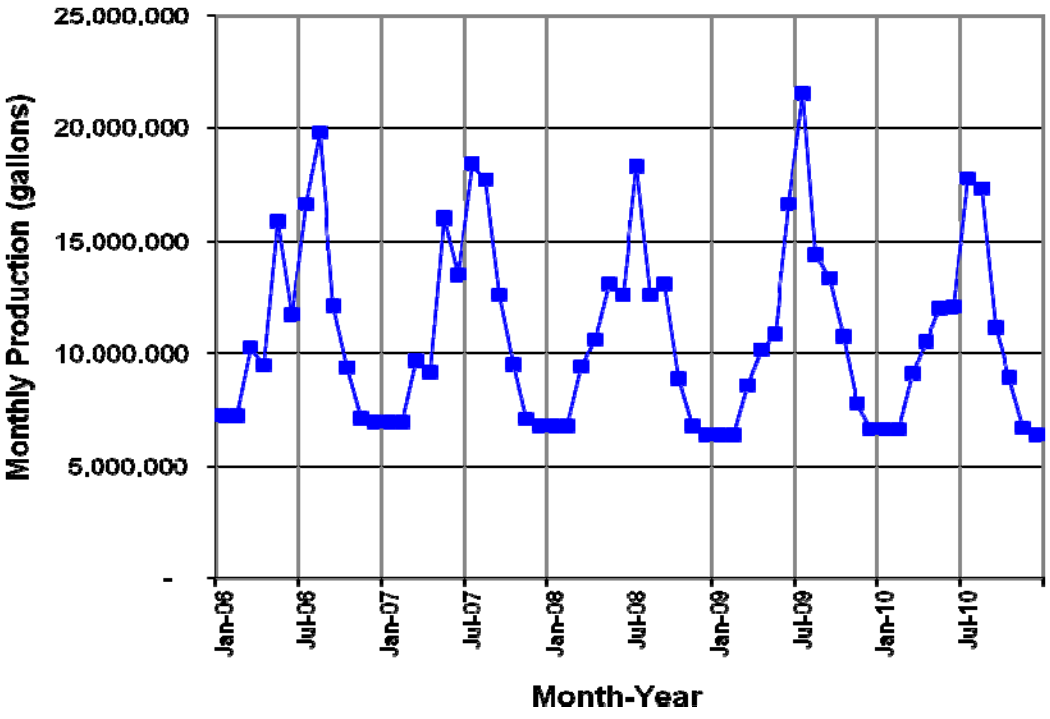
2006-2010 Average Day Demand

Year	Service Area Pop. (1)	Production (gal) (2)	Consumption (gal) (3)	ADD (gpd)	Per Capita Production (gal/cap-dy)	Annual Production (ac-ft/yr)
2006	2,075	132,000,000	82,411,000	362,000	174	406
2007	2,080	132,000,000	82,386,000	362,000	174	406
2008	2,085	127,000,000	76,919,000	348,000	167	390
2009	2,100	133,000,000	83,236,000	364,000	173	408
2010	2,165	127,000,000	77,106,000	348,000	161	390
2006-2010 Average:		**130,000,000**	**80,410,000**	**356,000**	**170**	**400**

(1) Source: Washington State Office of Financial Management.
(2) Estimated production from consumption assuming constant 50,000,000 gal. (153 ac-ft.) per year DSL.
(3) Source: Mabton billing records.

FIGURE 2-2

2006-2010 Mabton Monthly Water Production



The monthly production values in Figure 2-2 have been adjusted for DSL (assumed to be constant), seasonal variations in the meter reading cycle, outliers and recording anomalies. Production is therefore estimated based upon consumption plus a constant amount of estimated DSL.

Maximum Day Demand

The maximum amount of water pumped from the City's wells in a 24-hour period is called the maximum day demand (MDD). MDD values are used to determine whether the water system has sufficient source capacity to meet current and future production demands and to determine its requirements for instantaneous water rights.

Since the City does not have production data, an analysis of the production data cannot be performed. DOH's 2009 Water System Design Manual (WSDM) recommends using a ratio of MDD to maximum month's average day demand (MMAD) in Eastern Washington of 1.3, which results in an MDD/ADD ratio of 2.1 for Mabton. The previous water system plan had used 2.0 for the MDD/ADD ratio. MMAD and MDD data for 2006 through 2010 are presented above in Table 2-3.

Peak Hour Demand

The maximum amount of water produced in a one-hour period during a maximum day is the peak hour demand (PHD). PHD is an important parameter in determining the amount of reservoir storage needed to make up the difference between the peak hour production requirement and the system's pumping capacity.

The City currently has very few records of the continuous reservoir levels needed to calculate the PHD. In the absence of actual field data, DOH provides a means to estimate PHD using Equation 5-1 from its WSDM.

$$PHD = \left(\frac{MDD}{N}\right) \times \left[(C)(N) + F\right] + 18$$

Where PHD is in gpm, MDD is in gpm, N is the number of equivalent residential units (ERUs), and C and F are coefficients based on N. For an average value for 2006 through 2010, MDD = 519 gpm (Table 2-3), N = 448 ERUs, C = 1.6 and F = 225 (WSDM),

$$PHD = \left(\frac{519}{448}\right) \times \left[(1.6)(448) + 225\right] + 18$$
$$= 1{,}109\ gpm,$$
$$So, \quad PHD / MDD = 1{,}109 / 519$$
$$= 2.13, \quad Use\ \ 2.1$$

Table 2-3 summarizes ADD, MDD and PHD for 2006 through 2010.

TABLE 2-3

2006-2010 Estimated Water Production

Year	Service Area Pop.[1]	Estimated ADD (gpd)[2]	Estimated MDD[3] (gpm)	Estimated PHD[4] (gpm)	Estimated Annual Production (ac-ft/yr)
2006	2,075	362,000	528	1,109	406
2007	2,080	362,000	528	1,109	406
2008	2,085	348,000	508	1,066	390
2009	2,100	364,000	531	1,115	408
2010	2,165	348,000	508	1,066	390

(1) Source: Washington State Office of Financial Management.
(2) From Table 2-2.
(3) MDD = 2.1*ADD. 2006-2010 average MDD = 519 gpm.
(4) PHD = 2.1* MDD.

Because the variability from year to year is not excessive, average values of ADD, MDD, and PHD will be used to project future demands.

Consumption History

Table 2-4 shows a summary of the City's recorded water consumption history for 2006 through 2010. These data are based on City billing records for all customer classes.

TABLE 2-4

2006 - 2010 Total Water Consumption

Year	SF Residential[(1)] (gal)	Apartments (gal)	Municipal[(2)] (gal)	Commercial[(3)] (gal)	Total (gal)
2006	55,072,000	8,524,000	15,590,000	3,225,000	82,411,000
2007	54,361,000	7,178,000	17,724,000	3,123,000	82,386,000
2008	54,860,000	6,042,000	13,220,000	2,797,000	76,919,000
2009	54,203,000	6,133,000	16,453,000	6,445,000	83,234,000
2010	51,084,000	6,846,000	8,836,000	10,340,000	77,106,000
Average	**53,916,000**	**6,945,000**	**14,365,000**	**5,186,000**	**80,412,000**
% of Total	**67%**	**9%**	**18%**	**6%**	**100%**

(1) Includes codes (1) Residential, (8) Outside Water Only, (10) Residential, and (11) Mobile Homes.
(2) Includes codes (0) Water Only, (2) Business and (5) Churches.
(3) Includes codes (4) City/Other Buildings and (6) Municipal.

The City's residential consumption is summarized in Table 2-5.

TABLE 2-5

2006-2010 Residential Water Consumption

Year	Service Area Population	Total Residential Consumption [(1)] (gal/yr)	Average Day Residential Consumption (gpd)
2006	2,075	55,071,000	151,000
2007	2,080	54,361,000	149,000
2008	2,085	54,860,000	150,000
2009	2,100	54,203,000	149,000
2010	2,165	51,084,000	140,000
Average:		**53,915,000**	**148,000**

(1) Residential Consumption from Table 2-4.

Distribution System Leakage

Section 8 of WAC 246-290, as revised to incorporate the 2003 Municipal Water Law, requires municipal water suppliers with 500 or more connections to meet a state distribution system leakage (DSL) standard of no more than 10 percent. DSL must be reported as a volume and as a percentage of total production. The City of Mabton has recently been going through a change in staff and management and does not have total source production records. Therefore, the City's DSL cannot be determined to any degree of accuracy (see "Water Use" above). The City is taking measures to repair or replace the source meter on Well No. 4. Once this meter is properly functioning and the City is able to develop a history of its water production, the DSL can be determined.

Currently, with an estimate of a constant 50,000,000 gal/yr. of DSL, the percentage of DSL is as shown in Table 2-6.

TABLE 2-6

2006-2010 Estimated Distribution System Leakage

Year	Metered Consumption (gal/yr) [(1)]	Estimated DSL[(2)] (gal/yr)	Estimated DSL[(3)] (percent)
2006	82,409,000	50,000,000	38%
2007	82,386,000	50,000,000	38%
2008	76,919,000	50,000,000	39%
2009	83,234,000	50,000,000	38%
2010	77,106,000	50,000,000	39%
5-Year Average DSL:			**38%**

(1) Table 2-4.
(2) See "Water Use" above for discussion of Estimated Distribution System Leakage.
(3) Percent of DSL = (Estimated DSL) / (Consumption + Estimated DSL).

The City also plans to begin a program of routinely calibrating source meters every three years to ensure these meters are reading accurately and reliably.

Equivalent Residential Units

Equivalent residential units (ERUs) are a way to express water use by non-residential customers as an equivalent number of residential customers. Because the City's population has remained relatively stable over the last five years, the average ERUs for each customer class for 2006 through 2010 are used to determine ERU values in Table 2-7. The average consumption per residential customer for 2006-2010 was 323 gpd/ERU (=53,916,000 gallons/yr ÷365 days/yr ÷ 457 residential connections). This number was divided into the annual consumption for each customer class to arrive at the number of ERUs for that class.

TABLE 2-7

2006-2010 Average Equivalent Residential Units

Classification	Average Metered Consumption (gal) [1]	2010 Number of Conn. [2]	ERUs [3]	ERUs / Conn.	Percent of Total ERUs
Residential	53,916,000	457	457	1.0	67%
Apartment Bldgs.	6,945,000	28	59	1.1	9%
Municipal [4]	14,365,000	14	122	2.5	18%
Commercial	5,186,000	33	44	1.3	6%
Total	**80,412,000**	**532**	682	-	**100%**

(1) From City billing records. The values shown are averages for 2006 through 2010, see Table 2-4.
(2) Table 2-1. Assumes 2010 connection count is approximately equal to the average connections for this period.
(3) Metered Consumption ÷ 323 gpd/ERU ÷ 365 days/yr.
(4) Includes customer class (4) City/Other Buildings and (6) Schools.

The total number of ERUs is about 29 percent more than the number of connections. It will be assumed that growth of all connections will occur at approximately the same rate as residential growth.

LARGEST WATER USERS

Table 2-9 lists the City's 10 largest retail water users in 2010. The two largest users by far, are the school district for Mabton Elementary (8.5%) and Mabton High School (7.9%). Both schools have large irrigated areas. These two demands account for approximately 16 percent of the City's annual usage.

TABLE 2-8

2010 Largest Water Users

Customer Water Service Address	Customer Class[1]	2010 Annual Usage (gal)	2010 Avg. Daily Usage (gal)	Percent of Total Consumption [2]
Seventh Ave. 120	6	6,554,000	17,956	8.5%
B St. 516-A	0	6,071,000	16,633	7.9%
Main St. 204 C	3	1,454,000	3,984	1.9%
North St. 330	2	876,000	2,400	1.1%
Main St. 615/617	3	655,000	1,795	0.9%
Mabton/Southside Rd. 8301	8	614,000	1,682	0.8%
No. Third St. 207	6	529,000	1,449	0.7%
Mabton/Southside Rd. 8279	8	440,000	1,205	0.6%
North Third St. 214	6	432,000	1,184	0.6%
Allison Rd. 182	0	347,000	951	0.5%

(1) City Customer Class codes: 0=Water Only; 2=Business; 3=Apartments; 6=Schools; 8=Outside Water Only.

(2) Total consumption for 2010 = 77,106,000 gallons, see Table 2-6.

FUTURE SERVICE AREA

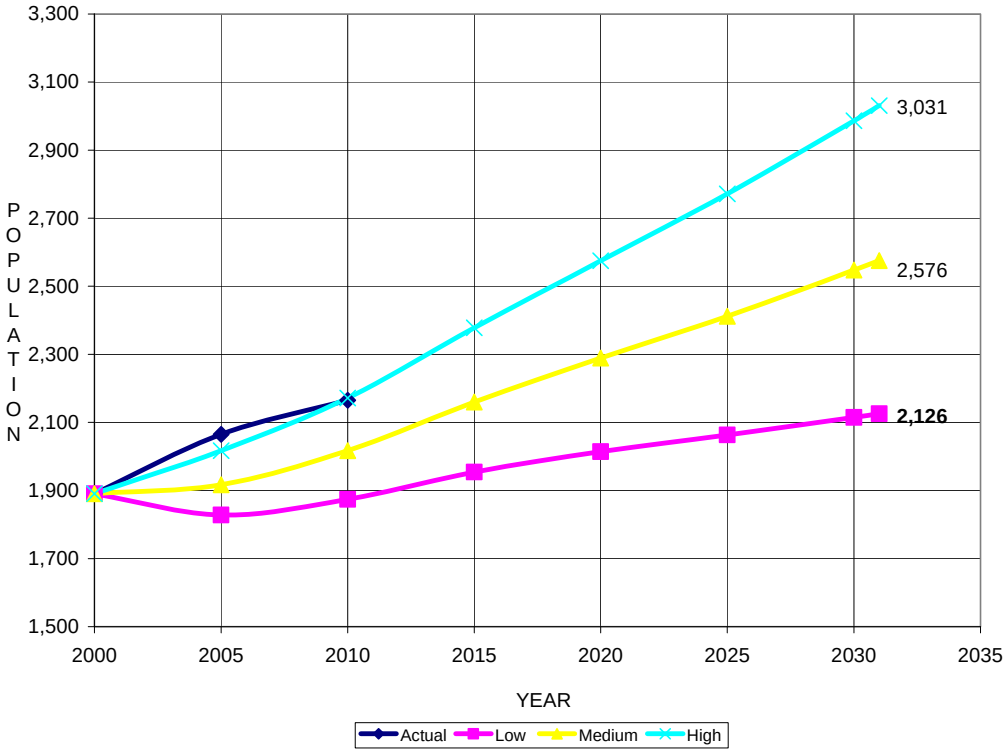
The City's residential housing has remained fairly constant. In 2008, the City adopted Resolution No. 2008-2, a resolution concerning the annexation of several parcels of land on the eastern edge of the City, referred to as the Northwest Horticulture/Allison Road Annexation. The City's water system permit color is currently coded Green, allowing new water system connections to serve this and other areas up to the number of DOH approved connections.

PROJECTED POPULATION, ADD, MDD, AND PHD

Figure 2-3 presents the low, medium and high population projections from the 2009 City of Mabton Comprehensive Plan Update and the actual population growth for 2000 to 2010.

FIGURE 2-3

City of Mabton
Comprehensive Plan Population Projections (1), (2), (3)



(1) The baseline 2000 population was 1,891.
(2) Data from the 2009 *Comprehensive Plan Update* for the years 2000 to 2025.
(3) Population projected for 2025 to 2031 at 0.5% for low projection, 1.1 % for medium projection and 1.5% for high projection.

The actual growth between 2000 and 2010 matched the "high" population projection because the actual population in 2010 was 2,165 people. For planning purposes, the 2009 City of Mabton Comprehensive Plan Update states that the medium and high forecasts should be utilized. This Plan will utilize the high population projection, since the historic growth rate matched the high population projection and the 2009 City of Mabton Comprehensive Plan Update requires utilizing the medium or high projection. The high growth rate projection is 1.5 percent per year between 2020 and 2025 per the City's planning consultant, the Yakima Valley Conference of Governments (YVCOG). Therefore, a growth rate of 1.5 percent per year will be utilized to extend the forecast from 2025 to 2031.

City officials do not know of any large businesses with plans to begin operations in the City in the near future. However, as the population increases, new businesses are expected to open, and businesses serving the everyday needs of the community are expected to expand to meet these needs. As a result, it is projected that the number of new businesses and new residences on the system will grow at the same annual rate as the population.

Table 2-9 summarizes the City's population, ADD, MDD, and PHD projections for the next six and 20 years. Population projections for the City's current corporate boundary were based on the 1.5 percent annual growth rate recommended in the City's comprehensive plan. The City's non-residential ERUs are conservatively assumed to grow at the same rate as the residential population. The ADD is based on a production demand of 323 gpd/ERU, plus an assumed constant amount of DSL of 50,000,000 gal./yr. to account for DSL (Table 2-6). Other values are based on an MDD/ADD ratio of 2.1, and a PHD/MDD ratio of 2.1.

TABLE 2-9

Projected ADD, MDD, and PHD

Year	Population (1)	ERUs (2)	ADD(3) (gpd)	Annual Prod. (af/yr)	MDD(4) (gpd)	MDD (gpm)	PHD(5) (gpm)
2012	2,230	702	364,000	408	764,000	531	1,114
2018	2,439	768	385,000	431	809,000	562	1,180
2032	3,004	946	443,000	496	930,000	646	1,356

(1) Population was estimated using Mabton's actual 2010 population growing at 1.5% annually.
(2) ERUs for Mabton are estimated to grow at 1.5% using Mabton's consumption of 323 gpd/ERU.
(3) ADD calculated from ERUs x 323 gpd/ERU + 50,000,000 gal/yr. (137,000 gpd) (DSL).
(4) MDD = ADD x 2.1.
(5) PHD = MDD x 2.1.

Projected savings from water use efficiency measures are discussed in Chapter 4.

CHAPTER 3

SYSTEM ANALYSIS

CHAPTER 3

SYSTEM ANALYSIS

The purpose of this chapter is to determine the ability of the City's existing water system to meet current and future water quality and quantity requirements. The major sections of this chapter are:

- System Design Standards
- Water Quality
- Facility Analysis
- Water System Physical Capacity Analysis
- System Deficiencies

SYSTEM DESIGN STANDARDS

Water systems are regulated by federal, state, and local design and construction standards. Standards that affect Mabton's water system are summarized in the sections below.

GENERAL FACILITY STANDARDS

WAC 246-290 is the primary drinking water regulation used by DOH to assess capacity, water quality, and compliance with drinking water standards. The 2009 Water System Design Manual (WSDM) serves as guidance for the preparation of plans and specifications for Group A public water systems in compliance with WAC 246-290. The WSDM also references the following codes and guidelines.

- Uniform Building Code (the International Building Code was adopted by all state and local agencies in 2004)
- Uniform Plumbing Code
- Recommended Standards for Water Works (RSWW), Ten State Standards
- Local codes
- American Water Works Association (AWWA) Standards
- American Society of Civil Engineers (ASCE) Standards
- American Public Works Association (APWA) Standards

Table 3-1 lists the suggested WSDM guidance and the City's policies with regard to each standard for general facility requirements.

TABLE 3-1

General Facility Requirements

STANDARD	DEPARTMENT OF HEALTH WATER SYSTEM DESIGN MANUAL	City of Mabton Standards
Average Day and Maximum Day Demand	Average Day Demand (ADD) should be determined from metered water use data. Maximum Day Demand (MDD) is estimated at approximately two times the ADD if metered data is not available.	ADD = Metered production MDD = 2.1 * ADD estimated based on WSDM.
Peak Hour Demand	Peak hour demand (PHD) is determined using the following equation: PHD = (MDD/1440(CN +F)+ 18, where MDD is in gpd/ERU, and C and F are coefficients based on N, the number of ERUs. See Eq. 5-3, WSDM	PHD = 2.1 * MDD based on Eq. 5-3, WSDM.
Source Capacity	Capacity must be sufficient to meet MDD and replenish fire suppression storage within 72 hours.	Same as WSDM, Chapter 7.
Storage Requirements	The sum of: Operational Storage Volume sufficient to prevent pump recycling. Equalizing Storage $V_{ES} = (Q_{PH} - Q_S) * 150$ Standby Storage $V_{SB} = (2 * ADD * N) - t_m * (Q_S - Q_L)$ Fire Suppression Storage $V_{FSS} = NFF * T$ ADD = average day demand, gpd/ERU N = number of ERU's Q_{PH} = peak hour demand, gpm Q_S = capacity of all sources, excluding emergency sources, gpm Q_L = capacity of largest source, gpm t_m = daily pump source run time, min (1440) NFF = needed fire flow, gpm T = fire flow duration, min	Same as WSDM, using the formulas provided in the manual, Chapter 9.
Minimum System Pressure	The system should be designed to maintain a minimum of 30 psi in the distribution system under peak hour demand and 20 psi under fire flow conditions during MDD.	Same as WSDM, Chapter 8.
Fire Flow Rate & Duration	The minimum fire flow shall be determined by the local fire authority or WAC 246-293 for systems within a critical water supply service area (CWSSA).	Fire flow requirements are based on the (local) Fire Department standards.
Minimum Pipe Size	The diameter of a transmission line shall be determined by hydraulic analysis. The minimum size distribution system line shall not be less than 6-inches in diameter.	Same as WSDM, Chapter 8.

TABLE 3-1 (cont.)

General Facility Requirements

STANDARD	DEPARTMENT OF HEALTH WATER SYSTEM DESIGN MANUAL	City of Mabton Standards
Reliability Recommendations	• Sources capable of supplying MDD within an 18-hour period • Sources meet ADD with largest source out of service • Back-up power equipment for pump stations unless there are two independent public power sources • Provision of multiple storage tanks • Standby storage equivalent to ADD x 2, with a minimum of 200 gpd/ERU • Low and high level storage alarms • Looping of distribution mains when feasible • Pipeline velocities not > 8 fps at PHD • Flushing velocities of 2.5 fps for all pipelines	Same as WSDM, Chapter 5.
Valve and Hydrant Spacing	Sufficient valving should be placed to keep a minimum of customers out of service when water is turned off for maintenance, repair, replacement or addition. As a general rule, valves on distribution mains 12-inches and smaller should be provided at least every 1,000 feet. Fire hydrants on laterals should be provided with their own auxiliary gate valve.	Valve and hydrant standards are outlined in the City's Developer Standards.
Water Quality Standards	The primary drinking water regulation utilized by Health to assess capacity, water quality, and overall compliance with drinking water standards.	WAC 246-290

CONSTRUCTION STANDARDS

The City has prepared a set of standards for developers and the City to follow when constructing water system components. These standards are included in Chapter 7 so they can be approved by DOH as part of this plan. Such approval is one of the requirements that will allow the City to construct distribution mains and distribution-related projects without the requirement to submit project reports (WAC 246-290-110) and construction documents (WAC 246-290-020) to DOH.

FIRE FLOW DEMANDS AND MINIMUM PRESSURE

The City does not have a listing of specific fire flow requirements for buildings located in the City. The IFC indicates that the minimum fire-flow requirement for one- and two-family dwellings of 3,600 square feet or less is 1,000 gpm for 2 hours, which applies for most of Mabton's residential neighborhoods. For buildings other than one- and two-family dwellings, or for buildings with greater than 3,600 square feet of area, the fire-

flow is per Table B105.1 (See Appendix D). The City's Volunteer Fire Chief has determined that the maximum fire flow requirement is 1,500 gpm for 2 hours.

Consistent with WAC 246-290-230, the City requires a minimum pressure of 30 psi under PHD conditions with operating and equalizing storage depleted, and 20 psi during concurrent fire flow and MDD conditions with fire suppression storage depleted.

WATER QUALITY

Group A public community water systems must comply with the drinking water standards of the federal Safe Drinking Water Act and its amendments. DOH has adopted these federal standards under WAC 246-290. To enable Group A water systems to comply with the regulations, Health issues each system a Water Quality Monitoring Report (WQMR) listing that system's reporting requirements. The City's current WQMR is provided in Appendix H.

The City, which provides continuous disinfection via chlorination, has had the occasional unsatisfactory bacteriological sample tests from the distribution system tests in recent years, but all repeat samples have been satisfactory. There have been two positive total coliform tests since January of 2008.

Well No. 3 frequently tests high in Nitrate-N with results of 10.2 to 24.6 mg/L verses a Maximum Contaminant Level (MCL) of 10 mg/L for Nitrate-N. This well is used for emergency only, and if used, the output is blended per agreement with the DOH, to produce water below the MCL. The blending is accomplished in the reservoir.

The City's water is discharged to aeration trays located at the top of the City's reservoir in order to remove methane gas and hydrogen sulfide which are naturally occurring in the City's water sources. This aeration helps to reduce the potential for a buildup of explosive gases due to the methane and also to reduce taste and odor issues due to the hydrogen sulfide.

The City is in compliance with all other State and federal water quality requirements. The City's Coliform Monitoring Plan is provided in Appendix F, and results of the last 12 years of test result exceedances as reported by the DOH are provided in Appendix G. Results of all tests can be found on the DOH Sentry website.

FACILITY ANALYSIS

Figure 1-1 shows a map of the City's existing water system. The system serves a single pressure zone.

SOURCE

The City's water supply consists of four wells, Wells No. 2, No. 3, No. 4 and No. 5. The City has removed the pump and motor from Well No. 2. Due to higher nitrate levels in Well No. 3, this well is reserved for emergency purposes only. Therefore, the City normally pumps from Wells No. 4 and No. 5. Well No. 4 has a capacity of approximately 200 gpm and Well No. 5 has a capacity of 500 gpm, for a total pumping capacity of approximately 700 gpm.

The source capacity analysis as shown in Table 3-2 is approximate due to the lack of a functioning source meter on Well No. 4. Without a functioning source meter, the production capacity of Well No. 4 cannot be verified. In addition, it has been observed that occasionally on high water demand weekends in the summer, the source capacity cannot keep up with system demands and replenish the reservoir during the night as indicated by the circle chart records which record the reservoir level. These circle charts indicate that occasionally the water level drops significantly, typically on hot, summer weekends.

Well No. 4 recently failed in 2013. When the pump was removed, general consensus was that the well had been drawing down the dynamic water level to the intake, and the pump had been damaged by pumping air. The well has been cleaned and is currently being repaired. A flow test of the well with a temporary submersible pump installed indicated a flow rate of 240 gpm with a stabilized drawdown to 411 bgs. For the purposes of this Water System Plan, a flow rate of 200 gpm has been estimated for this well. The actual flow rate of the equipped well will be known once the repair is completed.

FIGURE 3-1

Reservoir Circle Chart of Pressure/Water Level

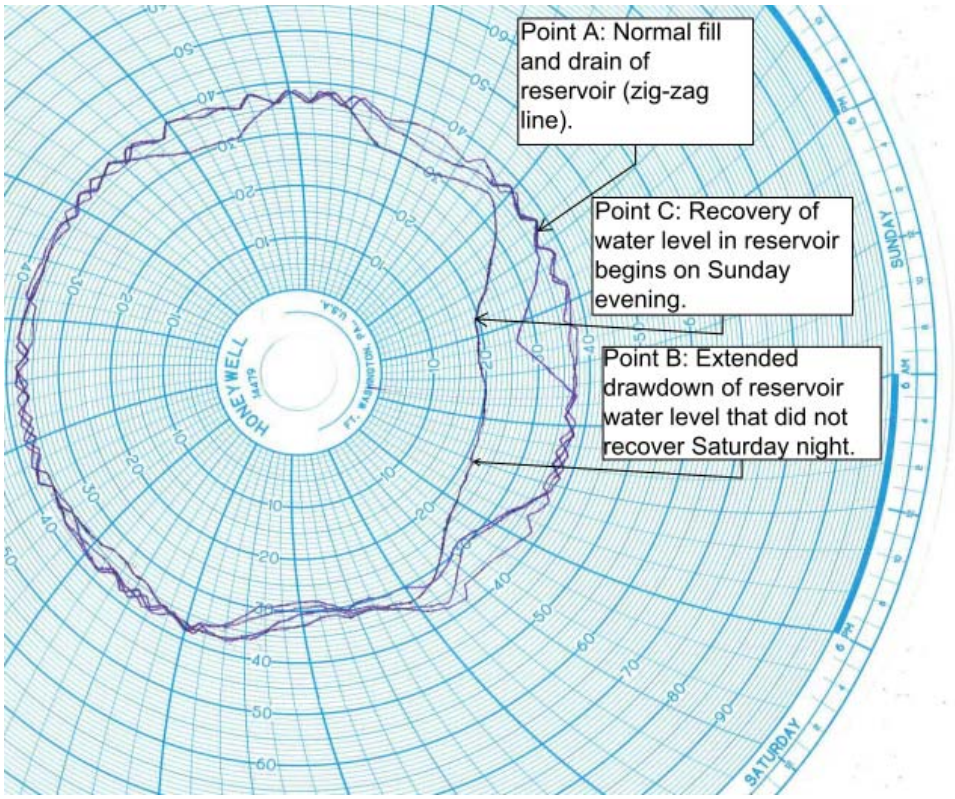


Figure 3-1 is an example of a circle chart for the City's reservoir dated 8-16-2012. The City used this particular chart to record four weeks of pressure measurements of the water in the reservoir which corresponds to the reservoir's water surface level.

Point A indicates normal filling and draining of the reservoir. This is when the water level is drawn down to a point and the well(s) are turned on to fill it back up. Point B shows that the water surface is drawn down, the wells have turned on, but the water surface continues to drop until Point C, where the demands have lessened (Sunday evening) and the water surface begins to recover, but in this case it is not until Monday evening that the water surface actually recovers to a normal fill and drain pattern.

At Point C, the recording of approximately 18 psi corresponds to a water surface elevation of approximately 41 feet above the bottom of the reservoir. At this level, the reservoir has drained roughly 305,000 gallons of the 612,000 gallons of usable capacity (about half of the reservoir volume).

The City's source capacity at times is insufficient to keep up with the demands. In addition, the City needs to have a source meter and level sensor installed for Well No. 4 in order to be able to know this well's output and dynamic water level and to provide some warning to the City when there may be a problem with the well. Also noted is that Wells No. 3 and No. 5 do not have level sensors. Level sensors are suggested for these wells in order for the operator to monitor the water levels which can help determine if there may be a problem with a dropping water table or clogged screen/perforations. The source meter on Well No. 3 is also not functioning, but as this source is generally for emergency use only, and therefore used very infrequently, installing a source meter on this well is of a lower priority. The City will try to repair this meter if possible.

The City's water consumption records indicate only approximately 85 gpd per person water usage. Since the City's Wastewater Treatment Plant (WWTP) receives approximately 80 gpd/person, it is possible that the consumption meters are under-reporting the water consumption or that there may be illicit water usage. This would help to explain why the City's sources cannot keep up with consumption.

Source and Treatment Capacity

WAC 246-290-222 (4) requires total source capacity to be sufficient to provide a reliable supply of water equal to or exceeding the MDD at all times. For the analysis in Table 3-2, both Wells No. 4 and No. 5 were assumed to be running. However, with the City's largest well, Well No. 5, out of service, the 200 gpm capacity of Well No. 4 is insufficient to meet the City's current MDD.

TABLE 3-2

Source Capacity Analysis

Year	Source Capacity[(1)] (gpm)	MDD [(2,3)] (gpm)	(+ / -)[(4)] (gpm)
2012	700	531	+ 169
2018[(5)]	1,700	562	+ 1,138
2032[(5)]	1,700	646	+ 1,054

(1) Assumes both Wells No. 4 (200 gpm) and No. 5 (500 gpm) are operating.
(2) From Table 2-10.
(3) Note that if either well is out of service, MDD cannot be supplied in 2012 (until new 1,000 gpm well is constructed).
(4) See the discussion above concerning the circle chart.
(5) Assumes new Well No. 6 in production at 1,000 gpm.

Source Reliability

Besides meeting the requirements of WAC 246-290-222 (4), the WSDM recommends that systems wishing to provide a high level of reliability to their customers consider the following source criteria for emergency conditions:

1. Provide sufficient source capacity to meet the MDD and replenish fire suppression storage within 72 hours. The largest fire suppression storage requirement is 180,000 gallons (1,500 gpm for 2 hours).
2. Meet the MDD with 18 (rather than 24) hours of pumping.
3. Meet the ADD with the largest source out of service.
4. Provide two independent power feeds, or portable or in-place backup power unless the power grid meets the following minimum reliability criteria:
   - Outage frequency averages three or less per year based on data for the three previous years with no more than six outages in a single year. A power outage is considered a loss of power for 30 minutes or longer.
   - Outage duration averages less than four hours based on data for the three previous years with not more than one outage during the three previous year period exceeding eight hours.

Table 3-3 indicates deficiencies in 2012 and that if the City constructs the new Well No. 6 at 1,000 gpm and the City's other sources continue to produce as indicated at the end of the 20-year planning period, the City will be able to meet the three recommended criteria.

TABLE 3-3

Source Reliability Analysis

Condition	Q (avail.) [(1)] (gpm)	Q (req'd) (gpm)	(+/-) (gpm)
2012			
1. Meet MDD & Replenish FSS w/in 72 hrs	700	572	+128
2. Meet MDD w/ 18 hrs Pumping	525	531	(6)
3. Meet ADD w/o Largest Source	200	253	(53)
2032			
1. Meet MDD & Replenish FSS w/in 72 hrs	1,700	688	+1,013
2. Meet MDD w/ 18 hrs Pumping	1,275	646	+629
3. Meet ADD w/o Largest Source	700	308	+392

(1) Includes estimated outputs Well No. 4, Q = 200 gpm, and Well No. 5, Q = 500 gpm. In 2032, it has been assumed that the City has constructed a new 1,000 gpm Well No. 6. For the second condition, Q (avail) = (18 ÷ 24) × Q (both wells) = 0.75 × 700 = 525 gpm in 2012.

Regarding the fourth condition, outage data from Pacific Power and Light indicate that the City has had four outages lasting longer than 30 minutes in the last three years. The longest was about 4.5 hours in length. The average outage was about 3 hours. Well No. 4 and Well No. 5 and the booster pumping station are all served by the same substation and feeder, so if this feeder is out, all three of these facilities are without power.

While backup power would provide increased reliability for the City's water supply, reliability criteria do not require it at this time. The City intends to provide backup power generation for the new 1,000 gpm Well No. 6. This well would be able to supply the City's demands if power were to fail. The pressures would not be boosted by the booster pump station, but low pressure water would be available.

Source Protection

Source water protection is covered under WAC 246-290-135. Pertinent sections of this rule for Mabton include a section on the sanitary control area (SCA) and a section on wellhead protection.

The SCA consists of the area within a 100-foot radius around each well that must be kept free from "construction, storage, disposal, or application of any source of contamination". The City owns all of the property within the SCA for Well No. 3 and the majority of the property within the SCAs for Wells No. 4 and No. 5. The City plans to approach property owners within the Well No. 4 and No. 5 SCAs to obtain a restrictive covenants per WAC 246-290-135(2)(g).

The City's 2005 Wellhead Protection Program and a 2012 update are provided in Appendix H.

Water Rights

Table 3-4 summarizes the adequacy of the City's water rights to serve its customers for the 6- and 20-year planning periods.

TABLE 3-4

Water Rights Adequacy

Year	Instantaneous Quantity (Qi)			Annual Volume (Qa)		
	MDD [1] (gpm)	Qi [2] (gpm)	(+ / -) (gpm)	Annual Prod. [1] (af/yr)	Qa [2] (af/yr)	(+ / -) (af/yr)
2012	531	1,000	+469	408	452.4	44.4
2018	562		+438	431		21.4
2032	646		+354	496		(43.6)

(1) From Table 2-8.
(2) Source: certificates for G3-00027C, G4-29212C and Report of Examination for G4-29212.

As indicated, the City's water rights are adequate to meet the current needs through the six-year planning period, however fall short for the 20-year planning period. The City's water rights self assessment form is provided in Chapter 4, Water Use Efficiency.

The City plans to keep their water use within their water rights by the following:

1. Conservation efforts including:
   a. leak detection (performed in December, 2012)
   b. water main leak repair (on-going)
   c. water main replacement
2. Obtain additional water rights through acquisition.
3. Apply for additional water rights. The City is aware that no water rights are being issued by the Department of Ecology at this time, however the City would like to establish a priority date for their application for additional rights should these become available in the Yakima Valley at some future date.

Note that the City's 2005 Water System Plan indicated that Mabton was currently exceeding the annual volume water right. Due to the lack of production records and information necessary to allow a reasonably accurate determination of distribution system leakage (DSL), the City hired American Leak Detection to perform a leak detection study to assist in prioritizing the selection of water main repairs and water main replacements. This study surprisingly found just two significant leaks in the City's distribution system, most of which is comprised of 4-inch cast iron piping installed back in 1936, which is now over 76 years old.

Once the City has functioning source meters and has developed an historical record of their water production, the determination of whether the City's water use is within or exceeding their water right can be more accurately determined. The City intends to continue their water conservation efforts, and will pro-actively seek to purchase additional water rights as it is projected that the City's rights will be exceeded in the 20-year planning period.

STORAGE

The City has one reservoir, a single 800,000 gallon welded steel reservoir located in the Mabton City Park at the intersection of South Main Street and Fern Street. The reservoir serves the City's single pressure zone after the pressure is boosted at the BPS, which is also located in the same park, adjacent to the reservoir. The reservoir has an overflow elevation of approximately 835 ft msl, however the City maintains the top of operational storage at 811 feet (in order to provide for the aeration trays and aeration of the water). Therefore the storage volume in use is approximately 612,000 gallons.

WAC 246-290 and the WSDM define the following storage volumes for reservoirs.

- *Operational Storage (OS).* Operational storage is the volume at the top of the reservoir that is used to control the well pumps. The City uses the top 5 feet, or approximately 35,000 gallons, for this purpose.

- *Equalizing Storage (ES).* This storage component consists of the amount of storage needed to make up the difference between the PHD and the source capacity of the water system. The WSDM requires sufficient ES to make up this difference for 150 minutes, i.e.,

  $$ES = (PHD - Q_S)(150 \text{ min}),$$

  where Q_S = the sum of all well capacities (in gpm) in the zone supplying the reservoir. WAC 246-290-230 (5) requires a minimum pressure of 30 psi at the bottom of ES.

- *Fire Suppression Storage (FSS).* Fire suppression storage is the amount of storage required to fight a fire. WAC 246-290-230 (6) requires a minimum pressure of 20 psi when the system is simultaneously providing MDD plus the required fire flow. The required FSS is determined to be the amount of required fire flow multiplied by the fire flow duration. The City's largest maximum fire flow storage requirement is 1,500 gpm × 120 min = 180,000 gallons.

- *Standby Storage (SB).* The purpose of standby storage is to provide a measure of reliability when sources fail, power outages occur, or another emergency places the burden of water system supply solely on storage. With the approval of the local fire authority (which the City's Fire Chief has granted), WAC 246-290-235 allows fire suppression and standby storage to be nested, with the larger of the two volumes being the minimum required. Section 9.0.4 of the WSDM indicates that SB should provide for two days of ADD assuming the largest water source is out of service, i.e.,

$$SB1 = (2\ days)(ADD) - t_m(Q_S - Q_L)$$

where Q_L = the capacity of the largest source, and t_m is the time that the sources are pumped during the two-day outage. The WSDM suggests using t_m = 1,440 minutes, or one day of pumping.

Alternatively, the WSDM recommends that SB be no less than 200 gallons times the number of ERUs being served by the reservoir.

Dead Storage (DS). Dead storage is water below the minimum design pressure of 20 psi during an emergency event. For Mabton the highest service meter is at approximately elev. 734, putting the minimum allowable hydraulic gradient at elev. 780 (734 + 20 ÷ 0.433). This elevation is approximately 57 feet from the bottom of the reservoir, which is why the City has a booster pumping station (BPS), to make use of the additional volume in the reservoir below this point and to boost pressures throughout the City.

WAC 246-290-235(4) allows fire suppression storage and standby volumes to be combined or "nested", provided the local fire protection authority does not require them to be additive. While the City's volunteer fire chief agrees that nesting of FSS and SB is allowable, it is found to not be necessary as the existing storage can provide both of these volumes independently. Table 3-5 shows the analysis of the City's physical storage capacity without nesting.

TABLE 3-5

Storage Volumes without Nesting

Year	Storage Component (Amounts in gal)					(+/-) [2] (gal)
	OS	ES	FSS [1]	SB	Total	
2012	35,000	62,000	180,000	140,000	417,000	195,000
2018	35,000	-	180,000	154,000	369,000	243,000
2032	35,000	-	180,000	189,000	404,000	208,000

(1) Fire Suppression Storage of 1,500 gpm for 2 hours.
(2) Total storage in reservoir = 612,000 gal.

As shown, the City has adequate storage based upon the City requirement of FSS=1,500 gpm for 2 hours for the current planning year of 2012 and the planning periods of 2018 and 2032 (assuming Well No. 6 is constructed at 1,000 gpm). There is a storage shortage projected beginning in 2018 if the new well or new reservoir is not constructed assuming no nesting. With nesting, the shortage appears in the 2032 planning period.

The City's volunteer fire chief sets the fire suppression storage (FSS) at 1,500 gpm for 2 hours.

The reservoir appears structurally sound, however from a brief visual inspection; it appears that the tank's seismic anchorage may not meet current code requirements. Table 3-6 shows the storage volumes with nesting of FSS and SB storage.

The existing reservoir cannot provide adequate pressures to the City's water system without the use of a booster station. It is estimated that the booster station, which normally must be run continuously, costs between $20,000 and $25,000 annually to operate. The City would like to construct a new, higher reservoir (as a capital improvement), or modify the existing tank in order to eliminate the need for a continuously running booster station. Note that the existing booster station includes a fire-flow booster. It is likely that the City would prefer to keep the seldom used, fire-flow booster even with a new or modified reservoir.

BOOSTER PUMPING STATION

The City constructed a closed-system BPS in 1988 to improve pressures throughout the City. One 10 HP service pump runs continuously to keep the system pressurized with a 15 HP pump and a second 15 HP pump to provide additional capacity in higher demand situations. There is also a 30 HP, (1,200 gpm @ 70' TDH) pump available to provide fire flow.

WAC 246-290 and the WSDM require that a closed system BPS meet the criteria shown in Table 3-6.

TABLE 3-6

Closed Booster Station Design Criteria

Condition	Reservoir Level	Demand Condition	Minimum Pressure
1(1)	ES Depleted	PHD	30
2	ES & FSS Depleted	PHD	30
3(2)	ES & FSS Depleted	MDD + Fire Flow	20

(1) For reliability purposes, DOH recommends the BPS provide this capability when the largest capacity booster pump is out of service.

(2) This demand condition is not met by the BPS.

TRANSMISSION AND DISTRIBUTION

This section provides a discussion of the hydraulic model calibration and results, and the improvements resulting from the modeling.

Hydraulic Capacity Analysis – Modeling

A hydraulic model was developed for the City's water system by creating an H_2ONet database of the distribution system, reservoirs, and wells. H_2ONet uses a graphical interface loaded into AutoCAD to develop the water system grid and components. A linked computer model performs hydraulic calculations and returns output flows and pressures.

Field fire flow testing was conducted on April 26, 2012 to obtain data necessary for calibration of the model. During this testing, several fire hydrants throughout the City were opened and flows were recorded with a pitot gauge on the hydrant. Pressures at nearby locations were recorded before, during, and after the testing. These values were used to adjust parameters in the H_2ONet model until its output generally matched the field results obtained through hydrant flowing.

In the model runs it was assumed that the City's reservoir was drawn down to El. 737, the level where OS, ES, and FSS are depleted, that all wells were off, and the system demand was set to fire flow plus the 2032 MDD. This case was more severe than the 2032 PHD with OS and ES depleted. The model was run for the City's single pressure zone with the BPS running, assuming the BPS could provide all the flow needed to meet the MDD + FF (which it actually cannot due to the BPS capacity). The small diameter of many of the City's water mains restrict flows and prevent the system from providing fire flows adequate to meet the City's fire flow requirements.

In general, the model indicates that the much of the City's distribution system cannot provide the City's fire flow requirement while supplying the MDD and providing minimum or better pressures. Since approximately 50 percent of the City's water mains consist of 4-inch cast iron pipes, these small diameter pipes simply do not allow for adequate flows to support the fire flow demands.

Fire Flow Deficiencies

As indicated above, there are several lines with hydrants that are unable to deliver the City's required fire flow of 1,000 gpm in residential areas and 1,500 gpm in commercial areas. In some locations, these demands can be met by combining the flows from two or more hydrants, however the spacing of hydrants in the City makes this impractical in many locations. The City plans to begin replacing some of the older, undersized water mains to build out a "skeleton" framework, to push higher flows out to the perimeter of the City, then to fill in the framework by replacing the smaller lines in the system.

To give a general indication of the projected fire flow improvements by the initial three projects for framework upgrades, after these improvements are made, the model indicates that the fire flows would be as shown in Table 3-7. Their locations are shown on Figure 4-1. These projects are identified as Priority A projects (Table 8-1).

TABLE 3-7

Fire Flow Improvements

Imp. No	Location	Improvement	Length (ft)	Location and Model Node	Fire Flow (gpm)[1]	
					Before	After[2]
1.	South Street 8" Water Main, Reservation St. to the Alley 170 ft. West of Main St.	Upsize 4" CI to 8" PVC Water Main	1,050	Intersection of South St. and Reservation Road, J130	596	1,149
2.	Monroe Street 8" Water Main, from Seventh Ave to Alley East of First Ave.	Upsize 4" CI to 8" PVC Water Main	1,850	Intersection of Monroe St. and Alley East of Sixth Ave., J120	482	906
3.	Alley East of First Ave. 8" Water Main, from Washington St. to Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	Intersection of Monroe St. and Alley East of First Ave., J110	471	926

(1) Before and after with criteria of MDD and 20 psi minimum.

(2) Note that while the fire flows at these nodes for improvements No. 2 and No. 3 are below the 1,000 gpm residential FF, once the additional projects within the City are performed, these nodes will supply in excess of 1,000 gpm.

TREATMENT

The City disinfects its water supply, but is not currently required to do so. The City endeavors to provide a residual of 1 mg/l throughout the distribution system and chlorinates with Wallace and Tiernan gas chlorination equipment located in the Well No. 3 well house. According to the City's 1989 Operations and Maintenance manual for the project which installed the chlorination system, the chlorine solution is injected via a ¾" PVC line in the reservoir through a chlorine manifold which distributes the chlorine for improved contact and mixing. No improvements are anticipated for the chlorination system at this time.

SYSTEM CONTROL

The City utilizes pressure switches to operate its water system. The system uses water level information from the reservoir to activate the City's wells that are in service. The pressure of the reservoir's discharge pipe is recorded at the BPS on a circular chart recorder and is also displayed on an analog meter. At this time, the City does not plan improvements to this system.

OPERATION AND MAINTENANCE

The City has identified several O&M projects for the next six years. These projects are discussed in Chapter 6, Operation & Maintenance (see Table 6-7).

WATER SYSTEM PHYSICAL CAPACITY ANALYSIS

Worksheet 6-1 from the WSDM, presented at the end of this chapter, shows that the City has sufficient source, and storage capacity to meet the City's 2012 needs, however is in need of either additional water rights or needs to reduce the annual consumption to be within the City's annual water right. Table 3-8 summarizes the adequacy of the City's water system components to meet existing, 6-year, and 20-year demands.

TABLE 3-8

System Component Adequacy[(1)]

Component	Available Capacity	Requirement			Comment
		2012	2018	2032	
Source, MDD, gpm[(2)]	700 / 1,700	531	562	646	Table 3-2
Water Rts, Qi, gpm	1,000	531	562	646	Table 3-4
Water Rts, Qa, ac-ft/yr	452.4	408	431	**496**	Table 3-4
Equalizing Storage, gal	62,000	62,000	-	-	Table 3-5
Fire Supp. Storage, gal	180,000	180,000	180,000	180,000	Table 3-5
Standby Storage, gal	397,000	140,000	154,000	189,000	Table 3-5

(1) Deficient values are shown in bold.
(2) Source capacity shown here is estimated with Well No. 4 at 200 gpm and Well No. 5 at 500 gpm in 2012. In 2018 and 2032, it is assumed that the City has an additional 1,000 gpm of source capacity with new Well No. 6.

SYSTEM DEFICIENCIES

Table 3-9 summarizes deficiencies identified in this chapter and the improvements the City plans to implement to correct them. A schedule for the improvements planned within the next six years is presented in Chapter 8. Preliminary cost estimates are also provided in Chapter 9.

TABLE 3-9

Summary of Deficiencies

Category	Deficiency	Improvement/Comment
Source	Water Rights. The City has sufficient instantaneous (Qi) water rights for the next 20 years and beyond, but has inadequate annual (Qa) water rights in the 20 year planning period.	The City will seek to reduce their water use and water losses in order to stay below their Qa water right, and seek to acquire additional water rights in the 6-year planning period.
	Wells. The City's wells with estimated total production at 700 gpm, are inadequate to serve its retail water service area for the next 20 years.	Well No. 4 needs to be repaired and a new, 1,000 gpm well is proposed to be drilled and equipped. Well No. 4 needs a source meter and water level sensor. Well 5 will also be fitted with a level sensor.
Storage	The City's storage volumes are adequate to meet 20-year demands if the 1,000 gpm well is constructed.	The DOH recommends more than one storage reservoir for increased reliability and for maintenance purposes. The City intends to construct a new 1 Mgal. reservoir or modify the existing reservoir in order to eliminate the booster station.
Treatment	The City is in compliance with all water quality requirements.	No improvements needed.
Control	The City does not have a functioning source meter on Well No. 4 or water level sensor on Well Nos. 4 and 5, otherwise, the City's controls are adequate to meet its 20-year needs.	The City will put a source meter and level sensor for the repaired Well No. 4. A level sensor is needed for Wells No. 3 and No. 5. If work is to be done on these two wells, the addition of a water level sensor will be considered.
Booster Pumping Station	The City's BPS is adequate to meet its 20-year needs.	No improvements needed, but the City would prefer to eliminate the need for the continuously running boosters, so will plan to construct a new higher, reservoir in order to eliminate this need.
Distribution	The distribution system has known locations of leaks in the distribution system.	Repair the identified leaks in the city's system, and then begin a water main repair and/or replacement program in order to reduce the DSL.
	Several 4- and 6-in lines (see Table 3-7 and 3-8) do not meet fire flow requirements, and many mains have out lived their service life.	Begin a water main replacement program to upsize and loop lines per Table 3-7 and 3-8.
O&M (see Ch. 6)	Source meters need to be periodically rebuilt & calibrated.	Implement a program to rebuild and calibrate one source meter every four years.
	Several valves are aged and do not close.	Perform testing of all valves in the City and then replace valves as necessary.
	Water mains require flushing to improve water quality.	Establish and implement a directional flushing program.

WORKSHEET 6-1: ERU Determinations

Mabton Water System Physical Capacity Documentation based on MDD

Note: *Capacity determinations are only for existing facilities that are operational for the water system[(1)].*

Specific Single-Family Residential Connection Criteria (measured or estimated demands) (see Chapter 2):

Average Day Demand (ADD): 323 gpd/ERU (p. 2-11)
Max. Day Demand (MDD): 679 gpd/ERU (MDD = ADD × MDD/ADD = 323 ×2.1)

Water System Service Connections Correlated to ERUs			
Service Classification	**Total MDD for the Classification, gpd**	**Total # Connections in the Classification**	**ERUs**
Residential			
Single-family	310,000	457	457
Multi-family	40,000	28	59
Nonresidential			
Industrial	---	---	---
Commercial	29,800	33	44
Governmental	82,600	14	122
Agricultural	---	---	---
Recreational	---	---	---
Other	---	---	---
DSL	288,000	N/A	424
Other (identify)	---	---	---
Total existing ERUs =			**1,105**

Physical Capacity as ERUs			
Water System Component	**Calculated Capacity (ERUs)**	**2010 [(2)] (ERUs)**	**2010 (+/-) ERUs**
Source(s)[(1)]	1,485	1,105	+380
Treatment	1,485	1,105	+380
Equalizing Storage	3,367	1,105	+2,261
Standby Storage	1,390	1,105	+585
Distribution	N/A	N/A	N/A
Transmission	N/A	N/A	N/A
Other (Qi)	2,121	1,105	+1,016
Other (Qa)	1,250	1,105	+144
Water System Physical Capacity ERUs)= (based on the limiting water system component shown above)		**1,250**	

(1) Well No. 3 is for emergency use only and has therefore not been included in these capacity determinations. Source capacity estimated as follows: Well No. 4 at 200 gpm and Well No. 5 at 500 gpm.

CHAPTER 4

WATER USE EFFICIENCY

CHAPTER 4

WATER USE EFFICIENCY

BACKGROUND

In 2003, the Washington State Legislature passed Engrossed Second Substitute House Bill 1338, which has come to be known as the 2003 Municipal Water Law. Among other things, the new law required the Washington State Department of Health (DOH) to develop a rule that defines how municipalities are to demonstrate efficient use of their water supplies. In response, DOH developed the Water Use Efficiency (WUE) Rule, which became effective on January 22, 2007. Key elements of the rule and the City of Mabton's progress in meeting the rule are summarized in Table 4-1.

TABLE 4-1

Summary of Water Use Efficiency Rule Requirements

Requirement	Deadline [(1)]	Status City of Mabton
Install source meters	January 22, 2007	In progress and included in this Water System Plan
Begin collecting production and consumption data	January 1, 2008	In progress and included in this Water System Plan
Include WUE program in planning documents	January 22, 2008	In this Water System Plan
Set WUE goals through a public process	July 1, 2010	Completed February 2013
Submit service meter installation schedule	July 1, 2009	In progress and included in this Water System Plan
Submit first annual performance report	July 1, 2009	Done
Meet distribution leakage standard	July 1, 2011	Undetermined[(2)]
Complete installation of all service meters	January 22, 2017	In progress and included in this Water System Plan

(1) These are the deadlines for municipalities with < 1,000 connections. Deadlines are generally earlier for larger municipalities.

(2) Since the City has not kept water production records, the distribution leakage can only be estimated at this time. Once the City has installed functioning production meters, the DSL can be more accurately determined.

PRODUCTION AND SOURCE METERS

The City's water supply is provided by two wells, Well No. 4 and Well No. 5. Well No. 4 has an estimated capacity to pump 200 gpm and Well No. 5 can pump approximately 500 gpm. Well No. 4 is equipped with an insertion flow meter inserted in the 8 inch well discharge pipe (currently not functioning). Well No. 5 is equipped with a 6-inch propeller flow meter. As the Well No. 4 flow meter is not currently functioning properly, the City plans to have this repaired or replaced. Further description of the City's wells is provided in Chapter 1.

The City began keeping water production records for Wells No. 5 in the January of 2012. At this time, water leakage cannot be accurately determined until the City has repaired the Well No. 4 source meter and then developed a production history.

As previously discussed in Chapter 2, the City has estimated their water losses. By combining this estimated water loss with the City's water consumption as determined by records from individual service water meters, it was possible to estimate production.

The annual production estimates, including average day demands, maximum day demands, and peak hour demands are summarized in Table 2-4. Water demand forecasts for the 6- and 20-year planning periods are provided in Table 2-10.

SERVICE METERS AND WATER CONSUMPTION

Table 2-5 summarizes the City's annual water consumption history for 2006 through 2010 by customer class. Meters are required upon hookup and all of the City's residential and commercial customers are metered. The following City parks have not yet been metered:

- Freezel Park at Washington and Main
- Governor's Park at Main Str. and South (these meters have been purchased, but not yet installed)
- Catholic Charities Housing Park

The City performs maintenance and replacement on service meters as needed.

INTERTIES

The City does not have any interties with other water systems.

WATER USE EFFICIENCY PROGRAM

In January 2009, DOH published the second edition of its Water Use Efficiency Guidebook (Guidebook). Section 5.3 of the Guidebook summarizes the items that are to be included in a WUE program. A discussion of each item is provided in this section.

CURRENT WATER USE EFFICIENCY PROGRAM

The City encourages efficient use of water through its annual consumer confidence report. It has also adopted a base rate plus an increasing block (two-step) volume charge rate structure that encourages conservation by charging customers by volume at increasing rates for water used over a base amount.

Because the City has just started to implement a formal water use efficiency program, it is not able to determine water savings over the last six years. However, the City plans to improve its procedures for tracking water production and consumption, and expects to be able to provide reasonable estimates of projected water savings in its next Water System Plan update.

WUE GOALS

The WUE rule requires a water system's elected governing body to establish WUE goals that are measurable and have a timeframe for implementation. Mabton's WUE goals are:

- Supply side goal. Track source water production for use in future WUE reports and for determining the City's DSL.
- Demand side goal. Reduce average residential per capita use, currently at 323 gallons per day per ERU (Chapter 2), by approximately 2 percent to a level of 317 gallons per day per ERU or less over the next six years.

These goals were adopted by City Council in a public meeting on April 9, 2013 (minutes are provided at the end of this chapter). The meeting was held in accordance with the requirements of WAC 246-290-830.

WUE MEASURES

The WUE Rule requires all municipal water systems to implement and evaluate certain mandatory water use efficiency measures. The City is also required to identify additional demand (i.e., customer) side measures. The purpose of adopting a particular set of water use efficiency measures is to develop a strategy to meet the City's two water use efficiency goals described above. The mandatory measures the City is required to address are summarized in Table 4-2.

TABLE 4-2

Mandatory Water Use Efficiency Measures

Mandatory Measures	Requirement	Status
Install source meters	Implementation	Completed (replacement planned)(1)
Install service meters	Implementation	In progress and in this Water System Plan
Calibrate meters per industry standards	Implementation	As needed
Water loss control action plan if DSL>10%	Implementation	DSL above 10%
Educate customers about WUE once per year	Implementation	On-going every year
Water conservation rates	Evaluation	Completed, evaluated inclined block rates

(1) Well No. 4 source meter will be repaired and meter readings will be kept.

In addition to these mandatory measures, WAC 246-290-810(4)(d) requires systems with more than 500 and less than 1,000 connections to adopt another four demand (i.e., customer) side water use efficiency measures. The Guidebook provides that a qualified WUE measure that is implemented for different customer classes counts as multiple WUE measures.

At its April 9, 2013, City council meeting, the City adopted, in addition to the mandatory measures, one demand side measure for its nine customer classes, which results in a total of nine measures, five more than required. The City has determined that implementing these measures will be cost effective, and plans to pay for these measures using operating funds from its water utility. The City believes these measures, in addition to ongoing efforts to educate its customers about water use efficiency, will enable it to meet its second WUE goal to reduce average annual consumption from 323 gpd/ERU to 317 gpd/ERU.

Table 4-3 summarizes the demand-side water use efficiency measures the City plans to implement over the next six years. The City believes that both goals will be very cost effective in reducing customer demand.

TABLE 4-3

Demand-Side Water Use Efficiency Measures

Demand Side Measures	Customer Classes Affected	Number of Measures (1)	Est. Ann. Water Savings(2)	Status	Cost
Notify customers of high meter reads	All (3)	9	2 gpd/ ERU	On-going	Minimal
Total Measures (4 required)		**9**			

(1) Per the Guidebook, if a qualified WUE measure is implemented for different customer classes, it counts as multiple WUE measures.

(2) Savings projected by the end of the 6-year planning period. Savings are expected to enable the City to meet its second goal, i.e., to reduce consumption from 323 gpd/ERU to 317 gpd/ERU.

(3) Water Only, Residential, Business, Apartments, City/Other Bldgs, Churches, Schools, Outside Water Only, Mobile Homes.

As indicated, the City plans to adopt, in addition to the mandatory measures, nine (9) Demand Side Water Use Efficiency Measures for each of its customer classes, which is 5 more than required. The City has determined that the cost to implement these measures will be minimal. The City believes these measures, in additional to efforts to educate its customers about water use efficiency, will enable it to meet its second WUE goal to reduce average day demand by 2% by December 31, 2018.

WUE EDUCATION

The City plans to encourage water use efficiency by periodically including water conservation information with its monthly billings and in its annual consumer confidence report.

EVALUATING WUE EFFECTIVENESS

Once the City has developed a historical record of water production (once the Well No. 4 source meter is repaired and functioning), the City plans to track the effectiveness of its WUE efforts by annually checking its distribution system leakage to determine whether its on-going leak detection and repair efforts are enabling it to eventually reduce its DSL to below 10 percent. It also plans to annually check its residential water use to determine if its demand-side water use efficiency measures are helping it meet its second WUE goal to reduce residential consumption from 323 gpd/ERU to317 gpd/ERU. The City's plan for collecting data to make these evaluations is summarized in Table 4-4.

TABLE 4-4

Water Use Data Collection Strategy

Data Type	Unit of Measure	Collection Frequency	Comments
Water Production	Gallons	Weekly	Total water produced from all sources
Revenue Water	Gallons	Monthly	Billed metered consumption plus estimated billed unmetered consumption
Unbilled Consumption	Gallons	Monthly	Estimated authorized unbilled metered and unmetered consumption
Authorized Consumption	Gallons	Monthly	The sum of Revenue Water and Unbilled Consumption
Distribution System Leakage (DSL)	Gallons	Annually	Water Production – Authorized Consumption
	Percent	Annually	(Water Production – Authorized Consumption) / * 100*Water Production
Apparent Losses	Gallons	Annually	Estimated unauthorized consumption, water theft, meter inaccuracies, and other non-leakage losses.
Leakage Eliminated	Gallons	Per Occurrence	When leaks are discovered and repaired, the leakage rate and duration are estimated and the resultant leakage volume for the billing period is estimated and recorded.

Although the WUE Rule does not allow the last two items, Apparent Losses and Leakage Eliminated, to be subtracted in the calculation of DSL, both are useful in tracking opportunities for reducing DSL.

Table 4-5 shows how meeting the City's water use efficiency goals would affect its projected water demands. The estimated water savings shown in Table 4-5 assume the City has meets its demand side goal of reducing customer usage from 323 gpd/ERU to 317 gpd/ERU for the first 6 year planning period, and then hold steady at 317 gpd/ERU until the 20 year planning period.

TABLE 4-5

Projected Water Demands with Water Savings (1)

Year	Popul-ation	ERUs	ADD (gpd)	Annual Prod. (af/yr)	MDD (gpd)	MDD (gpm)	PHD (gpm)
Without Savings (Table 2-10)							
2012	2,230	702	364,000	408	764,000	531	1,114
2018	2,439	768	385,000	431	809,000	562	1,180
2032	3,004	946	443,000	496	930,000	646	1,356
With Savings							
2,012	2,230	702	364,000	408	764,000	531	1,114
2,018	2,439	768	377,000	422	792,000	550	1,155
2,032	3,004	946	434,000	486	911,000	633	1,329
Net Savings							
2,012	2,230	702	-	-	-	-	-
2,018	2,439	768	8,000	9	17,000	12	25
2,032	3,004	946	9,000	10	19,000	13	28

(1) Savings attributable to reducing customer demands from 323 gpd/ERU to 317 gpd/ERU by 2018.

DISTRIBUTION SYSTEM LEAKAGE

Current DOH rules require calculation of the three-year average DSL to determine compliance with its maximum 10 percent DSL allowance. However, with no historical source production records, this calculation cannot be performed. The analysis of the City's DSL presented in Chapter 2 estimates that City's DSL is approximately 38 percent (Table 2-6). The City seeks to more accurately track water production and consumption in order to calculate DSL.

CONSERVATION RATE STRUCTURE

The City has an inclined block rate structure. At its April 9, 2013 meeting, the City considered implementing seasonal rates in addition to increasing the volume charges for higher consumption users. At that meeting, the City decided to not change its current inclined block rate structure. There are several reasons for this.

- The City believes that while increasing these charges might promote some conservation, decreased consumption is likely to result in a decrease in revenue.
- The City's water utility is currently in good financial health (see Chapter 9), and is expected to remain so in the future.
- The City's average consumption rate of 323 gpm/ERU is already lower than many communities in Yakima County, and the City believes that any

additional reductions can be achieved better with the WUE measures outlined above.

Since 2010, the City has increased the base rate charged for water service by $6.00 per month per connection. The volume charge has remained the same during this time.

WATER SUPPLY CHARACTERISTICS

Mabton's water supply characteristics are summarized as follows:

- Name and Location. The City's water supply consists of two wells known as Well No. 4 and Well No. 5. A map of the wells and the City's water system is provided on Figure 1-1. Additional description of the City's sources is provided in Chapter 1.
- Capacity and Seasonal Limitations. Well No. 4 is assumed to have a capacity of producing 200 gpm and Well No. 5 is capable of producing 500 gpm. There are no seasonal limitations on these wells. However, the City's wells have had difficulty keeping up with peak summer demands. It is evident that the water levels in the wells have continued dropping which has contributed to the water system being occasionally unable to keep up with demands. As the City does not have water level sensing transducers in its wells, the static or dynamic water levels cannot easily be determined. It is recommended that the City install water level transducers in each of their functioning wells in order to better monitor the water levels and that these level sensing transducers be connected via telemetry (best) or be manual read at least once per year.
- Water Rights. Based upon the leakage assumptions provided in Chapter 2, the City appears to have sufficient water rights to serve its existing population, and has a surplus to meet the 6-year demands. Additional discussion of the City's water rights is provided in Chapters 1 and 3. The City's water right self assessment form is provided in Table 4-6. Pertinent water right documentation is provided in Appendix J. Note however that without functioning source meters and historical production records, it is difficult to assess the City's actual water production and consequently, the adequacy of its water rights..
- Legal Constraints. There are currently no legal constraints that would affect the City's ability to supply water to its customers over the next 20 years.

TABLE 4-6

Water Rights Self Assessment

Permit Certificate or Claim #	Name of Right Holder or Claimant	Priority Date	Source Name/Number	Primary, Additive or Non-Additive	Existing System Capacity - based on Water Right Limits		Water Right Requirement		Projected System Capacity Status (Excess or Deficiency)	
					Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
1. G3-00027C	Mabton	Mar. 3, 1971	Well No. 2, S02 and Well No. 3, S03	Primary	1,400	280	0	0	0	0
2. G3-00381C	Mabton	June 2, 1971	Well (no source No.)	Non-additive	15	2	0	0	0	0
3. G4-29212C	Mabton	Feb. 24, 1987	Well #4, Well #5, S05 Wellfield (WWF S01, S04)	Primary(3)	1,000	452.4(2)	700	408	+300	+44.4
Claims										
NA										
Total					**1,000 (1)**	**452.4 (2)**				
2012 (Existing)					1,000	452.4	700	408	+300	+44.4
2018 (6-year)					1,000	452.4	1,000	431	+0	+21.4
2032 (20-year)					1,000	452.4	1,000	496	+0	-43.6

Intertie Name/Identifier	Name of Purveyor Providing Water	Existing Limits on Intertie Water Use		Proj. Production/Withdrawal with New Project On-line		Current Intertie Supply Status (Excess/Deficiency)	
		Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow rate (Qi)	Maximum Annual Volume (Qa)	Maximum Instantaneous Flow Rate (Qi)	Maximum Annual Volume (Qa)
NA	NA	NA	NA	NA	NA	NA	NA

(1) CG4-29212C limits Qi to 1,000 gpm.

(2) 280 acre-feet are supplemental to Ground Water Certificate No. G3-00027C.

CHAPTER 5

SOURCE WELL PROTECTION

CHAPTER 5

SOURCE WATER PROTECTION

GENERAL

The City is providing an update to its previously completed Wellhead Protection Plan, May 2005 in this Plan. Included for this purpose, the following are provided in Chapter 10 (Appendix H):

- Update of the listing of potential contaminant sources
- Contact letter to potential contamination source owners

Chapter 5 includes updated mapping of wellhead travel-time circle and potential contaminant sources (Figure 5-1).

OBJECTIVE

Water from underground aquifers, commonly referred to as groundwater, forms the primary source of drinking water for approximately 65 percent of Washington State residents. The City of Mabton relies on wells to meet its water supply needs. To protect groundwater supplies, the Environmental Protection Agency (EPA) and Washington Department of Health (DOH) require public water utilities to develop a wellhead protection program as a component of its water system plan. The purpose of a wellhead protection program is to provide water systems with a proactive program for preventing groundwater contamination. The minimum requirements for a wellhead protection plan are specified in WAC 246-290-135(3).

WELLHEAD PROTECTION AREA DELINEATIONS

In developing a wellhead protection program, a first step is to establish the land areas around each well from which groundwater may flow to the well. These areas are likely to contribute pollutants to the groundwater and are referred to as “zones of contribution”. The time-of-travel for a given zone is determined by estimating the distance in feet of a hypothetical particle of water traveling through the aquifer to a pumping well over a selected period of time. Zones of contribution require proper land use management to minimize the possibility of contaminants entering the groundwater system. The most commonly accepted tools for delineating wellhead protection zones include the calculated fixed radius method, analytical models, and numerical models.

The calculated fixed radius method was used to analyze the wellhead protection area zones of contribution. Based on WAC 246-290-135 and through the use of the DOH susceptibility analysis techniques, wellhead protection areas are estimated for six-month,

1-year, 5-year, and 10-year periods. The delineations of the City's zones of contribution are shown on Figure 5-1.

POTENTIAL CONTAMINANT SOURCES

Within a wellhead protection zone, there are many diverse activities that may contaminate an aquifer and potentially prevent its use as a viable drinking water source. It is important that these activities are properly inventoried and, if necessary, regulated to prevent degradation of groundwater quality. Relevant activities and sources at a minimum include land use practices, industrial and commercial operations, underground storage tanks, hazardous materials storage and use, septic tanks, and dry wells. These activities are potential sources for groundwater contamination. A discussion of these practices and their potential affects on groundwater, and the regulatory requirements that may apply are included in the sections that follow. However, the first step in identifying potential contaminant sources is to develop an inventory of businesses and industries that handle hazardous products.

INVENTORY OF POTENTIAL CONTAMINANT SOURCES

An essential element of wellhead protection is an inventory of all potential sources of groundwater contamination in and around the delineated wellhead protection areas. The purpose of the inventory is to identify past, present, and proposed activities that may pose a threat to a water supply source.

Other purposes for maintaining an inventory of potential contaminant sources are to assist in the development of plan management strategies, to establish a mailing list for notifying potential contaminant sources within the wellhead protection areas, and to notify agencies regarding inventory findings. An accurate inventory and description of hazardous material handlers is required in WAC 246-290-135.

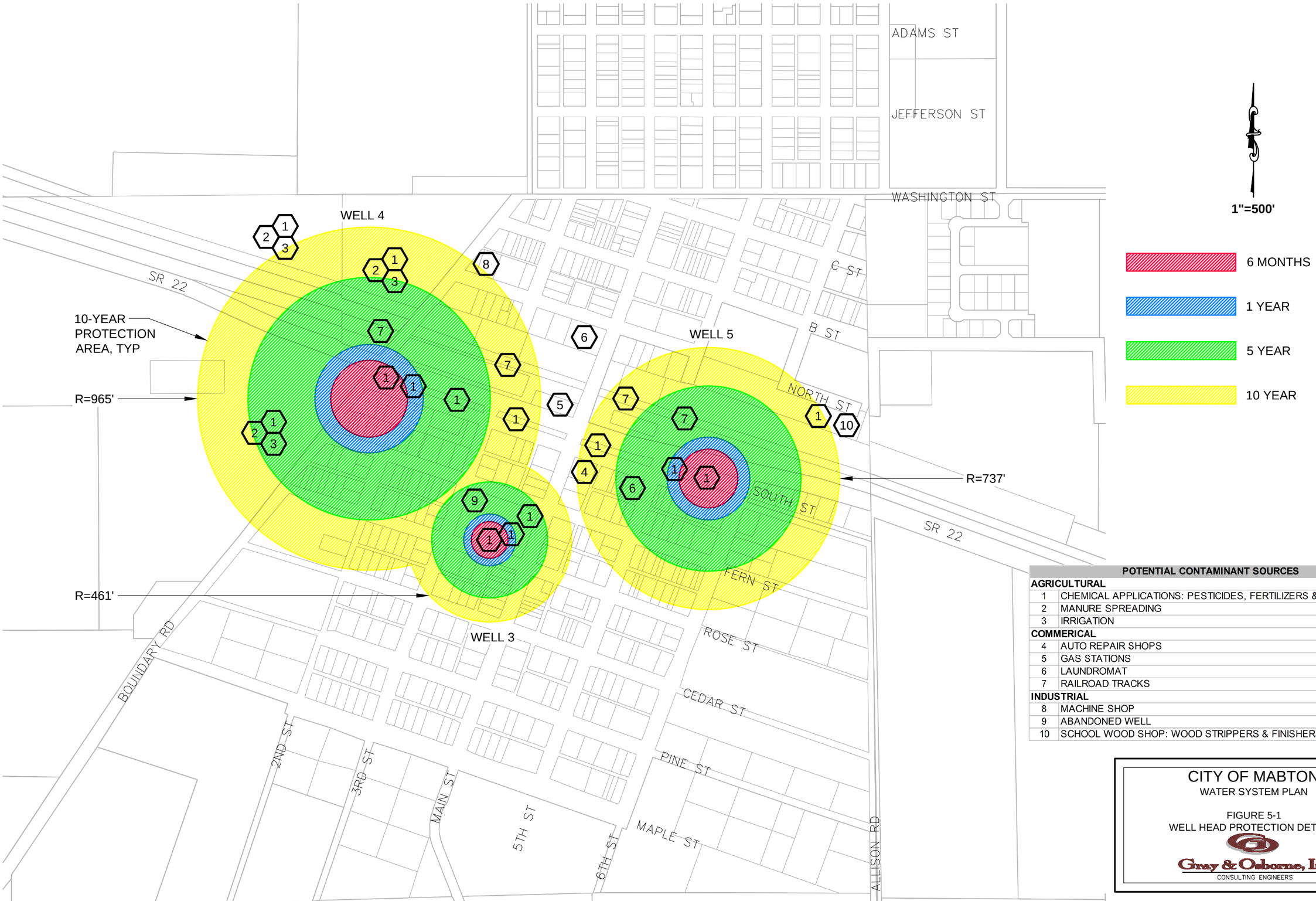
Appendix H includes a list of residences and businesses located within the wellhead protection areas (WPA) for all sources within the City's service area. This information identifies potential contaminant sources.

NOTIFICATIONS

Minimum requirements for notification of wellhead protection areas are issued to owners and operators of potential sources of contamination, to regulatory agencies and local governments, and to local emergency incident responders.

Notices to Owners of Potential Sources of Contamination

A standard letter (included in Appendix H) has been sent to all land or business owners identified on the list of potential contaminant sources. The standard letter states that their property is in the wellhead protection area, and states that the activities of their business



POTENTIAL CONTAMINANT SOURCES	
AGRICULTURAL	
1	CHEMICAL APPLICATIONS: PESTICIDES, FERTILIZERS & FUNGICIDES
2	MANURE SPREADING
3	IRRIGATION
COMMERICAL	
4	AUTO REPAIR SHOPS
5	GAS STATIONS
6	LAUNDROMAT
7	RAILROAD TRACKS
INDUSTRIAL	
8	MACHINE SHOP
9	ABANDONED WELL
10	SCHOOL WOOD SHOP: WOOD STRIPPERS & FINISHERS

CITY OF MABTON

WATER SYSTEM PLAN

FIGURE 5-1
WELL HEAD PROTECTION DETAILS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M: \MABTON\11064 WSP\FIGURES\FIGURE 5-1

may be a potential source for ground water contamination. Residents within the WPAs have been notified through public service messages of their potential impact upon the City's drinking water supply. Landowners with on-site septic systems should be notified that, when operated properly, septic systems would not be a significant threat to the City's wells. However, the dumping of chemicals into septic systems, on to the ground, or into storm drains in the wellhead protection area could contaminate the City's water supply and that enforcement action may be taken.

NOTIFICATION TO REGULATORY AGENCIES AND LOCAL GOVERNMENTS

Under WAC 246-290-135, it is required that notification is provided to regulatory agencies and local government of the WPAs and an inventory of potential sources of contamination in the area be identified. The regulatory agencies and local government office that must receive the notification are listed as follows:

Washington State Department of Ecology
Eastern Region Office
N. 4601 Monroe
Spokane, WA 98205-1295
Phone: (509) 329-3400

Washington State Department of Health
Division of Drinking Water
Eastern Regional Office
Contact: Russell Mau, P.E.
Riverview Corporate Center
16201 East Indiana Avenue, Suite 1500
Spokane Valley, Washington 99216
Phone: (509) 329-2116

Washington State Department of Health
Wellhead Protection Program, Headquarters
243 Israel Rd. SE
Tumwater, WA 98501
P.O. Box 47823
Olympia, WA 98504-7822
Phone: (360) 236-3114

Yakima County Health District
1210 Ahtanum Ridge Drive
Union Gap, WA 98903
Phone: (509) 575-4040

U.S. Environmental Protection Agency
Attn: Ground Water Unit
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-6708

The City has sent notification to regulatory agencies and local governments of the boundaries of the WHPs and the finding of the WHPS inventory.

NOTIFICATION TO LOCAL EMERGENCY INCIDENT RESPONDERS:

It is required by regulation that documentation of coordination with incident responders be provided. The following incident responders have been contacted and provided with information regarding the City's WPAs:

Mabton Police Department
305 Main Street
Mabton, WA 98935
Emergency: 911
Non-emergency: (509) 894-4096

Mabton Fire Department
315 North Street
Mabton, WA 98935
(509) 894-4777

Yakima County Sheriff's Office
1822 S 1st Street
Yakima, WA 98907
Emergency: 911
Business: (509) 574-2500

Fire Protection Bureau
Washington State Patrol
PO Box 42600
Olympia, WA 98504-2600
Emergency: 911
Business: (360) 596-3902

Yakima County Public Services
128 North 2nd Street
Yakima, WA 98901
Business: (509) 574-2300

Emergency Response, Washington
State Department of Transportation
Doug Pierce
Transportation Bldg.
47358, Olympia 98504-7358
Emergency: 911
Business: (360) 705-7812

Yakima County Health District
1210 Ahtanum Ridge Drive
Union Gap, WA 98903
Phone: (509) 575-4040

Spill Response Program
Washington State Department of Ecology
Will Strand
Central Regional Office
15 West Yakima Avenue, Suite 200
Yakima, WA 98901
(509) 575-2806

Washington State Department of Health
Division of Drinking Water
Eastern Regional Office
Contact: Russell Mau, P.E.
Riverview Corporate Center
16201 East Indiana Avenue, Suite 1500
Spokane Valley, Washington 99216
Phone: (509) 329-2116

CHAPTER 6

OPERATION AND MAINTENANCE

CHAPTER 6

OPERATION AND MAINTENANCE

In its 1997 Planning Handbook, the Department of Health identifies several elements that are important in a properly managed operation and maintenance (O&M) program. A list of these elements and where they are discussed or presented in this Plan is provided in Table 6-1.

TABLE 6-1

Operation & Maintenance Program Elements

Operation and Maintenance Component	Location in Plan
Water System Management and Personnel	Chapter 1
Operator Certification	Chapter 6
Routine Operating Procedures	Chapter 6
Coliform Monitoring Plan	Appendix F
Emergency Response Plan	Appendix K
Safety Procedures	Chapter 6
Cross-Connection Control	Appendix L
Customer Complaint Response Program	Chapter 6
Record keeping and Reporting	Chapter 6
O&M improvements	Chapter 6

SYSTEM PERSONNEL

The City's water system personnel are listed below. The City's daytime phone number is (509) 894-4096. A comprehensive list of emergency phone numbers is provided in Appendix K.

TABLE 6-2

Water System Personnel

Name	Title	Certification	Phone
Chris Morris	Public Works Lead	Temporary	(509) 439-4077 (Cell) (509) 894-4096 (City Hall)
Myra Hartley	Waste Water Plant Operator	WDM2	(509) 439-4103 (Cell)
Noe Trujillo	Public Works Employee, On Call for Water System	N/A	(509) 439-4230 (Cell) (509) 894-4096 (City Hall)

Note that while the certification level required for the water system operator is actually Water Distribution Manager 2 (WDM2) for the City of Mabton, the City has been working toward the goal of either training an existing employee for this role or hiring from outside a suitably qualified employee. Mr. Chris Morris has a temporary certification to operate the water system. Myra Hartley, the Waste Water Plant Operator has the WDM2 certification.

OPERATION AND MAINTENANCE PROGRAM

Tables 6-3 through 6-5 provide general information on the City's operation and maintenance program. Table 6-3 summarizes the City's principal operating and preventive maintenance activities and their frequency. Photos of the City's facilities are provided at the end of this chapter.

TABLE 6-3

Operation and Maintenance Practices

Activity	Frequency
Well inspection	5 days / wk
Record well production and reservoir data	Flow meter/weekly/manually Reservoir on chart recorder
Collect water samples for coliform testing	Monthly (two samples)
Read service meters	Monthly, except when snow covered
Clean/inspect booster pumping station screen	Every 6 months
Flush fire hydrants and blowoffs	Annually
Exercise valves	Annually
Inspect reservoir screen and hatch	Annually
Perform preventive maintenance on control valves	As Needed
Test/Replace service meters > 2-inches	As needed
Test/Replace service meters < 2-inches	Every 10 years
Test/Replace production meters	As Needed
Inspect and clean reservoir	As Needed
Pull and inspect well pumps & motors	As Needed

Table 6-4 summarizes the normal settings, positions and readings used for the City's water reservoir.

TABLE 6-4

Normal Reservoir Settings (800,000 gal. Reservoir)

Item	Elev. (ft, msl)	Elev. in Reservoir[(1)] (ft)	Setting
Reservoir	723 (+/-)	112 (+/-)	Overflow
	NA	NA	High Level Alarm
	811 (+/-)	88 (+/-)	Lead Well Off
	811 (+/-)	88 (+/-)	Lag Well Off
	806 (+/-)	83 (+/-)	Lead Well On
	806 (+/-)	83 (+/-)	Lag Well On

(1) Usually multiple wells would be arranged in a lead-lag type operation, however the City understands that the current setting for the wells is that both Well No. 4 and Well No. 5 turn on at the same reservoir level.

The reservoir's pressure transmitter is set at 5-feet above the floor of the reservoir.

Table 6-5 provides a list of the typical water system supplies used by the City, and the current suppliers for these materials.

TABLE 6-5

Supplies and Suppliers

Supply	Supplier	Phone
PVC Pipe	H.D. Fowler, Yakima	(877) 562-2100
Gate valves		
Fire hydrants		
Service meters & setters		
Meter boxes		
Repair bands		
Dresser couplings		
Miscellaneous pipe fittings		
Electrical	Stoneway Electric Supply, Yakima	(509)-469-6154

RECORD KEEPING

The City keeps the following water system records and data.

TABLE 6-6

Record Keeping Practices

Record Type	Comment
Source meter readings	Weekly readings kept indefinitely
Maximum Day Demand	Not available
Peak Hour Demand	Not available
Service meter readings	Records kept indefinitely
Unbilled authorized consumption	Not currently tracked
Bacteriological test results	Records kept 5 years
DOH correspondence, incl. sanitary surveys	Records kept indefinitely
Legal documents	Records kept indefinitely
Backflow Device Inspection Notices	Records kept 5 years
Backflow Violation Case Files	Records kept 5 years
Water Availability Request Forms	Records kept 2 years

The City is attempting to keep water system mapping, including the location of pipelines, hydrants, and valves up to date based on the best information available. In recent years, there has been a significant loss of institutional knowledge of the water system and the City has been working on redeveloping this information and the documentation of existing facilities.

COMPLAINT RESPONSE

The City maintains customer complaint records to verify trends that may help the City improve service to its customers. Response to questions and complaints is typically verbal, either through a field visit or a telephone call. However, depending on the nature of the question or complaint, written response can also be given. Bimonthly City Council meetings, scheduled on the second and fourth Tuesdays of the month, are the main venue for public involvement in the water system.

SAFETY PROCEDURES

All appropriate Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Administration (WISHA) regulations are routinely followed during operation of the system. Operation and maintenance staff is trained in safety practices including confined space, first aid, and fall restraint. The City maintains fall equipment for inspecting reservoir hatches and screens, and confined space equipment for underground vaults.

SANITARY SURVEY FINDINGS

The City's last DOH sanitary survey was conducted on January 12, 2010. No significant deficiencies were noted, and all have been corrected. A copy of the DOH letter is provided in Appendix M.

DEFICIENCIES

The City has identified the several O&M deficiencies and plans to take action to correct them. These projects are summarized in Table 6-7 below and are discussed further in Chapter 8.

TABLE 6-7

Operation and Maintenance Improvements

Deficiency	Action
The City's Well No. 5 check valve was found to be leaking.	Repair.
Source meters need to be periodically repaired, rebuilt and/or calibrated.	Repair, rebuild, replace and/or calibrate as needed.
Several 1-inch and smaller meters have been failing and several are difficult to read due to fading or the crystal has been smashed.	Replace as necessary.
2-inch meters are often inaccurate.	Commit to a program to replace every 5 years.
Valves are aging and the majority of which do not function properly. It is difficult to isolate a portion of the water system without functioning valves.	Replace valves as necessary.
Hydrants are aging and some do not function adequately.	Replace hydrants as necessary.
Much of the City's water mains consist of aging cast iron and AC pipe, more than half of which is 4-inch diameter and smaller, with much of the remainder aging and in need of replacement.	Replace as funding permits.
Per the WSDM 5.7.1 Water System Reliability Recommendations, an alarm system should be included that "notifies the operator(s) of overflows, or when the storage level drops below the point where the equalizing storage volume is depleted. This should only occur during abnormal operating conditions."	Install as upgrades are performed and as funding permits.

PHOTOS

	
500 gpm Well No. 5 Well House	Well No. 5 – Motor and Piping
	
200 gpm Well No. 4 Well House	Well No. 4 – Motor and Piping
	
800,000 gal. Welded Steel Reservoir	BPS

	
BPB Fire Pump and Bypass	BPS Building

CHAPTER 7

CONSTRUCTION STANDARDS

CHAPTER 7

CONSTRUCTION STANDARDS

In 2004, the City adopted Construction Specifications for its water utility. A copy of these documents is provided in Appendix N. The City requests that DOH review and approve these documents. Such approval would allow the City to construct distribution mains without the requirement to submit project reports (WAC 246-290-110) and construction documents (WAC 246-290-020) to DOH.

The City has under contract a Professional Engineer (Gray & Osborne, Inc.), licensed in the State of Washington. The City's engineer will design and/or review any plans for distribution mains to be constructed in the City. If a developer proposes to construct a water main extension within the City, the developer would be required to submit engineering plans and specifications for review and approval by the City's engineer per Mabton Municipal Code 13.04.560.

The City will maintain a file with copies of the construction completion reports from any project completed under the DOH project submittal review waiver.

CHAPTER 8

CAPITAL IMPROVEMENT PROGRAM

CHAPTER 8

CAPITAL IMPROVEMENT PROGRAM

Several water system deficiencies are identified in Chapter 3. A brief description of the improvements required to address these deficiencies is presented in the following sections. A map showing the location of each project is presented on Figure 8-1. Detailed cost estimates are provided in Appendix O. A schedule for implementing these improvements is provided in Table 8-1. Financing for improvements planned during the next six years is discussed in Chapter 9.

SOURCE IMPROVEMENTS

The City's source capacity is not adequate to meet its current, 6- and 20-year needs. Well No. 4 is currently being repaired, and is now anticipated to produce in the range of 200 to 250 gpm, much lower than the original 1,000 gpm. The City will have the flow meter for this well either repaired or replaced once this well has been repaired. This flow meter will allow the City to more accurately determine the City's source capacity and the City's water use.

Whether or not the City's annual water rights are adequate to meet its 20-year needs will depend upon water use reductions in the water system DSL (Distribution System Leakage) and increases in the City's water use efficiency. With the current DSL estimated to be 38 percent of production (see Chapter 2, Water Use), the City's annual withdrawal right is estimated to be exceeded by 2032. Thus, if the DSL were reduced to 10 percent or less (as recommended by DOH), the City's annual withdrawal in 2032 may fall within their annual withdrawal water right. Another possibility is for the City to acquire additional water rights.

The City plans to discuss this issue with DOH (and Ecology, if necessary) and determine what the next steps are. This plan can be amended to address any significant engineering studies or construction projects that the agencies determine may be needed.

As mentioned previously, the source meter and level sensor at Well No. 4 is not functioning properly, therefore this well's production (and therefore the City's total production) has not been accurately measured. The City plans to either replace this malfunctioning meter and level sensor or have them repaired and in operation in 2013.

Currently the City has no emergency backup power to power the wells or the booster pumping station. The City anticipates installing an emergency generator to power the new Well No. 6 in case of an extended power outage.

STORAGE

After the City constructs a new 1,000 gpm well (Well No. 6), the existing storage is adequate for the 20-year planning period.

The City anticipates having the reservoir cleaned out.

The City would like to eliminate the need for the continuously running booster station due to the costs of the power to run these boosters. By either constructing a new, higher reservoir, or by increasing the height of the existing reservoir, the booster station (except for the fire-flow booster) can be eliminated. The City plans to construct a new 1,000,000 gallon reservoir or to increase the height of the existing reservoir if this is found to be possible.

TREATMENT

No treatment improvements are planned for the 20-year planning period.

TELEMETRY

No major telemetry improvements are planned for the 20-year planning period.

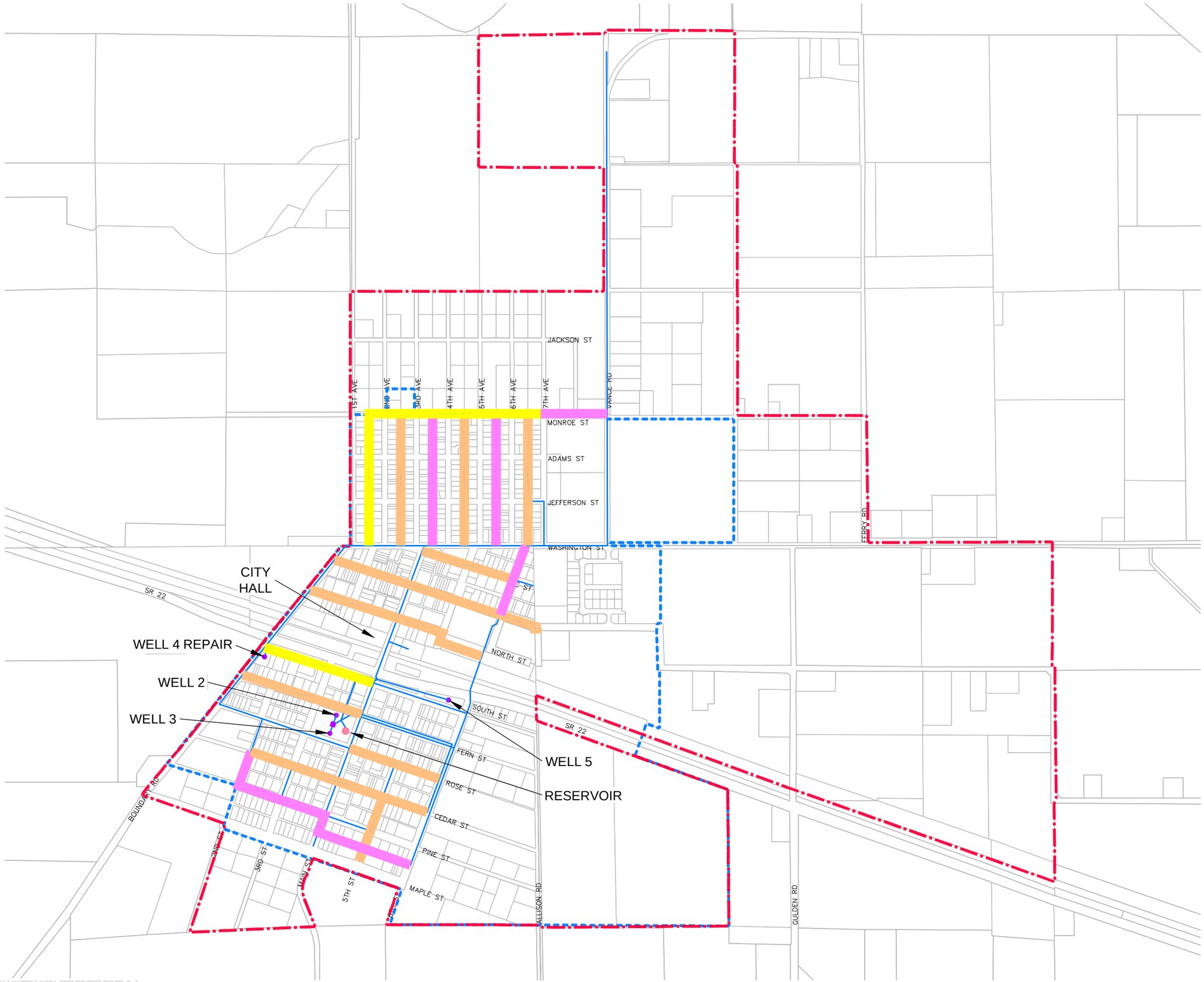
DISTRIBUTION SYSTEM

The City's distribution system contains many 4-inch and 6-inch lines that are inadequate to support the fire flows required by the City's fire chief. The 6-year improvements are summarized in Table 8-1. The 6- and 20- year water main improvements have been categorized into three priority groups, Category A, B and C. Figure 8-2 shows the location of each proposed improvements.

As previously shown in Table 1-6, approximately 76% of the distribution piping is CI pipe, which was installed in the 1930s and may be approaching the end of its useful life. Also notable is that roughly half of the City's piping is just 4-inches in diameter, leading to significant pressure losses during fire-flow conditions. It is the City's desire to begin replacing the CI pipe which is now over 70 years in age. In 2012, the City applied for PWTF funding for three projects in order to begin the process of gradually replacing and upsizing water mains. Since the funding for the PWTF was cut, the City will be seeking funding for these projects with a DWSRF loan.

The City's leak detection study indicates that there is a sizable leak in a 2-inch diameter PVC pipe on 3rd Avenue. The City is planning to repair this leak in early Spring of 2013.

The following water main improvements are included in the 20-year capital improvement plan. Each of these projects replaces old and undersized water mains, improving fire flows and reducing leakage from old pipes while reducing maintenance and repairs. They have been categorized into Priority A, B and Priority C. Also indicated are an approximate number of water services that would likely be upgraded with the project.



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- CITY LIMITS
- URBAN GROWTH AREA
- EXISTING WATER MAIN
- CATEGORY A 6-YEAR CAPITAL IMPROVEMENTS
- CATEGORY B 20-YEAR CAPITAL IMPROVEMENTS
- CATEGORY C 20-YEAR CAPITAL IMPROVEMENTS

NOTES:

1. **NOT ALL CAPITAL IMPROVEMENTS ARE SHOWN ON THIS FIGURE.**
2. **ALL WATER MAIN IMPROVEMENTS WILL BE 8-INCH C900 PVC**

CITY OF MABTON

WATER SYSTEM PLAN

FIGURE 8-1
CAPITAL IMPROVEMENTS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

I:\MABTON\11084 WSP\FIGURES\FIGURE 8-1

TABLE 8-1

Fire Flow and DSL Improvements

No.	Water Main Location	Improvement	Length (ft)	Services (count)	Estimate
6-Year Capital Improvements, (Category A)				**Subtotal:**	**$900,000**
1.	South Street, Reservation St. to the Alley 170 ft. West of Main St.	Upsize 4" CI to 8" PVC Water Main	1,050	8	$240,000
2.	Monroe Street, from Seventh Ave to Alley East of First Ave.	Upsize 4" CI to 8" PVC Water Main	1,850	20	$390,000
3.	Alley East of First Ave, from Washington St. to Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	36	$270,000
20-Year Capital Improvements, (Category B)				**Subtotal:**	**$1,410,000**
4	Alley East Of 3rd Ave. From Washington St. To Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	36	$260,000
5	Alley East Of 5th Ave. From Washington St. To Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	36	$260,000
6	Monroe St. From 7th Ave. To Vance Rd.	Upsize 4" CI to 8" PVC Water Main	700	2	$160,000
7	N. 6th St. From B St. To Washington St.	Upsize 4" CI to 8" PVC Water Main	800	8	$190,000
8	In Alley North Of Maple St. From 6th St. To Main St. (1)	Upsize 4" CI to 8" PVC Water Main	1,200	16	$220,000
9	Pine St. From Main St. To 2nd St. (2)	Upsize 4" CI to 8" PVC Water Main	1,400	26	$320,000
20-Year Capital Improvements, (Category C)				**Subtotal:**	**$2,920,000**
10	Alley East Of 2nd Ave. From Washington St. To Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	36	$260,000
11	Alley East Of 4th Ave. From Washington St. To Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	36	$260,000
12	Alley East Of 6th Ave. From Washington St. To Monroe St.	Upsize 4" CI to 8" PVC Water Main	1,400	36	$260,000
13	C St. From 6th Ave. To Main St.	Upsize 4" CI to 8" PVC Water Main	1,000	10	$220,000
14	B St. From Allison St. To Boundary Rd.	Upsize 4", 6" CI to 8" PVC Water Main	2,100	22	$450,000
15	North St. From 6th Ave. To Boundary Rd.	Upsize 4", 6" CI to 8" PVC Water Main	1,800	12	$360,000
16	Fern St. From Main St. To Boundary Rd.	Upsize 4" CI to 8" PVC Water Main	1,300	24	$290,000
17	Rose St. From 6th Ave. To Main St.	Upsize 4" CI to 8" PVC Water Main	1,000	18	$230,000
18	Cedar St. From 6th Ave. To 2nd St.	Upsize 4" CI to 8" PVC Water Main	1,900	40	$420,000
19	5th St. From Maple St. To Cedar St.	Upsize 4" CI to 8" PVC Water Main	700	8	$170,000
				Total:	**$5,230,000**

(1) Includes from Alley to Pine St. (200 ft.).
(2) Includes from Pine St. to Cedar St. (400 ft.).

BOOSTER PUMPING STATION

No Booster Pumping Station (BPS) improvements are planned for the 20-year planning period. The need for the BPS will be eliminated when the new reservoir is constructed (except for the fire-flow booster pump).

OPERATION AND MAINTENANCE

The City has identified several O&M projects for the next six years. These projects are also discussed in Chapter 6.

- Source Meter Repair/Replacement. The City has plans to repair/replace its source meter for Well No. 4. This meter has not been functioning properly requiring repair and/or replacement.
- Valves. The City plans to begin a program to add or replace valves throughout the City's system. Currently, the majority of the valves do not close, preventing the isolation of water mains for flushing or in the case of a water main break.
    - The 2012 leak detection study also indicated that there is a significant leak in the Well No. 5. discharge pipe check valve. The City plans to repair this leaky valve in early 2013. Costs for this repair are expected to be minimal.
- Service Meters. The water used at the City's parks is not yet metered. The City plans to place service meters for all parks for all uses (including irrigation) at the parks.
    - The City has the four meters required to meter Governor's Park and anticipates installing these meters early in the Spring of 2013. Costs for this installation are expected to be minimal.
    - The meter for Fezell Park has not yet been purchased, but once these funds become available, the City intends to meter this park as well.
    - The Water Department has budgeted to purchase 20 meters per year, and has prioritized the following :
        - Dead meters.
        - Incorrectly reading meters.
        - Difficult to read meters.
        - Reservoir Cleaning. There are no records of when the City's 800,000 gal. reservoir was last cleaned, and the reservoir is due for a cleaning.
        - Hydrant Replacements. The City has several hydrants that are no longer operable and will begin an annual program to replace them.

SCHEDULE

A schedule for the City's planned capital improvements is provided in Table 8-2. Planning level cost estimates are provided in Appendix O.

TABLE 8-2

Capital Improvement Plan [(1)]

	Project	2013 Cost [(1)]	2013	2014	2015	2016	2017	2018	'19-'32
SOURCE									
1.	Well No. 4 Repair	$130,000	X						
2.	Well No. 6 (New Well)	$1,800,000		X					
WATER RIGHTS									
3.	Water Rights	$700,000		X					
STORAGE									
4.	New Reservoir	$1,300,000		X					
TREATMENT									
-	No Improvements	-							
TELEMETRY									
-	No Improvements	-							
DISTRIBUTION									
5.	South St., Reservation St. to the Alley	$240,000		X					
6.	Monroe St., Alley to 7th Ave.	$390,000		X					
7.	Alley East of 1st Ave.	$270,000		X					
8.	Alley East Of 3rd Ave.	$260,000							X
9.	Alley East Of 5th Ave.	$260,000							X
10.	Monroe St. 7th Ave., To Vance Rd.	$160,000							X
11.	N. 6th St.	$190,000							X
12.	Alley North Of Maple St.	$220,000							X
13.	Pine St.	$320,000							X
14.	Alley East Of 2nd Ave.	$260,000							X
15.	Alley East Of 4th Ave.	$260,000							X
16.	Alley East Of 6th Ave.	$260,000							X
17.	C St.	$220,000							X
18.	B St.	$450,000							X
19.	North St.	$360,000							X
20.	Fern St.	$290,000							X
21.	Rose St.	$230,000							X
22.	Cedar St.	$420,000							X
23.	5th St.	$170,000							X
BOOSTER STATION									
-	No Improvements	-							
OPERATION & MAINTENANCE									
24.	Source Meter Repair	$10,000	X						
25.	Distribution System Valves	$25,000/yr.	X	X	X	X	X	X	
26.	Service Meters	$3,000/yr.	X	X	X	X	X	X	
27.	Reservoir Cleaning	$5,000	X						
28.	Hydrant Replacements	$4,000/yr	X	X	X	X	X	X	X
29.	Water System Plan	$55,000							X

(1) Engineering News Record (ENR) National Construction Cost Index January, 2013 = 9437.

CHAPTER 9

CAPITAL IMPROVEMENT FINANCING

CHAPTER 9

CAPITAL IMPROVEMENT FINANCING

EXISTING RATES AND CHARGES

Mabton's water rates are established by ordinance. Meters are read on a monthly basis and customers are billed according to the rate schedule summarized in Table 9-1. As indicated, the City charges a base rate that includes the first 536 cubic feet (cf) of usage for 1½ inch and smaller meters, and 938 cf of usage for meters 2-inches and greater in size. Each 134 cf (approximately 1,000 gal.) of usage above these amounts is assessed a volume charge as shown in the table. The volume charge has two levels and is therefore considered to be an inclining block structured rate, which helps to encourage water conservation.

TABLE 9-1

2012 Water Service Rates [(1)]

Classification	Monthly Base Rate	Senior Monthly Base Rate	Volume Charge (per 134 cf)	Volume w/ Base (cf)
3/4 " or smaller	$26.35	$18.35	(included)	First 536
			$1.24	Next 402
			$1.28	Over 938
1"	$27.59	$19.59	(included)	First 536
			$1.24	Next 402
			$1.28	Over 938
1¼ " to 1½"	$34.11	$26.11	(included)	First 536
			$1.24	Next 402
			$1.28	Over 938
2"	36.21	28.21	(included)	First 938
			$0.98	Next 4,020
			$1.08	Over 4,958
3"	59.29	51.29	(included)	First 938
			$0.98	Next 4,020
			$1.08	Over 4,958
4"	$99.26	$91.26	(included)	First 938
			$0.98	Next 4,020
			$1.08	Over 4,958
6"	$192.51	$184.51	(included)	First 938
			$0.98	Next 4,020
			$1.08	Over 4,958

Source: City of Mabton Ordinance 977, January 24, 2012.

Connection charges are also defined by ordinance. A connection to the City's distribution system for meters 2 inches and smaller in size requires a payment to the City of the cost of labor and materials plus 10 percent. For larger meters, the costs are determined by the clerk-treasurer. The City also charges new customers a "water system connection fee" of $300. The property owner bears all expenses for the construction of the water service from the water main to the building.

HISTORICAL FINANCIAL STATUS

Revenues and expenditures between 2009 and 2011 for the City's water utility are shown in Table 9-2. Like many Washington cities, Mabton combines its water and sewer systems into a single combined utility.

Table 9-2 has been summarized to show only those revenue and expenditure line items associated with the domestic water system. The City assigns most water system revenue and expenditure categories their own line items. For the few instances where water revenues and costs are combined with those of the sewer utility (see footnotes), the City estimates that these amounts should be split equally between water and sewer.

TABLE 9-2

Water Utility Historical Revenue and Expenditures

REVENUES	**2009**	**2010**	**2011**
Water Sales	288,430	291,821	284,917
Connection Charges	3,346	2,709	0
Late Fees/On/Off Charges(1)	10,490	10,558	10,378
Interest & Other Earnings(1)	1,462	306	155
Water/Sewer Utility Tax(1)	69,352	49,883	54,259
Total Revenues	**373,080**	**355,277**	**349,709**
EXPENDITURES			
Salaries, Wages & Benefits	99,614	75,624	109,541
Supplies	25,718	15,256	22,804
Utilities	43,621	44,694	49,155
Repairs, Maintenance, Fuel, Insurance	13,801	12,759	27,348
Miscellaneous	25,546	22,763	24,622
Prof. Serv., Other Services and Charges	16,174	14,285	19,303
Utility Taxes(1)	70,892	45,513	54,258
Well Project, Principal & Interest	19,790	0	0
1989 Bond, Principal & Interest	14,500	10,728	11,622
Total Expenditures	**326,778**	**241,622**	**318,653**
Revenues minus Expenditures	**46,302**	**113,655**	**31,056**
Beginning Water Balance(1)	111,511	172,707	286,362
Ending Water Balance(1,2)	172,707	286,362	317,418

(1) Because Mabton operates a combined water-sewer utility, these items were combined with the sewer utility in the City's annual reports. The City estimates that the water utility portion of these items was 50%.

(2) Actual value from average of combined utility.

The following items are worth noting:

- Operation Salaries and Benefits have varied somewhat because of changes in personnel and shifting duties of some employees to/from water and sewer.

- As indicated, it was necessary to estimate the 2009 Beginning Cash balance as half the combined balance for the combined Water/Sewer Fund. The fact that the balance has increased each year indicates the water portion of the combined fund has remained financially viable during these years.

SIX-YEAR FINANCING PLAN

Table 9-3 summarizes the City's projected 6-year financing plan.

TABLE 9-3

Six-Year Financing Plan

REVENUES	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Water Sales	285,000	285,000	285,000	285,000	285,000	285,000	285,000
Connection Charges	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Late Fees/On/Off Charges[(1)]	10,800	10,800	10,800	10,800	10,800	10,800	10,800
Interest & Other Earnings[(1)]	700	700	700	700	700	700	700
Water/Sewer Utility Tax[(1)]	57,000	57,000	92,420	94,300	96,260	98,340	100,500
Revenues From Increase Rates[(2)]		0	177,100	186,500	196,300	206,700	217,500
Total Revenues	355,600	355,600	568,120	579,400	591,160	603,640	616,600
Loan Revenues			4,900,000				
Total Revenues	**355,600**	**355,600**	**5,468,120**	**579,400**	**591,160**	**603,640**	**616,600**
EXPENSES							
Salaries, Wages & Benefits	97,800	100,700	103,700	106,800	110,000	113,300	116,700
Supplies	21,900	22,600	23,300	24,000	24,700	25,400	26,200
Utilities	47,200	48,600	50,100	51,600	53,100	54,700	56,300
Booster Station Power Savings[(3)]				(22,000)	(23,000)	(24,000)	(26,000)
Repairs, Maint., Fuel, Insurance	18,500	19,100	19,700	20,300	20,900	21,500	22,100
Miscellaneous	25,000	25,800	26,600	27,400	28,200	29,000	29,900
Prof. Serv., Other Services,	17,100	17,600	18,100	18,600	19,200	19,800	20,400
Utility Taxes	57,000	57,000	92,420	94,300	96,260	98,340	100,500
O&M Expenditures							
Source Meter Repair		1,000					
Distribution System Valves		25,000	25,000	25,000	25,000	25,000	25,000
Service Meters		3,000	3,000	3,000	3,000	3,000	3,000
Reservoir Cleaning		5,000					
Hydrant Replacement		4,000	4,000	4,000	4,000	4,000	4,000
CAPITAL IMPROVEMENTS (DEBT FINANCED)							
Well No. 4 Repair[(4)]		130,000					
Well No. 6			1,910,000				
Water Mains[(5)]			930,000				
Reservoir			1,340,000				
Water Rights	-	-	720,000	-	-	-	-
DEBT SERVICE							
1989 Bond, Princ. & Int.	11,300	11,300	11,300	11,300	0	0	0
New Loans, Princ. & Int.[(6)]				203,500	203,500	203,500	203,500
Loan Reserve Fund				20,350	20,350	20,350	20,350
Total Expenditures	**295,800**	**470,700**	**5,277,220**	**588,150**	**585,210**	**593,890**	**601,950**
Revenues minus Expenditures	**59,800**	**(115,100)**	**190,900**	**(8,750)**	**5,950**	**9,750**	**14,650**
Beginning Water Balance	317,400	377,200	262,100	453,000	444,250	450,200	459,950
Ending Water Balance	377,200	262,100	453,000	444,250	450,200	459,950	474,600

Notes for Table 9-3:

(1) 2012 est. based upon ave. of 3 prev. years plus pop. growth rate of 0% annually, with 3% inflation.
(2) Revenues from Increased Rates assumed from a monthly rate increase of $21/ ERU/month in 2014, 3% annually thereafter, 1.5% annual population growth rate.
(3) Projected booster station power costs savings if new reservoir is constructed to eliminate the continuously running booster pumps.
(4) Well No. 4 Repair assumed to be paid out of reserves.
(5) Water Mains project includes water main improvements in South St., Monroe St. and the Alley east of 1st Ave.
(6) Funding for the Well No. 6, Water Mains Project, Reservoir and Water Rights assumed to be through USDA RD with a 40 year, 2.75% loan.

Due to the recent failure of Well No. 4, the cost of the repair of this well and this reduction in production, the City is in a position where it will need to raise revenues to pay for these capital improvements. Table 9-3 indicates that with an annual increase of a one-time $21 per month increase and 3 percent annually to the base rate, assuming 1.5 percent annual growth in population, and successful applications for USDA RD loans with 40-year, 2.75% terms, the City can fund the repair of Well No. 4, new Well No.6, the three water main projects included in the Water Mains Project, the new Reservoir, purchase additional water rights and complete its planned O&M improvements.

With these increased revenues, over the 6-year planning period, the City's revenues are projected to be sufficient to enable the Water Fund's ending cash balance to remain solvent. In the twenty-year planning period, additional capital improvements will be necessary to replace the City's aging infrastructure, which may require additional rate adjustments to enable the City to take on these additional improvements beyond the 6-year planning horizon.

FUNDING SOURCES

There are several outside funding sources available to the City if the need arises for additional large projects during the planning period. The funding source(s) selected for a particular project will depend on the status of the City's financial commitments, its capital and cash flow requirements, funding source availability, and the impact on the service rates and connection charges.

The City had the Rural Community Assistance Corporation (RCAC) perform an income survey in 2011.

Grant and loan programs available through public funding agencies are summarized in Table 9-4. Following the table are brief descriptions of each program listed in the table, as well as descriptions of other financing options including revenue bonds, developer financing, general facility charges, and utility local improvement districts (ULIDs).

TABLE 9-4

Grant and Loan Programs

Agency	Program	Maximum Amount	Type	Application Cycle
Washington State Department of Health	Drinking Water State Revolving Fund	$12,000,000	Loan	March
Wash. State Dept. of Commerce	Community Development Block Grant, General Purpose	$1,000,000	Grant	January
Wash. State Dept. of Commerce	Community Development Block Grant, Planning Only	$24,000 or $35,000	Grant	Open all year as $ available
Washington State Public Works Board	Public Works Trust Fund Planning Loan (1)	(1)	(1)	(1)
Washington State Public Works Board	Public Works Trust Fund Preconstruction Loan (1)	(1)	(1)	(1)
Washington State Public Works Board	Public Works Trust Fund Construction Loan (1)	(1)	(1)	(1)
USDA Rural Development	Community Assistance Grant and Loan Program	Variable	Loan and grant	Year-round
U.S. Congress	State and Tribal Assistance Grant	Variable	Grant w/. 45% match	Year-round
Wash. State Dept. of Commerce	Community Economic Revitalization Board, Committed Private Partner Program	Variable	Loan	Year-round
Wash. State Dept. of Commerce	Community Economic Revitalization Board, Construction Program	$1 M max. possible grant	Loan & Grant	Year-round
Wash. State Dept. of Commerce	Community Economic Revitalization Board, Planning Projects	$50k max. grant, 25% match	Grant	Year-round

(1) No funding is currently available for FY 2013-2015. Terms thereafter to be determined.

DRINKING WATER STATE REVOLVING FUND

In 1997 the Washington State Department of Health began taking applications for a new loan program called the Drinking Water State Revolving Fund (DWSRF). The program was funded by Congress as part of the 1996 reauthorization of the Safe Drinking Water Act. The program provides low-interest loans to help publicly owned as well as privately owned not-for-profit and for-profit water systems make improvements to water systems for public health protection.

The program is primarily targeted toward projects that will improve public health and safety. Infrastructure improvement projects can also be considered, but are given a lower priority in the ranking. Project rankings and selection are made by the Department of Health; program financial administration is handled by the Department of Commerce.

COMMUNITY DEVELOPMENT BLOCK GRANT

The Community Development Block Grant program, administered by the Washington State Department of Commerce, consists of two programs that can be used to fund water system improvements. The first is the General Purpose Grant program, which allows applicants to request up to $1 million for design and construction of public facilities, community facilities, housing rehabilitation, or economic development projects that principal benefit low- and moderate-income persons. If total project costs exceed $10 million, the maximum grant can be increased to $1.5 million.

The second program is the Planning-Only Grant program. This program supports a range of planning activities that lead to implementation of priority projects that benefit low- and moderate-income communities. Funding levels are set at a maximum of $24,000 for most projects, although projects meeting certain priority needs may be eligible for up to $35,000. Grants are offered to qualifying applicants on a first-come, first-serve basis until the year's allocation for the program is exhausted.

PUBLIC WORKS TRUST FUND

The Public Works Trust Fund (PWTF) is a revolving loan fund designed to help local governments finance needed public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by legislative action, offers loans substantially below market rates, payable over periods typically ranging up to 20 years, and in amounts up to $5,000,000 per jurisdiction. In past years, PWTF has also offered planning loans for planning projects and preconstruction loans for engineering design. These programs have been temporarily suspended because of State budget deficits.

Interest rates on construction loans are 0.5 percent, 1 percent, or 2 percent, with the lower interest rates providing an incentive for a higher local match. A minimum of 15 percent

of project costs must be provided by the local community to qualify for a 0.5 percent loan. A 10 percent local share qualifies the applicant for a 1 percent interest rate, and a 15 percent local share qualifies for a 2 percent loan.

To be eligible for the program, an applicant must be a local government such as a City, a County, or special purpose utility district, and have a long-term plan for financing its public work needs. If the applicant is a City or a County, it must adopt the 1/4 percent real estate excise tax dedicated to capital purposes, which Mabton has done. Eligible public works systems include streets and roads, bridges, storm sewers, sanitary sewers, and domestic water. Loans were offered for purposes of repair, replacement, rehabilitation, reconstruction or improvement of existing eligible public works systems, and can be sized to meet the needs of growth.

USDA RURAL DEVELOPMENT

USDA Rural Development (RD) has a loan program that is available to communities whose rates, as a result of projected RD debt payments, are expected to exceed the rates of "similar" communities. Under certain hardship conditions, RD's funding options include a limited grant program. The loan program provides long-term 30- to 40-year loans at an interest rate currently between 1.875 and 3.125 percent. RD loans are issued as revenue bonds with a 1.1 debt coverage requirement.

STATE AND TRIBAL ASSISTANCE GRANTS

State and Tribal Assistance Grants (STAG grants) are available through the federal government by petitioning the applicant's federal Representative or Senators. There is no formal application form, although legislators often have developed their own application form to describe the project and its need. The program requires a 45 percent match, using any type of funding other than funding derived from EPA (e.g. DWSRF). Funding is approved annually as a separate appropriation in the federal budget.

COMMUNITY ECONOMIC REVITALIZATION BOARD

The Community Economic Revitalization Board (CERB) has three Core Financing Programs:

Committed Private Partner Program:

The Committed Private Partner Construction Program requires an eligible private business commitment as part of the public entity's application. The applicant and business must provide evidence that a private development or expansion is ready to occur and that the private development is contingent upon the approval of CERB funds. CERB requires that the project generate either significant job creation or significant private investment in order to be eligible for funding.

Prospective Development Construction Program:

Loans up to $1,000,000 per project, grants in unique cases. Interest rates of 3% for non-distressed and 2.5% for distressed counties. 20-year term maximum, requires 10% match. Jurisdictions in rural counties and rural communities are eligible for Prospective Development awards. The applicant must provide evidence that a private development or expansion is likely to occur as a result of the public improvements. CERB requires that the project generate either significant job creation or significant private investment in order to be eligible for funding. Applicants must demonstrate convincing evidence (based on a feasibility study) that the median hourly wage of the private sector jobs created after the project is completed will exceed the countywide median hourly wage. Applicants must also demonstrate the need for CERB assistance and that no other timely source of funds is available at a reasonably similar rate to the current CERB rate.

Planning Projects:

Grants up to $50,000 per application, requires 25% matching funds.

CERB provides limited funding for studies which evaluate high-priority economic development projects. Projects should target job growth and long-term economic prosperity and can include: site-specific plans, studies, and analyses that address environmental impacts, capital facilities, land use, permitting, feasibility, marketing, project engineering, design, site planning and project debt and revenue impacts. When considering planning applications, the Board will give priority to those projects which could ultimately result in a type of project eligible for CERB construction funds.

CERB accepts applications from public entities to finance public infrastructure and planning activities on an ongoing basis. The Board meets every two months to make funding decisions.

REVENUE BONDS

Revenue bonds are tax-free bonds issued by a utility that are repaid by revenues from monthly service charges. In order to make revenue bonds marketable to investors, the bonds typically have contractual provisions for the utility to meet debt coverage requirements. The District must show that its annual net operating income (gross income less operation and maintenance expenses) is equal to or greater than a factor, typically 1.2 to 1.4 times the annual debt service on all par debt. If a coverage factor has not been specified it will be determined at the time of any future bond issues.

DEVELOPER FINANCING

Developers typically fund the construction of extensions to the water mains to property within new plats. The developer extensions are turned over to the City for operation -and maintenance upon completion. Developer extensions must be constructed to meet the requirements of the City's construction standards.

GENERAL FACILITIES CHARGE

In order to finance improvements of general benefit to the City, a general facilities charge may be adopted. General facilities charges are usually established as one-time charges assessed at hook up against new water customers as a way to recover part or all of the cost of existing and additional facilities constructed for their use.

The general facilities charge or fee is typically deposited into a construction fund for construction of water infrastructure. The intent is that all new system customers will pay an equitable share of the cost of the system improvements needed to accommodate growth. Typical types of construction financed by the general facilities charge are general improvements that benefit the entire system, such as wells, booster pump stations, distribution mains, and office and storage space.

UTILITY LOCAL IMPROVEMENT DISTRICTS

Another potential source of funds for improvements comes through the formation of utility local improvement districts (ULIDs) involving a special assessment made against properties benefiting by the improvements. ULID bonds are further backed by a legal claim to the revenues generated by the utility, similar to revenue bonds.

Water system expansion is a frequent application of ULID financing. Typically, ULIDs are formed at the written request (by petition) of the property owners within a specific section of the service area. Upon the receipt of a sufficient number of signatures or petitions, and acceptance by the City council, the local improvement area is formed, and a water system is designed for that particular area in accordance with the City's construction standards.

Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the water system improvements. A City-wide ULID could form part of a financing package for large-scale capital projects such as water line extensions or replacements that benefit all residents in the service area. The ULID assessment places a lien on the property that must be paid in full upon sale of the property. ULID participants have the option of paying their assessment immediately upon receipt, thereby reducing the portion of the costs financed by the ULID bonds.

CHAPTER 10

LIST OF APPENDICES

CHAPTER 10

LIST OF APPENDICES

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B	WELL LOGS
C	LEAK DETECTION REPORT
D	FIRE MARSHALL LETTER AND FIRE FLOW REQUIREMENTS
E	WATER QUALITY MONITORING REPORT
F	COLIFORM MONITORING PLAN
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I	WATER QUALITY MONITORING REPORT
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APPENDIX A

PERMIT AND WATER FACILITIES INVENTORY REPORT

Washington State Department of Health

Division of Environmental Health
Office of Drinking Water

Individual System View - MABTON, CITY OF - Water System Id - 49650

Compliance Actions | Operating Permits | Operators | Reports | Water Use Efficiency

General Information | Source Information | Samples | Exceedances

Last Permit Color Issued: Green Last Permit Issued Date: 6/1/2012

Last Permit Issued Definition: Green: Systems in this category are considered adequate for existing uses and adding new service connections up to the number of approved service connections.

Current Color: Green Current Color is what the calculated permit color would be based on information as of 1/17/2013

Current Color Definition: Green: Systems in this category are considered adequate for existing uses and adding new service connections up to the number of approved service connections.

Override Comments:

Current Permit Conditions:

Links to external resources are provided as a public service and do not imply endorsement by the Washington State Department of Health

Department of Health, Office of Drinking Water

Street Address:
243 Israel Road S.E. 2nd floor
Tumwater, WA 98501

Mail:
PO BOX 47822
Olympia, WA 98504-7822

Phone: (360) 236-3100

Send inquiries about DOH and its programs to the Health Consumer Assistance Office
Comments or questions regarding this Web site? Send email to Environmental Health Application Testing and Support or call 360-236-3113.

Washington State Department of Health

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
Updated: 10/15/2012
Printed: 9/5/2013
WFI Printed For: On-Demand
Submission Reason: Pop/Connect

RETURN TO: Eastern Regional Office, 16201 E Indiana, Suite 1500, Spokane Valley, WA, 99216

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
49650 R	MABTON, CITY OF	YAKIMA	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS	7. OWNER NAME & MAILING ADDRESS	8. Owner Number 003522
CHRISTOPHER E. MORRIS CITY OF MABTON PO BOX 655 MABTON, WA 98935	MABTON, CITY OF ANGEL REYNA PO BOX 655 MABTON, WA 98935	TITLE: MAYOR
STREET ADDRESS IF DIFFERENT FROM ABOVE ATTN ADDRESS CITY STATE ZIP	STREET ADDRESS IF DIFFERENT FROM ATTN ADDRESS 305 MAIN ST CITY MABTON STATE WA ZIP 98935	

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone:	(509) 894-4568	Owner Daytime Phone:	(509) 894-4096
Primary Contact Mobile/Cell Phone:	(509) 439-4077	Owner Mobile/Cell Phone:	(509) 439-4012
Primary Contact Evening Phone:	(xxx) xxx-xxxx	Owner Evening Phone:	(xxx) xxx-xxxx
Fax:	E-mail: XXXXXX	Owner Fax Phone:	E-mail: XXXXXX

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [x] Not applicable (Skip to #12)
- [ ] Owned and Managed — SMA NAME: _____ SMA Number:
- [ ] Managed Only
- [ ] Owned Only

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

- [ ] Agricultural
- [x] Commercial / Business
- [x] Day Care
- [x] Food Service/Food Permit
- [ ] 1,000 or more person event for 2 or more days per year
- [ ] Hospital/Clinic
- [ ] Industrial
- [ ] Licensed Residential Facility
- [ ] Lodging
- [ ] Recreational / RV Park
- [x] Residential
- [x] School
- [ ] Temporary Farm Worker
- [x] Other (church, fire station, etc.): _____

13. WATER SYSTEM OWNERSHIP (mark only one)

- [ ] Association
- [x] City / Town
- [ ] County
- [ ] Federal
- [ ] Investor
- [ ] Private
- [ ] Special District
- [ ] State

14. STORAGE CAPACITY (gallons)

800,000

15	16	17	18									19			20	21					22	23	24			
	SOURCE NAME	INTERTIE	SOURCE CATEGORY									USE				TREATMENT					DEPTH		SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL	SPRING	SPRING FIELD	SPRING IN	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	Well #4 - ABR606				X								X					X				X	740	450	SE NW	01	08N	22E
S02	Well #2 - AFL768		X												X			X					1180	200	SE NW	01	08N	22E
S03	Well #3 - AFL767		X											X		Y		X				X	1004	250	SE NW	01	08N	22E
S04	Well #5 - ALF995				X								X			Y		X					425	500	SE NE	01	08N	22E
S05	Wellfield / S01, S04			X									X			Y		X				X	420	950			00N	00E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
49650 R	MABTON, CITY OF	YAKIMA	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	590	632
A. Full Time Single Family Residences (Occupied 180 days or more per year)	501		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	28		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	89		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	42	42	39
28. TOTAL SERVICE CONNECTIONS		632	671

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per 2290

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
B. How many days per month is water accessible to the public?												

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?												
B. How many days per month are they present?												

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	2	2	2	2	2	2	2	2	2	2	2	2

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other _____

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: _____

DATE: _____

PRINT NAME: _____

TITLE: _____

WS ID	WS Name
49650	MABTON, CITY OF

Total WFI Printed: 1

APPENDIX B

WELL LOGS

WELL NO. 1 WELL LOG

The Dep. The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. _____

Water Right Permit No. _____

(1) **OWNER:** Name City of Mabton Address P.O. Box 655, Mabton, WA 98935

(2) **LOCATION OF WELL:** County Yakima S½ ¼ NE ¼ Sec. 1 T. 8 N., R. 22 W.M.

(2a) **STREET ADDDRESS OF WELL** (or nearest address) In middle of City Park at Main and Fern Streets GH

(3) **PROPOSED USE:** ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☐ ☐ DeWater

(4) **TYPE OF WORK:** Owner's number of well (if more than one) _____

Abandoned ☐ New well ☐ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☐ Jetted ☐

(5) **DIMENSIONS:** Diameter of well _____ inches.

Drilled _____ feet. Depth of completed well _____ ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: _____ " Diam. from _____ ft. to _____ ft.

Welded ☐ Liner installed ☐ Threaded ☐ _____ " Diam. from _____ ft. to _____ ft.

_____ " Diam. from _____ ft. to _____ ft.

Perforations: Yes ☐ No ☐

Type of perforator used _____

SIZE of perforations _____ in. by _____ in.

_____ perforations from _____ ft. to _____ ft.

_____ perforations from _____ ft. to _____ ft.

_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☐ No ☐

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes ☐ No ☐ Size of gravel _____

Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☐ No ☐ To what depth? _____ ft.

Material used in seal _____

Did any strata contain unusable water? Yes ☐ No ☐

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

(7) **PUMP:** Manufacturer's Name _____

Type: _____ H.P. _____

(8) **WATER LEVELS:** Land-surface elevation above mean sea level _____ ft.

Static level _____ ft. below top of well Date _____

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level

Was a pump test made? Yes ☐ No ☐ If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

" " " "

" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? Yes ☐ No ☐

(10) **WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
This is the Well #1 in Mabton drilled in about 1920 to a depth of 1,140 feet. It is reported to have been abandoned on or prior to 1956. It had been capped and not used since then but was never grout sealed until this time. The bore hole and casing was sealed with neat cement grout with a high pressure grout pump, 320 LF of 1¼" G.I. pipe and a pump rig. Job required 8 cubic yards of neat cement to seal it to the surface. Work supervised by: Pat Jungmann Retired Well Driller		

RECEIVED
FEB 6 1989
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work started 9/30/88, 19. Completed 10/1/88, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME Bob Spink
(PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 636A Jadwin Avenue, Richland, WA 99352

(Signed) Bob Spink City Engineer License No. _____
(WELL DRILLER)

Contractor's Registration No. _____ Date 2/2, 19 89

(USE ADDITIONAL SHEETS IF NECESSARY)

WELL NO. 2 WELL LOG NOT FOUND

WELL NO. 3 WELL LOG

Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

STATE OF WASHINGTON

Permit No G 3-00027

(1) OWNER: Name TOWN OF MABTON Address Town Hall, Mabton, Wa. 98935

(2) LOCATION OF WELL: County Yakima SW ¼ NE ¼ Sec 1 T 8 N., R 22E W.M.

Bearing and distance from section or subdivision corner 910'N & 530'E. from the center of Sec 1

PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 2
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 1,004 ft. Depth of completed well 1,004 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0 ft. to 130 ft.
Threaded ☐ 12" Diam. from 120 ft. to 307 ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used ?
SIZE of perforations ? in. by ? in.
295 perforations from 295 ft. to 305 ft.
96 perforations from 96 ft. to 115 ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 718 ft.
Static level 34 ft. below top of well Date 5/28/57
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom?
Yield: 400 gal./min. with 66 ft. drawdown after 24 hrs.
" 300 " 42 " "
" 450 " 74 " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 5/2
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 61 Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil	0	10
Sand and Gravel	10	15
Cemented Gravel	15	28
Gravel	28	73
Blue Clay	73	76
Sand and Gravel	76	127
Black Porous Bassalt	127	132
Black Bassalt	132	167
Black Bassalt with Clay	167	180
Green and Blue Clay	180	229
Blue Sand Rock	229	240
Blue Shale	240	289
Black Bassalt with Shale	289	297
Black Porous Bassalt	297	300
Black Bassalt with Shale	300	308
Black Bassalt	308	312
Red Bassalt	312	328
Brown Basalt	328	347
Black Basalt	347	363
Dull Gray Basalt	363	380
Gray Basalt	380	400
Black Basalt	400	407
Gray Basalt with Sand	407	418
Black Basalt	418	450
Gray Basalt with Sand	450	453
Gray Basalt	453	479
Black Basalt	479	487
Black Porous Basalt	487	513
Black Basalt	513	666
Red Basalt	666	690
Black Basalt	690	757
Gray Basalt with Sand	757	860
Black Basalt with Sand	860	885
Black Basalt	885	890
Black and Gray Basalt	890	1004
Sand	1004	

Work started September 19 56 Completed May 19 57

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Dilley Drilling Co.
(Person, firm, or corporation) (Type or print)

Address 605 Meadowbrook Road Yakima, Wash. 9890

[Signed] Victor E. Dilley
(Well Driller)

License No. 223 02 3587 Date Aug. 2, 1972

(USE ADDITIONAL SHEETS IF NECESSARY)

F. No. 7336—OS—(Rev. 4-71).

The Dep. The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WELL NO. 4 WELL LOG

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. B
Permit No. 64-29212P

(1) **OWNER:** Name City of Mabton Address P.O. Box 655 Mabton, WA. 98935

(2) **LOCATION OF WELL:** County Yakima NW ¼ NE ¼ Sec. 1 T. 8 N., R. 22 E.W.M.
Bearing and distance from section or subdivision corner

(3) **PROPOSED USE:** Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) **TYPE OF WORK:** Owner's number of well (if more than one) 4
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 15" 0-437 ft, 12" 437-594 and 9 7/8" from 594-740.6 inches.
Drilled 740.6 ft. Depth of completed well 740.6 ft.

(6) **CONSTRUCTION DETAILS:**

Casing installed: 16" Diam. from 0 ft. to 134 ft.
Threaded ☐ 12" Diam. from +18" ft. to 437.7 ft.
Welded ☒ 10" Diam. from 411 ft. to 594 ft.
8" 563 729

Perforations: Yes ☒ No ☐
Type of perforator used Factory
SIZE of perforations 5/32 in. by 3 in.
perforations from 563 ft. to 726 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite & Cement
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) **PUMP:** Manufacturer's Name
Type: H.P.

(8) **WATER LEVELS:** Land-surface elevation above mean sea level ft.
Static level 67 ft. below top of well Date 11-8-87
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Layne of Washington
Yield: gal./min. with ft. drawdown after hrs.
" " "
" see attached "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
	see attached				

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 66 Was a chemical analysis made? Yes ☒ No ☐
*SEE ATTACHED

RECEIVED
NOV 25 1987
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

(10) **WELL LOG:**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Br sand	0	20
Br sandy clay	20	48
Cemented gravel	48	50
Gravel	50	62
Br sand clay	62	67
Gravel	67	129
Basalt grey	129	179
Br broken basalt	179	191
Br clay & basalt	191	203
Green clay	203	217
Gray clay & blue	217	259
Green clay	259	271
Gray clay	271	286
Br basalt	286	297
Med. black basalt	297	304
Black basalt	304	319
Trace of red	319	320
Black basalt	320	369
Hard grey basalt	369	418
Black basalt	418	423
Grey basalt	423	438
Black broken	438	442
Grey basalt	442	444
Black basalt	444	446
Grey basalt	446	459
Black broken	459	462
Med grey basalt	462	486
Very black broken	486	503
Black broken	503	517
Grey basalt	517	593
Black broken pyrite	593	610
Black basalt	610	667
Black basalt	667	673
Cracks in rock, black	673	677
Hard basalt	677	689
Fractured basalt	689	710

Work started May 26, 19 87 Completed Nov. 6, 19 87

WELL DRILLER'S STATEMENT: (continued)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

ENTERED

NAME L & L Drilling, Inc.
(Person, firm, or corporation) (Type or print)
Address P.O. Box 167 Wilson Creek, WA. 98860

[Signed] Larry Webley
(Well Driller)

License No. 0518 Date Nov. 11, 19 87

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

Page 2

WATER WELL REPORT

STATE OF WASHINGTON

B

Application No. .....

Permit No. .....

(1) OWNER: Name City of Mabton Address .....

(2) LOCATION OF WELL: County ..... NW ¼ NE ¼ Sec. 1 T. 8 N., R. 22 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) .....
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well ..... inches.
Drilled ..... ft. Depth of completed well ..... ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ..... " Diam. from ..... ft. to ..... ft.
Threaded ☐ ..... " Diam. from ..... ft. to ..... ft.
Welded ☐ ..... " Diam. from ..... ft. to ..... ft.

Perforations: Yes ☐ No ☐
Type of perforator used .....
SIZE of perforations ..... in. by ..... in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

Screens: Yes ☐ No ☐
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... from ..... ft. to ..... ft.
Diam. ..... Slot size ..... from ..... ft. to ..... ft.

Gravel packed: Yes ☐ No ☐ Size of gravel: .....
Gravel placed from ..... ft. to ..... ft.

Surface seal: Yes ☐ No ☐ To what depth? ..... ft.
Material used in seal .....
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ..... Depth of strata .....
Method of sealing strata off .....

(7) PUMP: Manufacturer's Name .....
Type: ..... H.P. .....

(8) WATER LEVELS: Land-surface elevation above mean sea level ..... ft.
Static level ..... ft. below top of well Date .....
Artesian pressure ..... lbs. per square inch Date .....
Artesian water is controlled by ..... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom? .....
Yield: ..... gal./min. with ..... ft. drawdown after ..... hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test .....
Bailer test ..... gal./min. with ..... ft. drawdown after ..... hrs.
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
PAGE 2		
Green clay	710	734
Broken basalt	734	740.6

RECEIVED
NOV 25 1987
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

Work started ..... 19 ..... Completed ..... 19 .....

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME ..... (Person, firm, or corporation) (Type or print)

Address .....

[Signed] ..... (Well Driller)

License No. ..... Date ..... 19 .....

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

WELL NO. 5 WELL LOG

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

#5

Please print, sign and return to the Department of Ecology

Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

STATE OF WASHINGTON ECOLOGY

Construction/Decommission

☐ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W210571

Current Notice of Intent No. W210571

Unique Ecology Well ID Tag No. ALF 996

Water Right Permit No. G4-29212C

Property Owner Name City of Morton

Well Street Address Hwy 12 + 3rd St

City Morton County Lewis

Location SE 1/4-1/4 NE 1/4 Sec 1 Twn 13 R 2E (EWM or WWM) ☑ circle one

Lat/Long (s, t, r still REQUIRED) Lat Deg ____ Lat Min/Sec ____ Long Deg ____ Long Min/Sec ____

Tax Parcel No. ____

PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ____

TYPE OF WORK: Owner's number of well (if more than one) ____

☒ New well ☐ Reconditioned ☐ Deepened — Method: ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 12 inches, drilled 710 ft. Depth of completed well 710 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 16" Diam. from 0 ft. to 135 ft.; ☐ Liner installed 12" Diam. from 72 ft. to 425 ft.; ☐ Threaded ____" Diam. from ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ____

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ____

Manufacturer's Name ____

Type ____ Model No. ____

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand ____

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 135 ft.

Material used in seal: Cement Grout

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Not Known Depth of strata ____

Method of sealing strata off Cement grout at 425'

PUMP: Manufacturer's Name ____

Type: ____ H.P. ____

WATER LEVELS: Land-surface elevation above mean sea level ____ ft.

Static level 76' ft. below top of well Date 06-20-06

Artesian pressure ____ lbs. per square inch Date ____

Artesian water is controlled by ____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Layne NW

Yield: 500 gal./min. with 107 ft. drawdown after 1 hrs 10 Mins.

Yield: 690 gal./min. with 192 ft. drawdown after 1 hrs.

Yield: 860 gal./min. with 325 ft. drawdown after 1 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
1:15	401'	1:45	82'	2:00	91'
2:05	90'				

Date of test 06-21-06

Bailer test ____ gal./min with ____ ft. drawdown after ____ hrs.

Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs

Artesian flow ____ g.p.m. Date ____

Temperature of water 57° Was a chemical analysis made? ☒ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure; and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Silt Fine Sand & Gravel	0	17
Sand Stone sand gravel	17	50
Silt Clay Sand gravel	50	135
Gray Basalt Hard	135	165
Brown Clay	165	180
Blue Green Clay	180	200
Blue Green Clay Stone	200	220
Ash Cinder Stone & Rock		
Ash Blue Sand	220	250
Cement Grout		
Blue Green Clay Stone	250	280
Sand Stone Conglomerate		
Black to Gray Basalt	280	300
Gray Basalt	300	366
Black Basalt	366	416
Gray Basalt	416	470
Brown Green Clayston	470	480
Black Basalt	480	560
Gray Basalt	560	675
Black Brown Pumice	675	710
Basalt clay Stone		
12" casing ends @ 425'		
Basalt @ 425'		

RECEIVED DEPT OF ECOLOGY FEB 12 2008 CENTRAL REGION OFFICE

4-10-06

Start Date [redacted] Completed Date 7-12-06

WELL CONSTRUCTION CERTIFICATION: *I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.*

Driller/Engineer/Trainee Name (Print) Robert Wendell

Driller/Engineer/Trainee Signature [redacted]

Driller or trainee License No. 2880

Drilling Company Blue Star Enterprises Pacific West

Address 2019 Rattler Loop

City, State, Zip Richland WA. 99354

Contractor's Registration No. Bluesee 965 KE Date 8-28-06

IF TRAINEE:

Driller's Licensed No. 2880

Driller's Signature [redacted]

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

Mailed to Eric Spratt 8-30-06

APPENDIX C

LEAK DETECTION REPORT

COPY

LEAK DETECTION SURVEY REPORT

City of Mabton

Mabton, WA

December 2012

AMERICAN LEAK® DETECTION
THE ORIGINAL LEAK SPECIALISTS™

P.O. Box 155 Spokane, WA 99210
800-928-5325

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

DEC 14 2012

December 11, 2012

Chris Morris
City of Mabton
PO Box 655
Mabton, WA 98935

RE: Leak Detection Survey Summary

Dear Chris,

American Leak Detection provided a leak detection survey for the City of Mabton water system 12/06/2012 and 12/07/2012 of all steel and plastic lines. The survey was conducted by Jordan Marsh with American Leak Detection and Noe, Chris and Mike with the City of Mabton.

During this survey 108 areas were tested throughout the system as shown on the Field Notes. Thirteen areas were initially found to have possible leak noise. All probable leak noise detected was noted and during the final phase these areas were re-tested to determine if they were real leaks and where they were originating.

This process yielded a total of 2 leaks: 1 on a service line and 1 on a check valve. Details of each leak detection can be found in the Survey Field Notes portion of the report.

In summary, the system tested very good with only these issues stated above. Thanks for the opportunity to serve your community.

Sincerely,

Patti Godwin
American Leak Detection

PO Box 155 • Spokane Washington 99210
800.928.5325 • 509.536.5166 • Fax 509.536.5002
Idaho 208.765.8550 • Moses Lake 509.764.6640 • Tri Cities 509.585.7812
Wenatchee 509.662.7324 • Yakima 509.972.2122
www.americanleakdetection.com
Each Office is Independently Owned and Operated

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

SURVEY FIELD NOTES

CUSTOMER: City of Mabton **DATES:** 12/06/2012 – 12/07/2012
ALD TECH: Jordan Marsh **CUSTOMER'S REPRESENTATIVE:** Noe Trujillo

SET UP# 27	GV CS CHECK VALVE FH MTR WELL	NOISE LEVEL: LOW	LOCATION: Well #5
Check valve is leaking by.			

SET UP# 54	GV CS OTHER FH MTR WELL	NOISE LEVEL: MEDIUM	LOCATION: 222 North St
Checked all available valves and meters in area. Noise did not develop in any direction. Monitor area for changes.			

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

LOCATE: 1

SET UP: 107

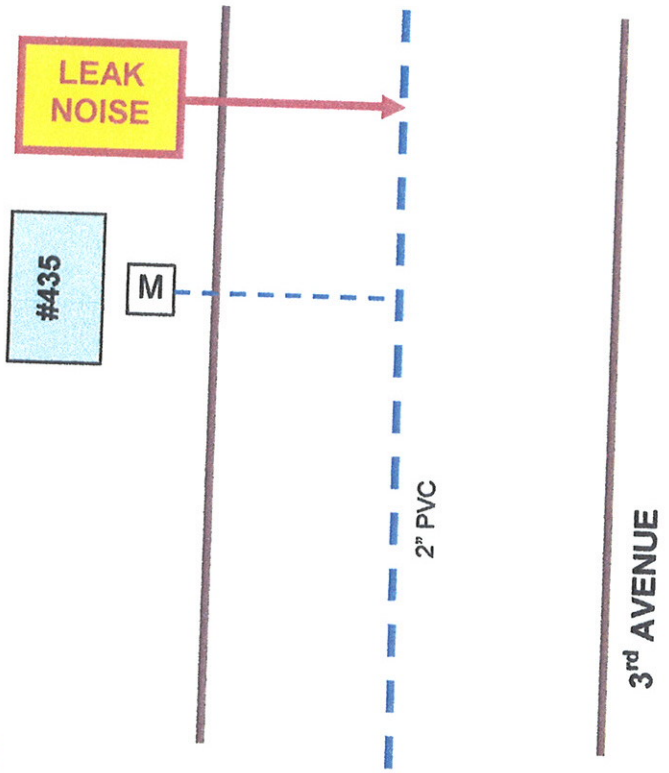
LOCATE DETAIL SHEET

CUSTOMER: City of Mabton **DATE:** 12/7/12

TECH: JMarsh **CUSTOMER'S REPRESENTATIVE:** NTrujillo

DETECTION OF LEAK: Correlator: ☐ Sonic: ☒

TYPE & SIZE OF MAIN: 2" PVC **SERVICE:** 435 3rd Ave



Ø : CURB STOP
FH : FIRE HYDRANT
⊗ : GATE VALVE
M : METER BOX
NOT TO SCALE

N

REMARKS: Leak noise best 11 feet north of #435 meter, approximately 11 feet east of fence. Marked with blue paint.

CUSTOMER INPUT:
DATE REPAIRED:_____ BY:_____ EST.LEAK SIZE:_____GPM

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

SURVEY TEST POINTS RECORD

SYSTEM: Mabton DATE: 12-6-12

NOTES	SET UP	CONTACT POINTS		
	# 1	(GV) FH MTR CS OTHER ____		Tank
	# 2	(GV) FH MTR CS OTHER ____		Main / Rose
	# 3	(GV) FH MTR CS OTHER ____		East of tank on Main
	# 4	GV (FH) MTR CS OTHER ____		Main / Rose
	# 5	(GV) FH MTR CS OTHER ____		Main / Cedar
	# 6	(GV) FH MTR CS OTHER ____		Main / Pine
	# 7	GV (FH) MTR CS OTHER ____		Main / Pine
	# 8	(GV) FH MTR CS OTHER ____		Alley B/T Pine + Maple on Main
	# 9	(GV) FH MTR CS OTHER ____		Main / Maple
	# 10	GV (FH) MTR CS OTHER ____		Maple / 3rd St
	# 11	GV (FH) MTR CS OTHER ____		Maple / 3rd St

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

SURVEY TEST POINTS RECORD

SYSTEM: Mabton DATE: 12-6-12

NOTES	SET UP	CONTACT POINTS		
See notes	# 27	GV FH CS MTR OTHER Check Valve	L	Well 5
	# 28	GV (FH) CS MTR OTHER ____		South / 6th st
	# 29	GV (FH) CS MTR OTHER ____		Fern / 6th st
Rech OK	# 30	(GV) FH CS MTR OTHER ____	L	Fern / 6th st
	# 31	GV FH CS (MTR) OTHER ____		617 E Fern
	# 32	GV (FH) CS MTR OTHER ____		Fern / 5th st
	# 33	(GV) FH CS MTR OTHER ____		Fern / Main
	# 34	(GV) FH CS MTR OTHER ____		Main / Rose
Rech ok	# 35	GV (FH) CS MTR OTHER ____	L	519 E Rose
Rose	# 36	(GV) FH CS MTR OTHER ____	L	Rose / 6th
	# 37	GV FH CS (MTR) OTHER ____		Northwest Horticulture

Find

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

SURVEY TEST POINTS RECORD

SYSTEM: Mabton DATE: 12-8-12

NOTES	SET UP	CONTACT POINTS		
	# 53	GV (FH) CS MTR OTHER ____		Ally b/t 3rd st / Main on South In ground under Round meter lid
See notes	# 54	GV ~~FH~~ CS (MTR) OTHER ____	M	222 North st
	# 55	GV ~~FH~~ CS MTR OTHER ____		Fire station
	# 56	GV ~~FH~~ CS MTR OTHER ____		Washington / 6th st
	# 57	(GV) FH CS MTR OTHER ____		Washington / 6th st
	# 58	GV (FH) CS MTR OTHER ____		C st / 6th st
	# 59	(GV) FH CS MTR OTHER ____		B st / 6th st
	# 60	GV ~~FH~~ CS MTR OTHER ____		B st / 6th st
	# 61	GV (FH) CS MTR OTHER ____		East side of MHS
	# 62	GV FH CS (MTR) OTHER ____		East side of MHS
	# 63	GV (FH) CS MTR OTHER ____		507 B st

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

SURVEY TEST POINTS RECORD

SYSTEM: Mahtas DATE: 12-6-12

NOTES	SET UP	CONTACT POINTS		
	# 79	GV FH (CS MTR) OTHER ____		109 Adams
	# 80	GV CS (FH) MTR OTHER ____		b/t 3rd ave & 2nd ave on Adams
	# 81	GV (FH) CS MTR OTHER ____		b/t 3rd & 4th on Adams
	# 82	GV CS (MTR) OTHER ____		304 ~~3rd~~ 5th ave
	# 83	GV CS (MTR) OTHER ____		601 Adams
	# 84	GV CS (MTR) OTHER ____		7th ave / Monroe
	# 85	GV (FH) CS MTR OTHER ____		6th ave / Monroe
Find	# 86	(GV) FH CS MTR OTHER ____		b/t 5th ave & ~~6th~~ ave on monroe
	# 87	(GV) FH CS MTR OTHER ____		b/t 4th ave & 5th ave on monroe
	# 88	GV (FH) CS MTR OTHER ____		4th ave / Monroe
Find	# 89	GV FH CS (MTR) OTHER ____		~~6th~~ 330 N 3rd ave

AMERICAN LEAK DETECTION
THE ORIGINAL LEAK SPECIALISTS™

SURVEY TEST POINTS RECORD

SYSTEM: Mabton DATE: 12-6-12

NOTES	SET UP	CONTACT POINTS		
	# 105	(GV) FH CS MTR OTHER _____		8th / 9th
	# 106	(GV) FH CS MTR OTHER _____		High school Rd / 9th
Locate 1	# 107	GV FH CS MTR OTHER _____	L	435 3rd Ave
	# 108	GV FH (MTR) OTHER _____		North end of 3rd Ave
	#	GV FH CS MTR OTHER _____		
	#	GV FH CS MTR OTHER _____		
	#	GV FH CS MTR OTHER _____		
	#	GV FH CS MTR OTHER _____		
	#	GV FH CS MTR OTHER _____		
	#	GV FH CS MTR OTHER _____		
	#	GV FH CS MTR OTHER _____		

APPENDIX D

FIRE MARSHALL LETTER AND FIRE FLOW REQUIREMENTS

Mabton Fire Department

315 North St. P.O. Box 655 Mabton, WA 98935 (509) 894-4096 Fax (509) 894-4813
Luke Cussins
Fire Chief
lcussins@bentonrea.com

November 21, 2012

Mayor Angel Reyna
City of Mabton
City Hall
PO Box 655
Mabton, WA 98935

Subject: City of Mabton Water System Plan Update

Dear Mayor Reyna:

The Fire Department understands the following:

- The Department of Health and The Washington Administrative Code (WAC 246-290-235 Finished Water Storage Facilities) allow standby and fire suppression water storage to be nested with the larger of the two volumes being the minimum available, provided the local fire protection authority does not require them to be additive.
- Nesting of standby storage and fire suppression storage is a choice taken by municipalities to avoid the need for additional reservoir capacity to be constructed.
- The City's current maximum fire flow requirement is 1,500 gpm for 2 hours for a total of 180,000 gallons.
- The City cannot immediately change facilities to stop nesting standby storage and fire suppression storage.

We believe that this decision is valid for the City's current water system plan 6-year planning period, but should be reevaluated during the development of the next water system plan.

The Fire Chief for the City of Mabton approves the nesting of standby and fire suppression storage for the City of Mabton.

If you have any questions or concerns, please contact our office.

Sincerely yours,

Luke Cussins

Volunteer Fire Chief
City of Mabton

cc: Jim Bricel, P.E., Project Manager, Gray & Osborne, Inc.

NOV 29 2012

APPENDIX B
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code.*

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings* having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m^2) shall be 1,000 gallons per minute (3785.4 L/min) for 1 hour. Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5m^2) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire-flow of 50 percent, as *approved*, is allowed when the building is equipped with an *approved automatic sprinkler system.*

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as *approved*, is allowed when the building is provided with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

SECTION B106
REFERENCED STANDARDS

ICC	IBC-09	International Building Code	B104.2, Table B105.1
ICC	IWUIC-09	International Wildland-Urban Interface Code	B103.3
NFPA	1142-07	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

TABLE B105.1*
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

APPENDIX C
FIRE HYDRANT LOCATIONS AND DISTRIBUTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION C101
GENERAL

C101.1 Scope. Fire hydrants shall be provided in accordance with this appendix for the protection of buildings, or portions of buildings, hereafter constructed.

SECTION C102
LOCATION

C102.1 Fire hydrant locations. Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets.

SECTION C103
NUMBER OF FIRE HYDRANTS

C103.1 Fire hydrants available. The minimum number of fire hydrants available to a building shall not be less than that listed in Table C105.1. The number of fire hydrants available to a complex or subdivision shall not be less than that determined by spacing requirements listed in Table C105.1 when applied to fire apparatus access roads and perimeter public streets from which fire operations could be conducted.

SECTION C104
CONSIDERATION OF EXISTING FIRE HYDRANTS

C104.1 Existing fire hydrants. Existing fire hydrants on public streets are allowed to be considered as available. Existing fire hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstruction of such roads.

SECTION C105
DISTRIBUTION OF FIRE HYDRANTS

C105.1 Hydrant spacing. The average spacing between fire hydrants shall not exceed that listed in Table C105.1.

Exception: The fire chief is authorized to accept a deficiency of up to 10 percent where existing fire hydrants provide all or a portion of the required fire hydrant service.

Regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in Table C105.1.

TABLE C105.1
NUMBER AND DISTRIBUTION OF FIRE HYDRANTS

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a, b, c] (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more[e]	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Reduce by 100 feet for dead-end streets or roads.

b. Where streets are provided with median dividers which cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

d. Reduce by 50 feet for dead-end streets or roads.

e. One hydrant for each 1,000 gallons per minute or fraction thereof.

APPENDIX E

WATER QUALITY MONITORING REPORT

Water Quality Monitoring Report for the Year 2011

System: MABTON, CITY OF **PWSID:** 49650 R **Report Date:** 03/02/2011
Contact: ANGEL REYNA **Group:** A - Comm **County:** YAKIMA **Region:** EASTERN

Part 1: List of Active Sources with Water Quality Monitoring Requirements

DOH Source#	Name	Type	Use	Susceptibility Rating
S05	Wellfield / S01, S04	Well Field	Permanent	Low

Part 2: Sampling Schedule for the Year 2011

Coliform Sampling (Routine)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	4	4	4	4	4	3	3	3	3	3	3	3

* Indicates the requirement is an exception from WAC 246-290.

- If the coliform (bacteriological) sampling schedule listed at the bottom of the current Water Facilities Inventory (WFI) form for your system is different from the schedule listed above, follow the schedule on the current WFI.
- Samples must be collected from representative points throughout the distribution system.
- Repeat samples are required following an unsatisfactory sample. In addition, collect a sample from each operating groundwater source.
- A minimum of 5 routine samples are required the month following one or more unsatisfactory samples in accordance with your system's Coliform Monitoring Plan.

Lead and Copper Distribution Sampling

- Lead and copper samples must be collected from indoor faucets within the distribution system after the water has sat unused in the pipes for at least 6 hours but no more than 12 hours.
- Sample faucets should be flushed with cold water the evening prior to collecting the sample.
- Part 2 indicates the month in which samples should be collected. Part 4 indicates the total number of sample required.
- If you are required to sample annually or once every 3 years, samples must be collected between June and September.

Chlorine Residual Sampling

- Systems that use continuous chlorination must take chlorine residual measurements daily (or at a reduced frequency approved by the department), and at the same time and location as routine and repeat coliform samples.

Disinfection Byproducts Sampling

- Systems that use continuous chlorination treatment must collect samples for total trihalomethanes (TTHM) and for haloacetic acids (HAA5) for each chlorination treatment facility identified in your individual disinfection byproducts (DBP) monitoring plan. Collect the samples from the distribution system at the frequency and locations identified in your DBP monitoring plan.

Chemical Sampling Requirements

- Source water chemical samples must be taken from a location as near to the source as possible, but after all treatment, and before entering the distribution system.
- Nitrate, nitrite and arsenic are included as part of a complete IOC.

Month	Source	Monitoring Requirement	Test Panel
January		*No source chemical sampling required this month*	

Washington State Department of Health
Division of Environmental Health, Office of Drinking Water

Water Quality Monitoring Report for the Year 2011

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Lead/Copper *	LCR	Distribution	LCR 1 Set of 20 samples between Jan 2010 - Dec 2012
Nitrate *	NIT	S05	Collect 1 sample(s) every 1 year
General Pesticides	Pest1	S05	1 sample between Jan 2011 - Dec 2013
Diquat	Diquat	All sources	State Waiver Thru Dec 2013
Radium 228	RAD 228	S05	2 sample(s) between Jan 2011 – Dec 2013
Total Trihalomethane	THM	Distribution	1 sample per treatment plant every 3 years
Volatile Organic Contaminants	VOC	S05	1 sample between Jan 2011 - Dec 2013

** These contaminant monitoring groups do not have waiver options under the SDWA.*

Water Quality Last Collect Date

Create Date: 2/24/2012

Analyte Group	WS ID	Water System Name	Test Panel	Source	Collect Date	Lab/Sample Number	Number Analytes	Number Measured	Number Triggers	# Secondary MCLs	# Primary MCLs	# THM Detections
DBP	49650 R	MABTON, CITY OF	HAA5	Distr.	09/27/2010	089 80086	8	7				
DBP	49650 R	MABTON, CITY OF	THM	Distr.	09/27/2010	089 70006	6	5	4			5
IOC	49650 R	MABTON, CITY OF	ICHEM	Distr.	08/28/1990	051 12679	18	18				
						051 12683	18	18	1	1		
						051 12684	20	20	3		1	
IOC	49650 R	MABTON, CITY OF	ICHEM	S01	09/29/1993	109 93015	1	1				
IOC	49650 R	MABTON, CITY OF	ICHEM	S02	08/28/1990	051 12683	18	18	1	1		
IOC	49650 R	MABTON, CITY OF	ICHEM	S03	08/28/1990	051 12684	20	20	3		1	
IOC	49650 R	MABTON, CITY OF	IOC	S01	06/25/2009	105 11192	43	31				
IOC	49650 R	MABTON, CITY OF	IOC	S02	09/14/1998	014 22297	43	4				
						081 57143	43	25	1	1		
IOC	49650 R	MABTON, CITY OF	IOC	S03	12/30/2002	149 00661	43	29				
IOC	49650 R	MABTON, CITY OF	IOC	S04	06/25/2009	105 11193	43	31				
IOC	49650 R	MABTON, CITY OF	LCR	Distr.	07/29/2009	105 13942	2	2				
						105 13943	2	2				
						105 13944	2	2				
						105 13945	2	2				
						105 13946	2	2				
						105 13947	2	2				
						105 13948	2	2				
						105 13949	2	2				
						105 13950	2	2				
						105 13951	2	2				
						105 13952	2	2				
						105 13953	2	2				
						105 13954	2	2				
						105 13955	2	2				
						105 13956	2	2				
						105 13957	2	2				
						105 13958	2	2				
						105 13959	2	2				
						105 13960	2	2				
						105 13961	2	2				
IOC	49650 R	MABTON, CITY OF	NIT	S01	09/14/2010	151 18449	3	3				
IOC	49650 R	MABTON, CITY OF	NIT	S02	07/09/2007	151 11449	3	3	1			
IOC	49650 R	MABTON, CITY OF	NIT	S03	09/06/2011	151 17718	3	3				
IOC	49650 R	MABTON, CITY OF	NIT	S04	09/14/2010	151 18450	3	3				
IOC	49650 R	MABTON, CITY OF	NIT	S05	11/07/2011	151 23886	3	3				
MICRO	49650 R	MABTON, CITY OF	COLI_AP	Distr.	01/24/2012	151 01283	3	1				
						151 01284	3	1				
RAD	49650 R	MABTON, CITY OF	RAD	Distr.	02/20/1990	101 03094	1	1				
RAD	49650 R	MABTON, CITY OF	RAD	S01	04/25/2007	028 34396	13	2				
RAD	49650 R	MABTON, CITY OF	RAD	S02	09/14/1998	101 06036	10	3				

LCR Sample Detail

Water System Information

Water System Name	MABTON, CITY OF	**Analyte Group**	IOC -- INORGANIC CONTAMINANTS
Water System ID	49650	**Test Panel**	LCR -- LEAD COPPER
WS Group-Type	Group A-Community	**County**	YAKIMA
Status	Active	**Region**	Eastern
Source Number		**Total Pop**	3335

Coll Date	Lab Sam	Purp	Location	Rslt Rng	Lead	Rslt Rng	Copper
07/29/2009	105-13942	RC	104 n 6th st	LT	.0005	LT	.0200
07/29/2009	105-13943	RC	430 5th st	LT	.0005	LT	.0200
07/29/2009	105-13944	RC	517 6th	LT	.0005	LT	.0200
07/29/2009	105-13945	RC	318 rose st	EQ	.0006	EQ	.0482
07/29/2009	105-13946	RC	302 rose st	LT	.0005	LT	.0200
07/29/2009	105-13947	RC	533 b st	EQ	.0011	LT	.0200
07/29/2009	105-13948	RC	419 b st	LT	.0005	EQ	.0238
07/29/2009	105-13949	RC	524 fern st	LT	.0005	LT	.0200
07/29/2009	105-13950	RC	605 fern st	EQ	.0010	EQ	.0205
07/29/2009	105-13951	RC	503 b st	LT	.0005	EQ	.0382
07/29/2009	105-13952	RC	322 6th ave	LT	.0005	EQ	.0288
07/29/2009	105-13953	RC	103 first ave	EQ	.0011	LT	.0200
07/29/2009	105-13954	RC	307 pine	EQ	.0006	EQ	.0365
07/29/2009	105-13955	RC	116 5th ave	LT	.0005	LT	.0200
07/29/2009	105-13956	RC	211 5th ave	EQ	.0099	EQ	.0835
07/29/2009	105-13957	RC	211 2nd ave	EQ	.0008	EQ	0388
07/29/2009	105-13958	RC	205 6th ave	LT	.0005	EQ	.0445
07/29/2009	105-13959	RC	kt	EQ	.0009	LT	.0200
07/29/2009	105-13960	RC	232 6th ave	LT	.0005	EQ	.0990
07/29/2009	105-13961	RC	130 4th ave	LT	.0005	EQ	.0252

Coll Date	Lab Sam	Purp	Location	Rslt Rng	Lead	Rslt Rng	Copper
07/25/2006	105-12877	RC	507 B. ST.	EQ	.0016	EQ	.0342
07/25/2006	105-12878	RC	302 Rose St	EQ	.0005	EQ	.0478
07/25/2006	105-12879	RC	803 Main St.	EQ	.0015	EQ	.0330
07/25/2006	105-12880	RC	205 6th Ave	EQ	.0009	EQ	.0698
07/25/2006	105-12881	RC	211 5th Ave	EQ	.0108	LT	.0200
07/25/2006	105-12882	RC	218 Rose St.	EQ	.0007	EQ	.0435
07/25/2006	105-12883	RC	605 Fern St.	EQ	.0006	LT	.0200
07/25/2006	105-12884	RC	714 Main St.	EQ	.0007	EQ	.0318
07/25/2006	105-12885	RC	308 5th Ave	EQ	.0041	LT	.0200
07/25/2006	105-12886	RC	232 6th Ave	EQ	.0008	EQ	.1480
07/25/2006	105-12887	RC	302 Pine St.	LT	.0005	EQ	.0225
07/25/2006	105-12888	RC	324 Pine St.	EQ	.0006	EQ	.0322
07/25/2006	105-12889	RC	322 6th Ave.	EQ	.0008	EQ	.0250
07/25/2006	105-12890	RC	322 6th Ave.	EQ	.0006	EQ	.0210
07/25/2006	105-12890	RC	322 6th Ave.	EQ	.0006	EQ	.0210
07/25/2006	105-12891	RC	524 Fern St.	EQ	.0025	EQ	.0390
07/25/2006	105-12892	RC	517 C. St.	EQ	.0007	EQ	.0388
07/25/2006	105-12893	RC	430 5th St.	LT	.0005	EQ	.0210
07/25/2006	105-12894	RC	116 5th Ave	EQ	.0006	LT	.0200
07/25/2006	105-12895	RC	130 4th St.	EQ	.0011	EQ	.0260

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
EASTERN DRINKING WATER REGIONAL OPERATIONS
16201 East Indiana Avenue, Suite 1500, Spokane Valley, Washington 99216-2830
TDD Relay 1-800-833-6388

November 3, 2010

Angel Reyna, Mayor
City of Mabton
PO Box 655
Mabton, Washington 98935

Subject: Mabton, City of; PWS ID #49650R; Yakima County
Wellfield Designation – S05 Wellfield (WWF S01, S04)

Dear Mr. Reyna:

Thank you for your time and the submittal of the required documentation. I reviewed the final documents for the project, and the wellfield designation **IS APPROVED**.

S05 is the new source identification number. The designation combines the information for both S01 and S04. The depth to open interval for S04 (Well #5), will be changed to reflect the information provided in the project report submitted for source approval for S04. In addition, the Department of Health (DOH) will update the Water Facilities Inventory to show:

- S05 is the wellfield, located in Township 8 North, Range 22 East, Section 1, in Yakima County. The wellfield is a permanent source, with a depth to groundwater of 420 feet, and capacity of 950 gpm.

Source Monitoring

Bryony Stasney will provide an updated water quality monitoring report for the city. If our records are not up to date, please notify our office by letter with the correct information.

Sincerely,

Andres R. Cervantes, PE
Regional Engineer
Office of Drinking Water
Division of Environmental Health

cc: Yakima County Health District
Bryony Stasney, DOH
Department of Ecology

Major Activity Report	ıd # 49650 R
Date of Inspection: September 13, 2010	**Type:** A-COMM

X	**Source Improvement / Treatment** (SI/T)	**Special Purpose Investigation** (SPI)		
	Routine Sanitary Survey (RSS)	**Significant Accomplishment** (SA)		X
Water System Name:		City of Mabton		
Contact Person:		Frank Tejerina		
County:		Yakima		

Dear Frank Tejerina:

Thank you for meeting with me about the city's current monitoring requirements, and showing me around the city facilities. I attached a copy of the pictures taken during our visit. You will see where I identified a significant deficiency in the pump motor base for S04 (Well #5).

The deficiency is the hole in the pump motor base open to the atmosphere. In most cases or a typical use for this open hole or port, are a static water level tube and a screened air vent, or if left unused fitted with a plug. In this case, it appears to be a drain for the water used to flush or lube the line shaft bearings. The use of the port for a drain is not a water quality issue in this case, but you must seal the open hole around the black poly pipe or find the appropriate plug.

Typical issues include bacterial and other chemical contaminants with these ground level or lower level holes, from small rodents and flooding.

Background: The city has two permanent sources, booster station, reservoir, and chlorination station. The wells feed into a common manifold at the booster / chlorination station, disinfected, and feed the upper section of the reservoir (WSP). The booster station meets the system demand and pressure, through the three main booster pumps, and a larger fire pump is on standby if necessary.

1. S01 and S04 are line shaft vertical turbine pumps.
2. Booster pumps consist of three centrifugal pumps for city supply, and a fourth in the event the city is fighting a large fire.
3. Reservoir is a tall stand-pipe that works as an aeration towers, with splash plates installed at the upper section.

Section's Involvement: Met with the new operator to review the sampling history and become familiar with the water system.

Outcome / Accomplishment: Clarified, the DBP (Disinfection By-Product) sampling requirements based on the total number of active treatment plants for a water system and not sources.

- In the city's case, there is only one treatment plant which will treat all four sources.

In addition, I reviewed the wells to determine if they met the minimum requirements outlined in the wellfield policy.

- Based on the IOC review, plans on file, original comments and design for S04 (Well #5), and they are under control by the city, the wells were considered a wellfield identified as S05.

Name:	**Date of Report:**

Photo-1: S04

Discharge to system

Wellhead

→ Metered

→ Vertical motor

→ Turbine pump

Taste and odor from source apparent in stream from pipe (small black poly),

→ Tapped off of pump motor base at housing for shaft bearing or gasket

Required:

- See Photo-5

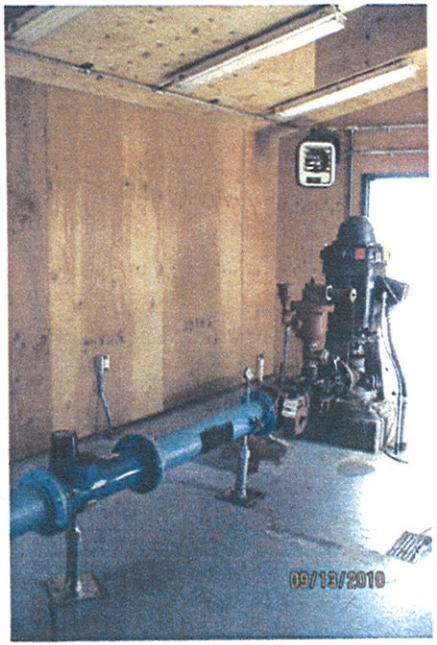


Photo-2: S04

Close-up Photo-1

Discharge to system

Wellhead

→ Air pressure relief valve

Vertical motor

→ US Motors



Photo-3: S04

Source Meter

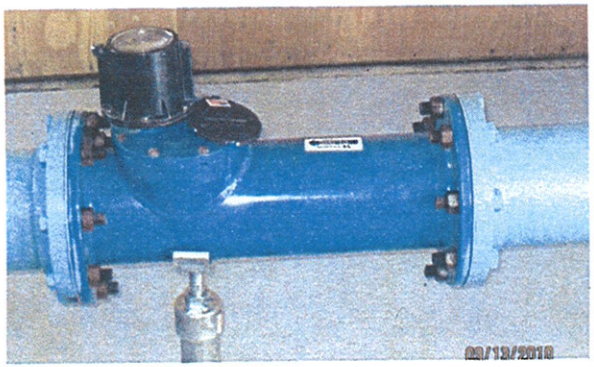


Photo-4: S04

Raw Water Sample tap

Pressure gage

Source control / Shut-off valve

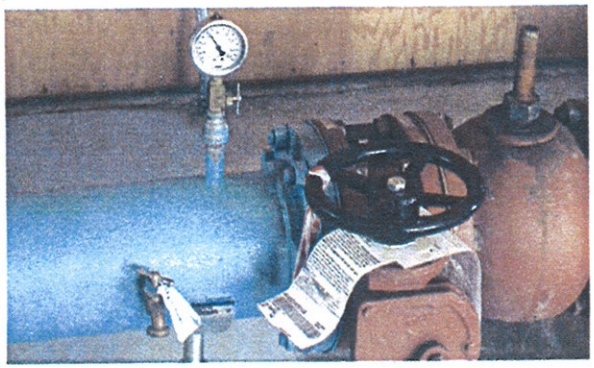


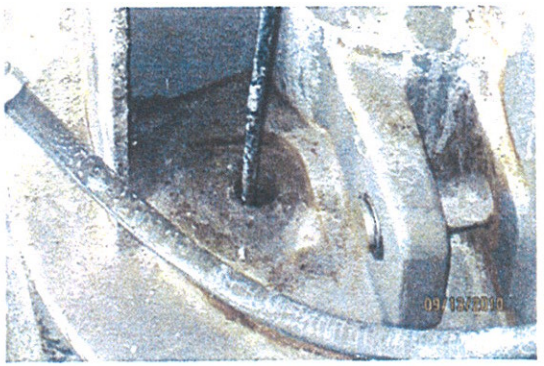
Photo-5: S04

Re-circulation line off of shaft packing \ seal

→ Through the pump motor base

→ No gasket observed

Required: Seal water tight in plug, and determine whether re-circulation line is necessary



APPENDIX F

COLIFORM MONITORING PLAN

Coliform Monitoring Plan for: City of Mabton

A. System Information

Water System Name City of Mabton	County Yakima	System I.D. Number 49650
Attach copy of current WFI	See Water System Plan	
Number of Routine Samples Required Monthly by Regulation: 2	Number of Sample Sites Needed to Represent the Distribution System: 4	

B. Routine and Repeat Sample Locations

Location/Address for <u>Routine</u> Sample Sites	Location/Address for <u>Repeat</u> Sample Sites
X1. 805 Washington St.	1-1. 805 Washington St.
	1-2. 617 Washington St.
	1-3. 1003 Monroe
	1-4. Well No. 4 - Raw Water Source
	1-5. Well No. 5 - Raw Water Source
X2. 408 B St.	2-1. 408 B St.
	2-2. 317 B St.
	2-3. 415 B St.
	2-4. Well No. 4 - Raw Water Source
	2-5. Well No. 5 - Raw Water Source
X3. 324 Pine	3-1. 324 Pine
	3-2. 307 Pine
	3-3. 202 Pine
	3-4. Well No. 4 - Raw Water Source
	3-5. Well No. 5 - Raw Water Source

Routine and Repeat Sample Locations (Cont.)

X4. 512 Fern	4-1. 512 Fern
	4-2. 509 Fern
	4-3. 528 Fern
	4-4. Well No. 4 - Raw Water Source
	4-5. Well No. 5 - Raw Water Source

C. Routine Sample Rotation Schedule

Month	Routine Site(s)	Month	Routine Site(s)
January	X2, X3	July	X2, X3
February	X1, X4	August	X1, X4
March	X2, X3	September	X2, X3
April	X1, X4	October	X1, X4
May	X2, X3	November	X2, X3
June	X1, X4	December	X1, X4

D. Month Following Unsatisfactory Samples

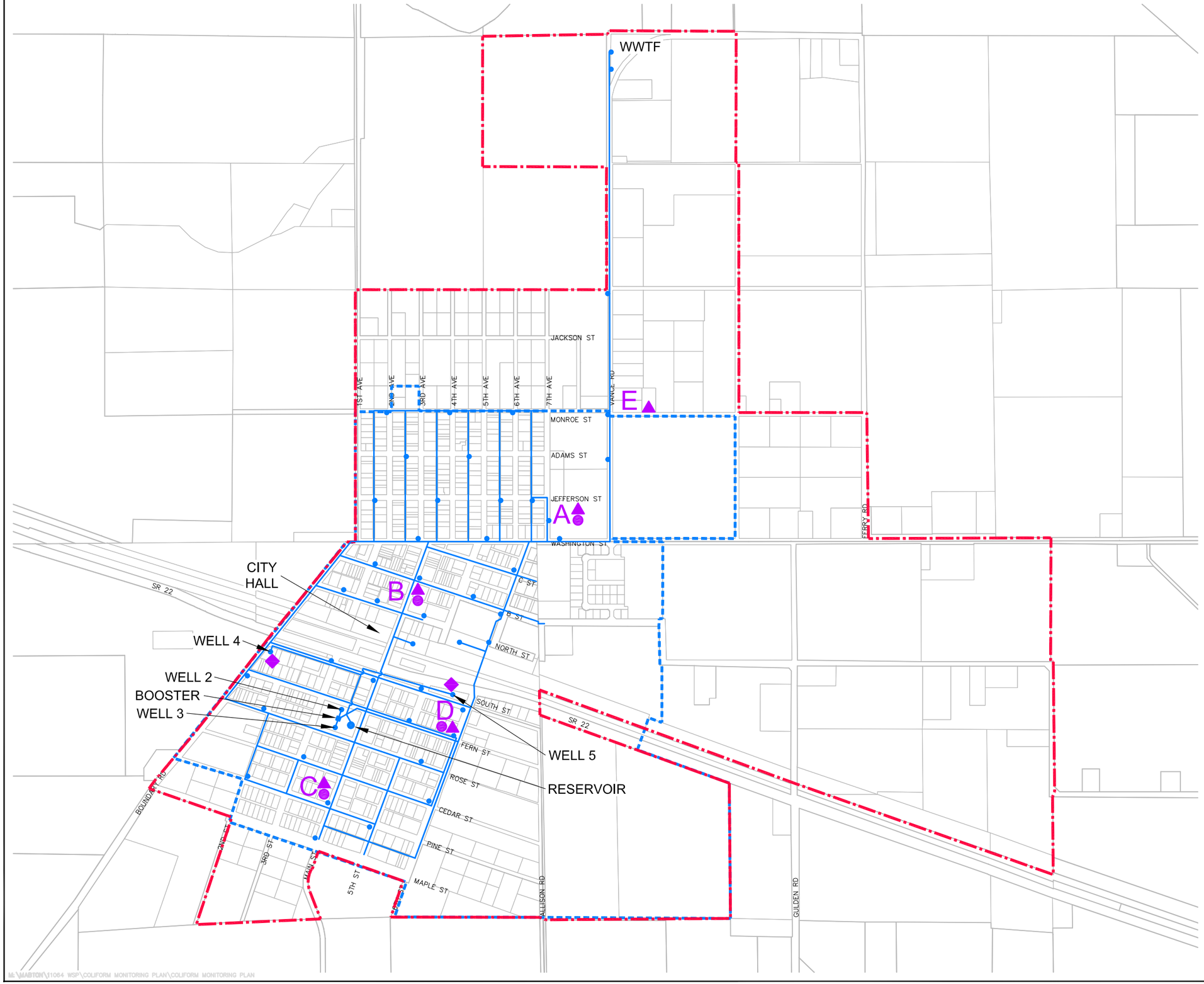
Location/Address for Routine Sample Site(s) Unsatisfactory the Previous Month	Location/Address for the five Routine Sample Sites
X1. 805 Washington St.	1. 805 Washington St. 2. 408 B St. 3. 324 Pine 4. 512 Fern 5. 1003 Monroe
X2. 408 B St.	1. 805 Washington St. 2. 408 B St. 3. 324 Pine 4. 512 Fern 5. 1003 Monroe
X3. 324 Pine	1. 805 Washington St. 2. 408 B St. 3. 324 Pine 4. 512 Fern 5. 1003 Monroe
X4. 512 Fern	1. 805 Washington St. 2. 408 B St. 3. 324 Pine 4. 512 Fern 5. 1003 Monroe

E. Preparation Information

System Name		Date Plan Completed	Dates Modified
City of Mabton		8-30-2013	
Name of Plan Preparer	**Position**		**Daytime Phone #**
Chris Morris	City of Mabton Public Works Lead		(509) 439-4077
State Reviewer		**Date Last Review**	

F. System Map

(See attached figure titled "Coliform Monitoring Plan".)



1"=1000'

CITY LIMITS

URBAN GROWTH AREA

WATER MAIN

COLIFORM MONITORING PLAN KEY

		ROUTINE SAMPLING SITE ●	REPEAT SAMPLING SITE ▲	GWR SAMPLING SITE ◆
A	805 WASHINGTON ST.	X1	X1-1	
			X2-1	
			X3-1	
B	408 B ST.	X2	X1-2	
			X2-2	
			X3-2	
C	324 PINE	X3	X1-3	
			X2-3	
			X3-3	
D	512 FERN	X4	X1-4	
			X2-4	
			X3-4	
E	1003 MONROE		X1-5	
			X2-5	
			X3-5	
F	WELL NO. 4			GWR1
G	WELL NO. 5			GWR2

CITY OF MABTON

WATER SYSTEM PLAN

COLIFORM MONITORING PLAN

Gray & Osborne, Inc.
CONSULTING ENGINEERS

APPENDIX G

WATER QUALITY EXCEEDANCES

Washington State Department of Health

Division of Environmental Health
Office of Drinking Water

Individual System View - MABTON, CITY OF - Water System Id - 49650

Compliance Actions | Operating Permits | Operators | Reports | Water Use Efficiency

General Information | Source Information | Samples | Exceedances

Type	Source	DOE Source	Collect Date	Analyte	Result Quantity	Units	Test Panel	Analyte Group	Sample Number	Lab Number
MCL1	03	37G202	7/18/2012	NITRATE-N	21.6	mg/L	NIT	IOC	14379	151
P	Distribution		7/12/2012	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	13853	151
MCL1	03	37G202	7/11/2011	NITRATE-N	24.6	mg/L	NIT	IOC	12535	151
P	Distribution		9/22/2008	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	18182	151
MCL1	03	37G202	4/9/2007	NITRATE-N	14.9	mg/L	NIT	IOC	05390	151
P	Distribution		3/28/2007	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	04720	151
P	Distribution		3/26/2007	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	04582	151
P	Distribution		3/26/2007	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	04583	151
MCL1	03	37G202	1/16/2007	NITRATE-N	10.2	mg/L	NIT	IOC	00864	105
MCL1	01	37G079	1/16/2007	NITRATE-N	10.2	mg/L	NIT	IOC	00864	105
MCL1	03	37G202	12/19/2006	NITRATE-N	16.4	mg/L	NIT	IOC	02350	151
MCL1	03	37G202	12/12/2003	GROSS ALPHA (MINUS URANIUM)	23.5	pCi/L	RAD	RAD	25159	028
P	Distribution		7/28/2003	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	00251	105
P	Distribution		6/13/2001	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	39795	014
P	Distribution		6/11/2001	TOTAL COLIFORM	Present	/100ml	COLI_AP	MICRO	39715	014
MCL1	03	37G202	9/12/2000	NITRATE-N	17.0	mg/L	IOC	IOC	35191	014
MCL1	03	37G202	9/12/2000	TOTAL NITRATE/NITRITE	17.0	ug/L	IOC	IOC	35191	014
MCL2	02	37G080	9/14/1998	MANGANESE	0.100	mg/L	IOC	IOC	57143	081
MCL2	02	37G080	9/13/1994	MANGANESE	0.100	mg/L	IOC	IOC	22974	081
MCL1	03	37G202	8/28/1990	NITRATE-N	12.4	mg/L	ICHEM	IOC	12684	051
MCL2	02	37G080	8/28/1990	MANGANESE	0.115	mg/L	ICHEM	IOC	12683	051
MCL2	03	37G202	12/17/1984	IRON	1.25	mg/L	ICHEM	IOC	07786	051
MCL1	03	37G202	12/17/1984	NITRATE-N	12.3	mg/L	ICHEM	IOC	07786	051
MCL1	Distribution		10/2/1984	NITRATE-N	12.5	mg/L	ICHEM	IOC	10838	052
MCL1	Distribution		10/2/1984	NITRATE-N	11.3	mg/L	ICHEM	IOC	10849	052

Records 1 - 25 of 36

Export CSV

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Links to external resources are provided as a public service and do not imply endorsement by the Washington State Department of Health

Department of Health, Office of Drinking Water

Street Address:
243 Israel Road S.E. 2nd floor
Tumwater, WA 98501

Mail:
PO BOX 47822
Olympia, WA 98504-7822

Phone: (360) 236-3100

Send inquiries about DOH and its programs to the Health Consumer Assistance Office
Comments or questions regarding this Web site? Send email to Environmental Health Application Testing and Support or call 360-236-3113.

APPENDIX H

WELLHEAD PROTECTION PROGRAM AND UPDATE

CITY OF MABTON

WELLHEAD PROTECTION PROGRAM

(FROM THE 2005 WATER SYSTEM PLAN)

AND

WELLHEAD PROTECTION PROGRAM UPDATE

CITY OF MABTON

P.O. BOX 655
305 MAIN STREET
PHONE: (509) 894-4096 MABTON, WASHINGTON 98935 FAX (509) 894-4813

April 14, 2005

Bill Roettger
PO Box 254
Mabton, WA 98935

RE: City of Mabton
Wellhead Protection Program

Dear Mr. Roettger:

In order to protect the drinking water supply for the customers of the City of Mabton, we are developing a wellhead protection program in accordance with State requirements. As part of our wellhead protection program, we mapped the area overlying the short term recharge zone of our drinking water supply wells. This is called our wellhead protection area.

Following the mapping of the wellhead protection area, we conducted an inventory of potential sources of ground water contamination within the area. The nature of your business, and its location within our wellhead protection area, means that your activities have the potential to affect our customers' drinking water supply.

WE realize you are already careful to protect the environment as you conduct your business. We hope that informing you of your location in our wellhead protection area will result in an increase in precautions to ensure that your activities will not impact our drinking water quality.

Sincerely,

Ildia L. Jackson
City/Public Safety Administrator

CITY OF MABTON

P.O. BOX 655
305 MAIN STREET
MABTON, WASHINGTON 98935

PHONE: (509) 894-4096 FAX (509) 894-4813

May 10, 2005

Jim Hall, Director
Yakima Valley Office of Emergency
Management
128 North 2nd Street
Yakima, WA 98901

RE: City of Mabton, Wellhead Protection Program

Dear Jim,

AS part of the wellhead protection program for the city of Mabton we are hereby informing you of the findings of our wellhead protection are delineation. This is in accordance with State regulations (WA 246-290-135).

Our district has 503 service connections, and serves a population of approximately 1,900 people. Our drinking water supply may be vulnerable to contamination.

The enclosed map shows the 10 year time of travel boundaries for our wellhead protection area with a potential to reach our wells. It is therefore of utmost importance to us that all reasonable steps be taken to ensure that land use activities within this area do not contaminate our customers' drinking water supplies.

Thank you for your support in protecting our drinking water.

Sincerely,

Ildia L. Jackson
City/Public Safety Administrator

ENC

AWMN

Ground Water Contamination Susceptibility Assessment Survey Form

Version 2.1

RECEIVED
JUN 08 1994
Department of Health
Division of Drinking Water

IMPORTANT! Please complete one form for each ground water source (well, wellfield, spring) used in your water system. Photocopy as necessary.

PART I: System Information

Well owner/manager : City of Mabton/ Wayne J Beeman

Water system name : City of Mabton

County: Yakima

Water system number: 49650R Source number: .S01

Well depth: [redacted] 750 (ft.) (*From WFI form*)

Source name: Well #4

WA well identification tag number: ___ ___ ___ - ___ ___ ___

X well not tagged

Number of connections: 450-Res/43-Non-RES Population served: 1,462

Township: 08N Range: 22E

Section: 01 1/4 1/4 Section: SE/NW

Latitude/longitude (if available): 46° 12' 30'' / 119° 57' 30''

How was lat./long. determined?

___ global positioning device ___ survey ___ topographic map
X other: Spink Engineering

* Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

PART II: Well Construction and Source Information

1) Date well originally constructed: 11 /06 /[redacted]87 month/day/year

last reconstruction: ___ / ___ /___ month/day/year

___ information unavailable

2) Well driller: L & L Drilling INC

P O.Box 167

Wilson Creek WA 98860

___ well driller unknown

3) Type of well:

[redacted]led: ___ rotary ___ bored ___ cable (percussion) ___ Dug

___ Other: ___ spring(s) ___ lateral collector (Ranney)

___ driven ___ jetted ___ other: _____

Additional comments: _____

4) Well report available? X YES (attach copy to form) ___ NO

If no well log is available, please attach any other records documenting well construction; e.g. boring logs, "as built" sheets, engineering reports, well reconstruction logs.

5) Average pumping rate: 1,000 (gallons/min)

Source of information: Well Test Date 8/13/88

If not documented, how was pumping rate determined? _____

___ Pumping rate unknown

6) Is this source treated? [redacted] (Because water treated prior to distribution to 1st customer)

If so, what type of treatment: Gas Chlorine

___ disinfection ___ filtration ___ carbon filter ___ air stripper ___ other

Purpose of treatment (describe materials to be removed or controlled by treatment):

7) If source is chlorinated, is a chlorine residual maintained: [redacted] YES ___ NO

Residual level: 1.4 mgl [redacted] (*At the point closest to the source.*)

PART III: Hydrogeologic Information

1) Depth to top of open interval: [check one]

___ < 20 ft ___ 20-50 ft ___ 50-100 ft ___ 100-200 ft [redacted] > 200 ft

___ information unavailable ('< ' *means less than;* '> ' *means greater than*)

2) Depth to ground water (static water level):

___ < 20 ft ___ 20-50 ft [redacted] 50-100 ft ___ > 100 ft

___ flowing well/spring (artesian)

How was water level determined?

[redacted] well log ___ other: _____

___ depth to ground water unknown

3) If source is a flowing well or spring, what is the confining pressure: N.A.

_____ psi (pounds per square inch)
or
_____ feet above wellhead

4) If source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source: ___ YES X__ NO

5) Wellhead elevation (height above mean sea level): 720 (ft)

How was elevation determined? ___ topographic map ___ Drilling/Well Log ___ altimeter

[redacted] other: Spink Engineering

___ information unavailable

6) Confining layers: (This can be completed only for those sources with a drilling log, well log or geologic report describing subsurface conditions. Please refer to assistance package for example.)

[redacted] evidence of a confining layer in well log

___ no evidence of a confining layer in well log

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the top of the open interval? [redacted] YES ___ NO

___ information unavailable

7) Sanitary setback:

___ < 100 ft* ___ 100-120 ft [redacted] 120-200 ft ___ > 200 ft

* if less than 100 ft describe the site conditions:

8) Wellhead construction:

[redacted] wellhead enclosed in a wellhouse

[redacted] controlled access (describe): Fenced & locked area wellhouse locked & secured

___ other uses for wellhouse (describe): Electrical Control seperated from well & pump motor

___ no wellhead control

9) Surface seal:

___ 18 ft

___ < 18 ft (no Department of Ecology approval) ('< ' *means less than*)

___ < 18 ft (Approved by Ecology, include documentation) ('< ' *means less than*)

[redacted] 18 ft ('> ' *means greater than*)

___ depth of seal unknown

___ no surface seal

10) Annual rainfall (inches per year):

___ < 10 in/yr [redacted] 25 in/yr ___ > 25 in/yr

PART IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped [redacted] (gallons)

How was this determined?

[redacted] meter

___ estimated: ___ pumping rate (_____)

___ pump capacity (_____)

___ other: _____

2) "Calculated Fixed Radius" estimate of ground water movement:
(see Instruction Packet)

6 month ground water travel time : [redacted] 360 (ft)

1 year ground water travel time : [redacted] 510 (ft)

5 year ground water travel time: [redacted] 1140 (ft)

10 year ground water travel time: 1,610 (ft)

Information available on length of screened/open interval?

[redacted] YES ___ NO

Length of screened/open interval: [redacted] 163 (ft)

3) Is there a river, lake, pond, stream, or other obvious surface water body within the 6 month time of travel boundary? ___ YES [redacted] NO (mark and identify on map).

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the 6 month time of travel boundary? ___ YES [redacted] NO (mark and identify on map).

Comments: _____

_____

_____

_____

_____

PART V: Assessment of Water Quality

1) Regional sources of risk to ground water:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	6 month	1 year	5 year	unknown
likely pesticide application	[redacted]	[redacted]	X	
stormwater injection wells				X
other injection wells				X
abandoned ground water well			[redacted]	
landfills, dumps, disposal areas				X
known hazardous materials clean-up site				X
water system(s) with known quality problems			[redacted]	
population density > 1 house/acre	[redacted]	[redacted]	[redacted]	
residences commonly have septic tanks	[redacted]	[redacted]	[redacted]	
Wastewater treatment lagoons				X
sites used for land application of waste				X

Mark and identify on map any of the risks listed above which are located within the 6 month time of travel boundary? (*Please include a map of the wellhead and time of travel areas with this form. Please locate and mark any of the following.*)

If other recorded or potential sources of ground water contamination exist within the ten year time of travel circular zone around your water supply, please describe:

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions: (Unless listed on assessment, MCLs are listed in assistance package.)

A. Nitrate: (Nitrate MCL = 10 mg/l)	YES	NO
Results greater than MCL		X
< 2 mg/liter nitrate	[redacted]	
2–5 mg/liter nitrate		X
> 5 mg/liter nitrate		X
___ Nitrate sampling records unavailable		

B. VOCs: (VOC detection level 0.5 ug/l or 0.0005 mg/l.)	YES	NO
Results greater than MCL or SAL		X
VOCs detected at least once		X
VOCs never detected	X	
___ VOC sampling records unavailable		

C. EDB/DBCP:	YES	NO
(EDB MCL = 0.05 ug/l or 0.00005 mg/l. DBCP MCL = 0.2 ug/l or 0.0002 mg/l.)		
EDB/DBCP detected below MCL at least once		
EDB/DBCP detected above MCL at least once		
EDB/DBCP never detected	[redacted]	
___ EDB/DBCP tests required but not yet completed		
___ EDB/DBCP tests not required		

D. Other SOCs (Pesticides):	YES	NO
Other SOCs detected (pesticides and other synthetic organic chemicals)		
___ Other SOC tests performed but none detected (list test methods in comments		
[redacted]ther SOC tests not performed		

If any SOCs in addition to EDB/DBCP were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list test methods here: _____

_____

_____

_____

E. Bacterial contamination:

	YES	NO
Any bacterial detection(s) in the past 3 years in samples taken from the source (not distribution sampling records).	___	___
Has source (in past 3 years) had a bacteriological contamination problem found in distribution samples that was attributed to the source.	___	___

___ Source sampling records for bacteria unavailable

Part VI: Geographic or Hydrologic Factors Contributing to a Non-Circular Zone of Contribution

The following questions will help identify those ground water systems which may not be accurately represented by the calculated fixed radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for that source. As a system develops its Wellhead Protection Plan for theses sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrologic boundaries within the 10 year time of travel zone of the CFR? (Does the largest circle extend over a stream, river, lake, up a steep hillside, and/or over a mountain or ridge?)

___ YES ___ NO

Describe with references to map produced in Part IV:

_____

_____

2) Aquifer Material:

A) Does the drilling log, well log or other geologic/engineering reports identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

___ YES ___ NO

B) Does the drilling log, well log or other geologic/engineering reports indicate that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

___ YES ___ NO

3) Is the source located in an aquifer with a high horizontal flow rate? (These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

___ YES ___ NO

4) Are there other high capacity wells (agricultural, municipal and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gal/min within...

	YES	NO	unknown
< 6 month travel time	___	X	___
6 month–1 year travel time	___	X	___
1–5 year travel time	___	___	___
5–10 year travel time	___	X	___

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within...

	YES	NO	unknown
< 1 year travel time		___	___
1–5 year travel time		___	___
5–10 year travel time	X	___	___

Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the zone of contribution for this source. Where possible, reference them to locations on the map produced in Part IV.

Suggestions and Comments

Did you attend one of the susceptibility workshops? X YES ___ NO

Did you find it useful? X YES ___ NO

Did you seek outside assistance to complete the assessment? X YES ___ NO

This form and instruction packet are still in the process of development. Your comments, suggestions and questions will help us upgrade and improve this assessment form. If you found particular sections confusing or problematic please let us know. How could this susceptibility assessment be improved or made clearer? Did the instruction package help you find the information needed to complete the assessment? How much time did it take you to complete the form? Were you able to complete the assessment without additional/outside expertise? Do you feel the assessment was valuable as a learning experience? Any other comments or constructive criticisms you have would be appreciated.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No.
Permit No. 64-29212F

(1) OWNER: Name City of Mabton Address P.O. Box 655 Mabton, WA. 98935

(2) LOCATION OF WELL: County Yakima NW ¼ NE ¼ Sec. 1 T. 8 N., R. 22 E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 4
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: 9 7/8" Diameter of well inches.
Drilled 740.6 ft. Depth of completed well 740.5 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0 ft. to 138 ft.
Threaded ☐ 12" Diam. from 118 ft. to 437.7 ft.
Welded ☒ 10" Diam. from 411 ft. to 564 ft.

Perforations: Yes ☒ No ☐
Type of perforator used Factory
SIZE of perforations 5/32 in. by 3 in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite & Cement
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level ft. below top of well Date 11-8-87
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? Layne of Washington
Yield: gal./min. with ft. drawdown after hrs.
" " "
See attached " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
see	attached				

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 66 Was a chemical analysis made? Yes ☒ No ☐
* SEE ATTACHED

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Br sand	0	20
Br sandy clay	20	48
Cemented gravel	48	50
Gravel	50	62
Br sand clay	62	67
Gravel	67	129
Basalt grey	129	179
Br broken basalt	179	191
Br clay & basalt	191	203
Green clay	203	217
Grey clay & blue	217	259
Green clay	259	271
Grey clay	271	286
Br basalt	286	297
Med. black basalt	297	304
Black basalt	304	319
Trace of red	319	320
Black basalt	320	369
Hard grey basalt	369	418
Black basalt	418	423
Grey basalt	423	438
Black broken	438	442
Grey basalt	442	444
Black basalt	444	446
Grey basalt	446	459
Black broken	459	462
Med grey basalt	462	486
Very black broken	486	503
Black broken	503	517
Grey basalt	517	593
Black broken pyrite	593	610
Black basalt	610	667
Black basalt	667	673
Cracks in rock, black	673	677
Hard basalt	677	689
Fractured basalt	689	710

Work started May 26 19 87 Completed Nov. 6 19 87

WELL DRILLER'S STATEMENT: (continued)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME L & L Drilling, Inc.
(Person, firm, or corporation) (Type or print)
Address P.O. Box 167 Wilson Creek, WA. 98860

[Signed] (Well Driller)

License No. 0518 Date Nov. 11 19 87

(USE ADDITIONAL SHEETS IF NECESSARY)

Original and First Copy with ...
...ent of Ecology
Copy — Owner's Copy
Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. ...

Permit No. ...

(1) OWNER: Name City of Mabton Address ...

(2) LOCATION OF WELL: County ... ¼ ¼ Sec. ... T. ... N., R. ... W.M.

...g and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well ... inches.
Drilled ... ft. Depth of completed well ... ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ... " Diam. from ... ft. to ... ft.
Threaded ☐ ... " Diam. from ... ft. to ... ft.
Welded ☐ ... " Diam. from ... ft. to ... ft.

Perforations: Yes ☐ No ☐
Type of perforator used ...
SIZE of perforations ... in. by ... in.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes ☐ No ☐
Manufacturer's Name ...
Type ... Model No. ...
Diam. ... Slot size ... from ... ft. to ... ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes ☐ No ☐ Size of gravel: ...
Gravel placed from ... ft. to ... ft.

Surface seal: Yes ☐ No ☐ To what depth? ... ft.
Material used in seal ...
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ... Depth of strata ...
Method of sealing strata off ...

(7) PUMP: Manufacturer's Name ...
Type: ... H.P. ...

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level ... ft. below top of well Date ...
Artesian pressure ... lbs. per square inch Date ...
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☐ If yes, by whom? ...
Yield: ... gal./min. with ... ft. drawdown after ... hrs.
... " ... " ... "
... " ... " ... "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ...
Bailer test ... gal./min. with ... ft. drawdown after ... hrs.
Artesian flow ... g.p.m. Date ...
Temperature of water ... Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
PAGE 2		
Green clay	710	734
Broken basalt	734	740.6

Work started ..., 19... Completed ..., 19...

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME ...
(Person, firm, or corporation) (Type or print)

Address ...

[Signed] ...
(Well Driller)

License No. ... Date ..., 19...

(USE ADDITIONAL SHEETS IF NECESSARY)

DATE PRINTED: 02/16/94

Washington State Department of Health

Environmental Health

WATER FACILITIES INVENTORY (WFI)

City of Mabton

UPDATED

Read Instructions on back before completing

FILE COPY

MAR – 2 1994

DATE UPDATED: 02/15/94

1. SYSTEM ID NO.	2. COUNTY	GROUP	TYPE	WRIA
49650R	YAKIMA	A	COMM	37

3. SYSTEM NAME: MABTON, CITY OF

STREET ADDRESS:

P.O. BOX (IF APPLICABLE): P.O. BOX 655

CITY: MABTON STATE: WA ZIP CODE: 98935

4. OWNER'S NAME (LAST, FIRST): MABTON, CITY OF OWNER NO.: 3522

STREET ADDRESS: P.O. BOX 655

P.O. BOX (IF APPLICABLE):

CITY: MABTON STATE: WA ZIP CODE: 98935

5. SYSTEM CONTACT PERSON: WAYNE J. BEEMAN - MANAGER TITLE:

DAY TELEPHONE: 509-894-4096 EVENING TELEPHONE:

WFI COMPLETED BY: TITLE:

DAY TELEPHONE: DATE:

8. SUBMITTED FOR: [ ] NEW SYSTEM [ ] NO CHANGE [ ] REACTIVATE [ ] SYSTEM NAME CHANGE* [ ] UPDATE [ ] DELETE

*OLD SYSTEM NAME - ENTER ONLY IF CHANGING WITH **THIS** WFI

6. OWNERSHIP (CHECK ONE ONLY)

- [ ] PRIVATE-NON-PROFIT
- [ ] PRIVATE-FOR-PROFIT
- [X] LOCAL GOVERNMENT (COUNTY/CITY/PUD/WATER DISTRICT)
- [ ] STATE
- [ ] FEDERAL

7. PREDOMINANT CHARACTERISTIC (CHECK ONE ONLY)

- [X] RESIDENTIAL
- [ ] RECREATIONAL
- [ ] BUSINESS/INDUSTRIAL/AGRICULTURAL/COMMERCIAL
- [ ] LODGING/FOOD SERVICE
- [ ] SCHOOL/DAY CARE
- [ ] OTHER (CHURCHES, ETC.)

SYSTEMS SERVING ANY RESIDENTS (PEOPLE LIVING IN A DWELLING SERVED BY THE SYSTEM), COMPLETE THIS SECTION

9. NUMBER ACTIVE RESIDENTIAL CONNECTIONS: 450

10. NUMBER ACTIVE RESIDENTIAL POPULATION: 1,462

SYSTEMS SERVING ANY NON-RESIDENTS (I.E., TRAVELERS, EMPLOYEES, STUDENTS, ETC.), COMPLETE THIS SECTION

11. NUMBER NON-RESIDENTIAL CONNECTIONS:

12. ENTER AVERAGE DAILY NON-RESIDENTIAL POPULATION SERVED FOR EACH MONTH. MAKE ENTRY FOR EACH MONTH

JAN.	APR.	JULY	OCT.
FEB.	MAY	AUG.	NOV.
MAR.	JUNE	SEP.	DEC.

13. DOES THE SYSTEM SERVE AT LEAST 25 OF THE SAME NON-RESIDENTS FOR 4 OR MORE DAYS PER WEEK FOR AT LEAST 180 DAYS PER YEAR? [ ] YES [X] NO

14. TOTAL NUMBER CONNECTIONS METERED: 493

15. DISTRIBUTION RESERVOIR(S) TOTAL CAPACITY: 800,000 GALLONS

16. DOH SOURCE NUMBER	17. SOURCE NAME (LIST UTILITY'S NAME FOR SOURCE. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S ID # AND NAME USING FOLLOWING FORMAT: XXXXXX/NAME. EXAMPLE: 77050Y/SEATTLE)	18. SOURCE CATEGORY: WELL	WELL FIELD	SURFACE	SPRING	FARMEY/INF. GAL	INTERTIE	PURCHASE-TREATED	PURCHASE-UNTREATED	19. USE: PERMANENT	SEASONAL	EMERGENCY	20. SOURCE METERED	21. TREATMENT: NONE	CHLORINATION	FILTRATION	FLUORIDATION	OTHER	22. WELL DEPTH (FEET)	23. SOURCE CAPACITY (GPM)	24. SOURCE LOCATION: 1/4, 1/4 SEC	SEC NO.	TWP.	RNG.	SWTR EVALUATION / VOC EVALUATION
S01	WELL #4	X								X				X					740	1,000	SE/NW	01	08N	22E	
S02	WELL #2	X									X			X					1,180	775	SE/NW	01	08N	22E	
S03	WELL #3	INACTIVE 11/25/1991																							

25. MINIMUM REQUIRED BACTERIOLOGICAL SAMPLING SCHEDULE

26.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	2	2	2	2	2	2	2	2	2	2	2	2

NO. APPROVED SERVICES (PER PLANS): 0 DATE OF LAST SANITARY SURVEY: 00 00 0000 BY DOH: [ ] LHD: [ ]

SYSTEM IN CRITICAL WATER SUPPLY SERVICE AREA? [ ] YES [ ] NO GW MGMT. AREA? [ ] YES [ ] NO FOR LHD USE ONLY

EFFECTIVE DATE RETRO. CHANGES: SIGNATURE OF DOH REVIEWER: DATE:

WATER SYSTEM

...STON STATE
...PARTMENT
OF HEALTH
...NVIRONMENTAL HEALTH

SOURCE TREATMENT INVENTORY

DATE PRINTED: 02/16/94

THIS SOURCE TREATMENT INVENTORY IS INTENDED TO PROVIDE MORE DETAILED TREATMENT INFORMATION THAN THE WFI. ONLY SYSTEMS WHICH ROUTINELY PROVIDE TREATMENT TO ONE OR MORE SOURCES SHOULD COMPLETE THIS FORM. PLEASE COMPLETE A SEPARATE FORM FOR EACH SOURCE TREATED.

SOURCE IDENTIFICATION

DOH SOURCE NO.	SOURCE NAME
S01	WELL #4
SYSTEM ID NO.	COUNTY
49650R	YAKIMA

SYSTEM NAME: MABTON, CITY OF

STREET ADDRESS:

P.O. BOX: P.O. BOX 655

CITY: MABTON | STATE: WA | ZIP CODE: 98935

OBJECTIVES

PROCESSES	A. DISINFECTION	B. PARTICULATE (TURBIDITY) REMOVAL	C. SOFTENING (HARDNESS REMOVAL)	D. IRON & MANGANESE REMOVAL	E. ORGANICS & COLOR REMOVAL	F. TASTE / ODOR CONTROL & DECHLORINATION	G. DISINFECTION BY-PRODUCTS CONTROL	H. INORGANICS REMOVAL	I. CORROSION CONTROL	J. DENTAL HEALTH
1. CHLORAMINES	X									
2. CHLORINATION, GASEOUS										
3. CHLORINATION, HYPOCHLORITE										
4. CHLORINE DIOXIDE										
5. IODINATION										
6. OZONATION										
7. ULTRAVIOLET RADIATION										
8. RAPID MIX / IN-LINE BLENDER										
9. COAGULATION										
10. FLOCCULATION										
11. SEDIMENTATION										
12. FILTRATION, CARTRIDGE										
13. FILTRATION, DIATOMACEOUS EARTH										
14. FILTRATION, GREENSAND										
15. FILTRATION, PRESSURE SAND (INCLUDES DUAL AND MULTI-MEDIA)										
16. FILTRATION, RAPID SAND (INCLUDES DUAL AND MULTI-MEDIA)										
17. FILTRATION, SLOW SAND										
18. pH ADJUSTMENT										
19. ION EXCHANGE										
20. LIME-SODA SOFTENING										
21. AERATION / AIR STRIPPING										
22. PERMANGANATE										
23. ACTIVATED CARBON, GRANULAR										
24. ACTIVATED CARBON, POWDERED										
25. REVERSE OSMOSIS										
26. DISTILLATION										
27. ELECTRODIALYSIS										
28. SEQUESTRATION										
29. CORROSION INHIBITORS - PHOSPHATES / SILICATES										
30. FLUORIDATION										
31. REDUCING AGENTS - SULFUR COMPOUNDS										
32. SLUDGE TREAMENT										
33. OTHER PROCESSES / OBJECTIVES (IDENTIFY)										
TREATMENT REQUIRED										

FORM COMPLETED BY: DATE:

TITLE: DAY TELEPHONE:

DOH REVIEWER: DATE:

National Chem Lab

103 12th Ave S.W. , Ephrata, Wa 98823
(509)754-5725

City of Mc[illegible]

NOV 2 7 [illegible]

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSES

Fill out boxes numbered 1 thru 14.

Laboratory Number: 109-93015

Date Received: 09-30-93

1. Date Collected: 09-29-93

2. System Name: CITY OF MABTON

3. System Id #: 49650R

4. Group(A or B):

5. County: YAKIMA

6. Source Type:
- [ ] Surface
- [ ] Spring
- [X] Well
- [ ] Purchase

7. Sample Taken
- [X] Before Treatment
- [ ] After Treatment

8. Source Number:

9. Source Name: ELL #4

10. Collected by: WAYNE BEEMAN
Phone 509-894-4096

11. If taken after treatment, list treatment as:
- [ ] Fluoridation
- [ ] Chlorination
- [ ] Filtration
- [ ] Water Softener
- [ ] Type:
- [ ] Other:

12. If taken from distribution, indicate address:

13. Party to pay for testing: CITY OF MABTON
Signature:
Name: CITY OF MABTON
Address: P.O. BOX 655
Phone #: 509-894-4096

14. Remarks:

MABTON, WA 98935

Laboratory Report

TESTS		MCL[1]	Less Than <	Results	Units	Compliance Yes	Compliance No	Chemist Initials
Antimony	Sb	0.006			mg/L			
Arsenic P	As	0.05			mg/L			
Barium P	Ba	2.0			mg/L			
Beryllium	Be	0.004			mg/L			
Cadmium P	Cd	0.005			mg/L			
Chromium P	Cr	0.1			mg/L			
Copper	Cu	1.0[2]			mg/L			
Iron	Fe	0.3			mg/L			
Lead P	Pb	0.015			mg/L			
Manganese	Mn	0.05			mg/L			
Mercury P	Hg	0.002			mg/L			
Nickel	Ni	0.1			mg/L			
Selenium P	Se	0.05			mg/L			
Silver P	Ag	0.1			mg/L			
Sodium P	Na				mg/L			
Thallium	Tl	0.002			mg/L			
Zinc	Zn	5.0			mg/L			
Hardness					mg/L as $CaCO_3$			
Conductivity		700			µmhos/cm @25°C			
Turbidity P		1.0			NTU			
Color		15.0			Color Units			
Chloride	Cl	250			mg/L			
Cyanide	CN	0.2			mg/L			
Fluoride P	F	2.0			mg/L			
Nitrate P	as N	10.0		0.14	mg/L	X		
Nitrite	as N	1.0			mg/L			
Sulfate	SO_4	250			mg/L			
TDS		500			mg/L			

Laboratory Comments:

Charge:	Laboratory Supervisor:	Date of Report:
$20.00	Gary Miller	11-17-93

[1]MCL = Maximum Contamination Level, [2]This is the State MCL, Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper, P = Primary Standard, TDS = Total Dissolved Solids

USE HEAVY PENCIL
DO NOT WRITE IN SHADED AREAS

Department of Health
DIVISION OF LABORATORIES
1610 N.E. 150th St., Seattle WA 98155-7224
(206) 361-2898

SEE BACK FOR INSTRUCTIONS

WATER SAMPLE INFORMATION FOR INORGANIC CHEMICAL ANALYSES

LAB NUMBER	DATE RECEIVED	DATE COLLECTED	COLLECTED BY:
5 11 21 79	8 29 90	/ /	Telephone:

SYSTEM I.D. NO.	SYSTEM NAME	SYSTEM CLASS (circle one)	COUNTY
		1 2 3 4	

SOURCE TYPE	SOURCE NO (Well No.)	IF SOURCE IS LAKE OR STREAM ENTER NAME
1. Surface 3. Well 2. Spring 4. Purchase	04	

THIS SAMPLE WAS TAKEN
- [x] Before Treatment
- [ ] After Treatment

IF SAMPLE WAS DRAWN FROM DISTRIBUTION SYSTEM IT WAS COLLECTED FROM SYSTEM AT: (Address)

IF TAKEN AFTER TREATMENT WAS IT _____ FILTERED _____ FLUORIDATED
_____ CHLORINATED _____ WATER SOFTENER: TYPE USED _____

REMARKS: (Water quality problems, address for additional copies, etc.)

FEES ARE CHARGED FOR CHEMICAL TESTING
A fee schedule is available from this department.

PARTY TO PAY FOR FEE FOR SERVICE TESTING

Signature (Required) (Print Full Name & Address)

Name

Street

WA

City Zip Code

Telephone: ( ) Area Code

LABORATORY REPORT

(DO NOT WRITE BELOW THIS LINE)

TESTS	MCL	LESS THAN	RESULTS	UNITS	Compliance YES	Compliance NO	CHEMIST INITIALS
rsei	0.05	<	0.010	mg/l	✓		LA
arium	1.0	<	0.25	mg/l	✓		PO
admium	0.01	<	0.002	mg/l	✓		RWO
hromium	0.05	<	0.010	mg/l	✓		RWO
ron	0.3	<	0.10	mg/l	✓		KK
ead	0.05	<	0.002	mg/l	✓		LA
Manganese	0.05		0.036	mg/l	✓		PO
Mercury	0.002	<	.0005	mg/l	✓		KK
elenium	0.01	<	0.005	mg/l	✓		RWO
ilver	0.05	<	0.010	mg/l	✓		RWO
odium			35	mg/l			KK
Hardness			70	mg/l AS CaCo3			HA
Conductivity	700		500	Micromhos/cm 25° C	✓		HA
urbidity	1.0		0.1	NTU	✓		HA
Color	15.0	<	5.	Color Units	✓		HA
luoride	2.0		0.7	mg/l	✓		HA
itrate	10.0	<	0.2	mg/l	✓		RWO
Chlo.	250		10	mg/l	✓		RWO
ulfate	250			mg/l			
TDS	500			mg/l			
Copper	1.0	<	0.25	mg/l	✓		PO/PT
Zinc	5.0	<	0.25	mg/l	✓		PO

DATE OF FINAL REPORT:

LABORATORY SUPERVISOR
(Name or Initials)

CHARGE: $195.00

REMARKS:
RWO

JP

RESULTS OF ANALYSIS

Date:

Identification	Lab Number	Test or Residue	Results	Units	MRL
			January 9, 1991		
City of Mabton Well # 4 S01	90E0300	EDB	ND	PPB	.02
		DBCP	ND		
City of Mabton Well # 2 S02	90E0301	EDB	ND	"	"
		DBCP	ND		

Ground Water Contamination
Susceptibility Assessment Survey Form
Version 2.2

IMPORTANT! Please complete one form for each ground water source (well, wellfield, spring) used in your water system. Photocopy as necessary.

PART I: System Information

Well owner/manager : City of Mabton

Water system name : City of Mabton

County: Yakima

Water system number: 49650R Source number: S03

Well depth: 1,004 (ft.) ~~(From WFI form)~~ Well Log

Source name: Well #3

WA well identification tag number: A F L - 7 6 7

_____ well not tagged

Number of connections: _____ Population served: _____

Township: 8 N Range: 22 E

Section: 1 1/4 1/4 Section: SE/NW

Latitude/longitude (if available): 46° 12' 30" / 119° 57' 25"

How was lat./long. determined?

____ global positioning device ____ survey ____ topographic map
____ other: USGS MAP

* Please refer to Assistance Packet for details and explanations of all questions in Parts II through V.

PART II: Well Construction and Source Information

1) Date well originally constructed: 5 / 28/57 month/day/year

last reconstruction: ___ / ___ /___ month/day/year

_____ information unavailable

PART III: Hydrogeologic Information

1) Depth to top of open interval: [check one]

___ (less than) 20 ft ___ 20–50 ft X 50–100 ft ___ 100–200 ft ___ (greater than) 200 ft

___ information unavailable

2) Depth to ground water (static water level):

___ (less than) 20 ft X 20–50 ft ___ 50–100 ft ___ (greater than) 100 ft

___ flowing well/spring (artesian)

How was water level determined?

___ well log X other: MEASURED

___ depth to ground water unknown

3) If source is a flowing well or spring, what is the confining pressure:

N/A psi (pounds per square inch)
or
N/A feet above wellhead

4) If source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with this source: ___ YES X NO

5) Wellhead elevation (height above mean sea level): 718 (ft)

How was elevation determined? ___ topographic map X Drilling/Well Log ___ altimeter

___ other: _____

___ information unavailable

6) Confining layers: (This can be completed only for those sources with a drilling log, well log or geologic report describing subsurface conditions. Please refer to assistance package for example.)

X evidence of a confining layer in well log } NO CONFINING LAYER ABOVE PERFORATIONS @ 96-115'
X no evidence of a confining layer in well log } CONFINING LAYER ABOVE 2ND SET OF PERFORATIONS AND OPEN HOLE.

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer? ___ YES ___ NO

X information unavailable

PART IV: Mapping Your Ground Water Resource

1) Annual volume of water pumped: 10,000,000 (gallons)

How was this determined?

X meter

___ estimated: ___ pumping rate (_____)

___ pump capacity (_____)

___ other: _____

2) "Calculated Fixed Radius" estimate of ground water movement:
(see Instruction Packet)

6 month ground water travel time : 110' (ft)

1 year ground water travel time : 160' (ft)

5 year ground water travel time: 360' (ft)

10 year ground water travel time: 510' (ft)

Information available on length of screened/open interval?

X YES ___ NO

Length of screened/open interval: >75' (ft)

3) Is there a river, lake, pond, stream, or other obvious surface water body within the 6 month time of travel boundary? ___ YES X NO (mark and identify on map).

4) Is there a stormwater and/or wastewater facility, treatment lagoon, or holding pond located within the 6 month time of travel boundary? ___ YES X NO (mark and identify on map).

Comments: _____

_____

_____

_____

_____

2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that meet the following conditions: (Unless listed on assessment, MCLs are listed in assistance package.)

A. Nitrate: (Nitrate MCL = 10 mg/l)	YES
Results greater than MCL	X
(less than) 2 mg/liter nitrate	___
2–5 mg/liter nitrate	___
(greater than) 5 mg/liter nitrate	X
Nitrate sampling records unavailable	___

B. VOCs: (VOC detection level 0.5 ug/l or 0.0005 mg/l.)	YES
Results greater than MCL or SAL	___
VOCs detected at least once	X
VOC test performed but never detected	___
VOC sampling records unavailable	___

C. EDB/DBCP:	YES
(EDB MCL = 0.05 ug/l or 0.00005 mg/l. DBCP MCL = 0.2 ug/l or 0.0002 mg/l.)	
EDB/DBCP detected below MCL at least once	___
EDB/DBCP detected above MCL at least once	___
EDB/DBCP never detected	___
EDB/DBCP tests required but not yet completed	X
EDB/DBCP tests not required	___

D. Other SOCs (pesticides and other synthetic organic chemicals):	YES
Other SOCs detected	___
Other SOC tests performed but none detected *	___
Other SOC tests not performed	___

*If any SOCs in addition to EDB/DBCP were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list test methods here: _____

_____

_____

_____

3) Is the source located in an aquifer with a high horizontal flow rate? (These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs.)

___ YES X NO

4) Are there other high capacity wells (agricultural, municipal and/or industrial) located within the CFRs?

a) Presence of ground water extraction wells removing more than approximately 500 gal/min within...

	YES	NO	unknown
6 month travel time	___	X	___
6 month–1 year travel time	___	X	___
1–5 year travel time	X	___	___
5–10 year travel time	___	X	___

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within...

	YES	NO	unknown
1 year travel time	___	X	___
1–5 year travel time	___	X	___
5–10 year travel time	X	[redacted]	___

Please identify or describe additional hydrologic or geographic conditions that you believe may affect the shape of the zone of contribution for this source. Where possible, reference them to locations on the map produced in Part IV.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. 11644
Permit No. G 3-00027

(1) OWNER: Name TOWN OF MABTON Address Town Hall, Mabton, Wa. 98935

(2) LOCATION OF WELL: County Yakima SW ¼ NE ¼ Sec 1 T 8 N., R 22E W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 3
New well ☐ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 10 inches.
Drilled 1,004 ft. Depth of completed well 1,004 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 16" Diam. from 0 ft. to 130 ft.
Threaded ☐ 12" Diam. from 120 ft. to 307 ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☒ No ☐
Type of perforator used ? ?
SIZE of perforations ? in. by ? in.
295 perforations from 295 ft. to 305 ft.
96 perforations from 96 ft. to 115 ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☐ No ☐ To what depth? ft.
Material used in seal
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level 718 ft.
Static level 34 ft. below top of well Date 5/28/57
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom?
Yield: 400 gal./min. with 66 ft. drawdown after 24 hrs.
" 300 " " 42 " "
" 450 " " 74 " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 5/2
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 61 Was a chemical analysis made? Yes ☒ No ☐

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Top Soil	0	10
Sand and Gravel	10	15
Cemented Gravel	15	28
Gravel	28	73
Blue Clay	73	76
Sand and Gravel	76	127
Black Porous Bassalt	127	132
Black Bassalt	132	167
Black Bassalt with Clay	167	180
Green and Blue Clay	180	228
Blue Sand Rock	228	240
Blue Shale	240	289
Black Bassalt with Shale	289	297
Black Porous Bassalt	297	300
Black Bassalt with Shale	300	308
Black Bassalt	308	312
Red Bassalt	312	328
Brown Basalt	328	347
Black Basalt	347	363
Dull Gray Basalt	363	380
Gray Basalt	380	400
Black Basalt	400	407
Gray Basalt with Sand	407	418
Black Basalt	418	450
Gray Basalt with Sand	450	453
Gray Basalt	453	479
Black Basalt	479	487
Black Porous Basalt	487	513
Black Basalt	513	666
Red Basalt	666	690
Black Basalt	690	757
Gray Basalt with Sand	757	860
Black Basalt with Sand	860	885
Black Basalt	885	890
Black and Gray Basalt	890	1004
Sand	1004	

Work started September 56 Completed May 57

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Dilley Drilling Co.
(Person, firm, or corporation) (Type or print)

Address 605 Meadowbrook Road Yakima, Wash. 98

[Signed] Victor E. Dilley
(Well Driller)

License No. 223 02 3587 Date Aug. 2, 1972

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71).

CITY OF MABTON

WELLHEAD PROTECTION PLAN UPDATE

12/07/2012

INVENTORY OF POTENTIAL SOURCES OF CONTAMINATION

The following addresses are locations of residences and businesses where there are thought to be potential sources of contamination within the Wellhead Protection Area:

Gary Anderson	22920 SR22, PO Box 188, Mabton, WA 98935
Burlington Northern Santa Fe	4920 N Railroad Ave., Pasco, WA 99301
R.E. Powell	451 N Main St., PO Box 98, Grandview, WA 98930
Mabton School District	306 Main St., PO Box 37, Mabton, WA
In and Out Repair	404 South St., PO Box 270, Mabton, WA
C & D	432 South St., PO Box 217, Mabton, WA
Cascade Custom Plants	8301 Sunnyside/Mabton Rd., PO Box 100, Mabton, WA

Wellhead Protection Notification Letters:

The Wellhead Protection letters were sent out on October 31st, 2012. The list of businesses and addresses are as follows, with physical addresses listed first and mailing addresses last.

Gary Anderson--22920 SR22 PO Box 188 Mabton, WA 98935
Burlington Northern Santa Fe--4920 N Railroad Ave. Pasco, WA 99301
R.E. Powell--451 N Main St PO Box 98 Grandview, WA 98930
Mabton School Dist.--306 Main St. PO Box 37 Mabton, WA
In and Out Repair--404 South St. PO Box 270 Mabton, WA
C & D--432 South St. PO Box 217 Mabton, WA
Cascade Custom Plants--8301 Sunnyside/Mabton Rd. PO Box 100 Mabton, WA

Sincerely,

Chris Morris
City of Mabton

Example Standard Wellhead Protection Letter sent out 10/23/2012:

October 23, 2012

M. _____
address
Mabton, WA 98935

RE: City of Mabton
Wellhead Protection Program

Dear M. _____:
In order to protect the drinking water supply for the customers of the City of Mabton, we have developed a wellhead protection program in accordance with State requirements. As part of the program, we mapped the area overlying the short term recharge zone of our drinking water supply wells. This is called our wellhead protection area.
Following the mapping of the wellhead protection area, we conducted an inventory of potential sources of groundwater contamination within that area. The nature of your business and its location within our wellhead protection area means that your activities have the potential to affect the quality of our customers' drinking water supply.
The City of Mabton realizes that you are already careful to protect the environment as you conduct your business. We hope that notifying you of your location in our wellhead protection area will result in an increase in precautions to ensure that your activities will not impact our drinking water quality. Thank you for your cooperation.

Sincerely,

Chris Morris
Public Works Lead

December 14, 2012

U.S. Environmental Protection Agency
Attn: Ground Water Unit
1200 Sixth Avenue
Seattle, WA 98101

RE: City of Mabton's Wellhead Protection Program

To Whom it may Concern,

As part of the wellhead protection program for the city of Mabton, we are hereby notifying you of the findings of our wellhead protection areas of delineation. This is in accordance with State regulations.

Our water system currently has about 630 connections that serves almost 2300 people. The Washington State Department of Health has rated our system as "susceptible," which means our drinking water supply may be vulnerable to contamination.

The enclosed map shows the 6-month and the 1,5,and 10 year time of travel boundaries for our wellhead protection area. The list of facilities or activities of concern is also enclosed. Any groundwater contamination that occurs in these boundaries has a high potential of reaching our wells. It is of utmost importance that all reasonable steps be taken to ensure that land use activities within these areas do not contaminate our customers' drinking water supply.

THANK YOU FOR YOUR SUPPORT IN PROTECTING OUR DRINKING WATER.

Sincerely,

Christopher Morris
Public Works Lead

Enclosed

December 14, 2012

Spill Response Program
Washington State Department of Ecology
Central Regional Office
15 West Yakima Avenue, Suite 200

RE: City of Mabton's Wellhead Protection Program

Dear Will,

As part of the City of Mabton's wellhead protection program, we are hereby notifying you of the findings of our wellhead protection areas of delineation. This is in accordance with WAC 246-290-135. The enclosed map shows the 6-month and the 1, 5, and 10 year time of travel boundaries for our wellhead protection area. Also enclosed is a list of facilities and/or activities of concern. If you have any questions please feel free to call me any weekday between 8am and 5pm.

Thank You,

Christopher Morris
Public Works Lead
(509)439-4077

Enclosed

APPENDIX I

WATER QUALITY MONITORING REPORT

RECEIVED
MAR 29 2013
By

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
OFFICE OF DRINKING WATER
PO BOX 47822 • Olympia, Washington 98504-7822
TDD Relay Service: 1-800-833-6388

March 2013

Subject: **WATER QUALITY MONITORING REPORT FOR 2013**

Dear Water System Manager/Purveyor:

Enclosed is the 2013 Water Quality Monitoring Report (WQMR) for your water system and an information sheet that explains some details about monitoring requirements. We developed the WQMR to help you keep track of the source-specific and distribution water quality monitoring requirements for your water system.

This year marks the end of a three year monitoring period. Samples scheduled on your 2013 WQMR must be collected during this year. Please pay close attention to your monitoring requirements this year.

As mentioned last year, we changed the way we are granting waivers for the 2011-2013 monitoring period. This is the first time we've updated our waiver model since we first introduced it in 1994. **We have already applied monitoring waivers to all eligible sources.** Part 4 will show your monitoring frequency with any applicable waivers. **You will not be invoiced for any of the waivers already granted on the WQMR.**

Please review your WQMR carefully. If you notice anything that doesn't look correct to you, please call your regional office to have your records updated or corrected. Most problems can be resolved with a phone call, and DOH can send you a revised WQMR.

You can find a complete list of laboratories accredited for drinking water analyses at the Washington State Department of Ecology's web site http://www.ecy.wa.gov/programs/eap/labs/search.html. Because radionuclide analyses are conducted by a limited number of labs, that list is included on the back of this letter.

For questions about your 2013 WQMR, please contact the appropriate DOH regional office staff listed below.

Eastern Regional Office	Bryony Stasney	(509) 329-2132
Northwest Regional Office	Steve Hulsman	(253) 395-6777
Southwest Regional Office	Sophia Petro	(360) 236-3046

Sincerely,

Mike Means
Manager, Water Quality Section
Office of Drinking Water

Enclosures

Information About Your 2013 Water Quality Monitoring Report (WQMR)

March2013

The Department of Health (DOH) developed the Water Quality Monitoring Report (WQMR) to help you track your system's annual water quality monitoring requirements. Information in your WQMR is specific to your system and its individual sources. The WQMR summarizes most of the microbiological and chemical sampling requirements that apply to each source (at the source, after treatment) and to the distribution system (at the tap). DOH uses the WQMR schedules for compliance and enforcement purposes, so please read it carefully.

Your system may have other monitoring requirements not listed on the WQMR. Other monitoring may be required for special investigations, most treatment systems, or special operation and maintenance situations. Your 2013 WQMR focuses on the Safe Drinking Water Act monitoring requirements that are linked to your source's water quality, history, compliance, and waiver status.

The 2013WQMR has five parts:

1. List of active sources
2. Sample collection information and calendars for 2013
3. Information on waivers
4. Summary of sampling requirements and waivers for 2011-2013 or current monitoring period
5. Special notices and regional office staff contacts

Part 1: Sources with Water Quality Monitoring Requirements

Part 1 lists your water system's active seasonal and permanent sources. This table does not list emergency, inter-tie, purchased water sources, or individual wells that make up a well field. These types of sources rarely have source-specific water quality monitoring requirements.

The table lists sources by key information from your recent Water Facilities Inventory (WFI). The table also shows the susceptibility to contamination for each source based on the susceptibility assessment on file with our department, water quality data, and information from your WFI. *All active sources require a susceptibility assessment rating as part of the wellhead and watershed protection programs. DOH will not grant chemical monitoring waivers for sources that do not have a susceptibility assessment rating.*

Part 2: Monitoring Schedule for 2013

Part 2 shows your system's sampling schedule for 2013. DOH assigns requirements to a particular month to help you stay on track and in compliance. Sampling months are assigned based in part on your past sampling dates, and also to even out the workload for laboratories. The monthly scheduling format can help you budget for monitoring expenses. If you miss collecting a sample in a particular month, collect it as soon as possible.

NOTE: 2013 is the last year in this 3-year monitoring period. Make sure you collect all the samples that are scheduled this year.

In general, there are three types of samplesbased on the location where the sample is collected:

1 - Distribution system samples - Most coliform, lead and copper, asbestos, and DBP samples are collected from representative locations in the distribution system.

2 - Finished water source samples– Most chemical samples (IOCs, VOCs, SOCs, and radionuclides) are collected from the finished water source sample tap (collected at the entry point to the distribution system).

3 - Raw water source samples -come from the tap closest to the source prior to all treatment. The raw water tap is used to collect the bacteria sample for Groundwater Rule triggered source monitoring following a positive coliform distribution sample, and may also be considered for chemical samples when a source has no treatment.

Coliform Monitoring: The coliform monitoring portion of this section lists the number of routine coliform samples required each month. This is the same as you would see on your WFI. We include it on the WQMR as a convenience. Coliform samples are usually collected from a cold water household tap within the distribution system.

If the population of your system changes during the year, your coliform monitoring requirement could change. When that happens, you will receive an updated WFI with a new coliform sampling schedule. Note: the coliform monitoring schedule on your most recent WFI provides the most accurate information.

Lead and Copper Monitoring: These samples must be collected from regularly-used, indoor kitchen or bathroom cold water faucets after the water has sat unused in the pipes for at least 6 hours but no more than 12 hours. Any faucetsthat will be used for lead and copper samples should be flushed with cold water the *evening before* taking the sample.

Disinfection By-Product (DBP) Monitoring: DBPs are scheduled on the monthly calendar for systems (except most large surface water systems) which have continuous chlorination or ozonation. These requirements will also show in part 4 for most systems.

Chemical Monitoring: Thissection lists source sampling requirements for organic and inorganic chemicals by month, source, and DOH test panel. This section doesnot list test method because more than one method may be used for any given test panel. Your lab will know the test methods for which they are accredited for drinking water. **Collect all chemical source samples as close to the source of water as possible, but *after* all treatment and before entering the distribution system.**

Part 3: Water Quality Monitoring Waivers

Part 3 provides general information about chemical monitoring waivers. Monitoring waivers can reduce or eliminate some monitoring requirements for sources with a waiver.

There are three categories of waivers:

1) ***Organic waivers*** reduce the monitoring requirements for volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). **Organic waivers require a susceptibility assessment rating.**

2) ***Inorganic waivers*** reduce the monitoring requirements for inorganic chemicals (IOCs). **Many sources may still need to sample for individual IOC compounds (for example, arsenic) as a condition of their IOC waiver.** Any inorganic sampling requirements you have for 2013 will be listed in Part 2 of the WQMR. Eligibility for an IOC waiver depends on source-specific IOC water quality history. **The annual sampling requirement for nitrate is never waived.**

3) ***Statewide waivers*** reduce or eliminate the monitoring requirements for some test panels (as listed in Part 4). We now include insecticides as a state waiver.DOH grants statewide waivers when applicable. These waivers are granted based on water quality information gathered from across the state.

Part 4: Water Quality Monitoring Summary

Part 4 is useful for planning and budgeting for all your monitoring requirements. Part 4 provides an overview of the scope and frequency of water quality monitoring requirements for each of your sources for the 2011-2013 monitoring period. The table identifies where and how often a sample must be collected and if any waivers have been granted. Information in Part 4 relates directly to the schedule in Part 2. Sample collection frequencies are listed according to test panel (for example, IOC, VOC, Herbicide). This section identifies the specific "test panel" and sample location required. If you have received a waiver for a specific test panel, it will show here.

Part 5: DOH Staff Contacts and Special Notes

Part 5 lists the name and phone number of your DOH regional office source monitoring and DBP staff. If you have questions about your 2013WQMR or notice any inaccuracies, call your regional office to have your records updated. In most cases, errors are resolved with a phone call and a revised WQMR will be sent to you. **Part 5 also contains *Special Notes* specific to your water system or individual sources. Please look for these Special Notes.**

IMPORTANT NOTE:

We changed the way we are granting organic waivers for the 2011-2013 monitoring period. This is the first time we've updated our waiver model since we first introduced it in 1994. Many conditions have changed in the state, and our waiver model needed an update. We developed the new model using our water quality data, data from Department of Agriculture, and source susceptibility information to waive source monitoring requirements to the maximum extent possible while still protecting public health.

DOH is no longer charging a waiver fee for most monitoring waivers, including organic and inorganic waivers. We will no longer send water systems a waiver options form. **We have granted all the waivers for which your sources currently qualify.**

Washington State Department of Health

Water Quality Monitoring Report for the Year 2013

System: MABTON, CITY OF PWSID: 49650 R Report Date: 03/07/2013
Contact: CHRISTOPHER E. MORRIS Group: A - Comm County: YAKIMA Region: EASTERN

Part 1: List of Active Sources with Water Quality Monitoring Requirements

DOH Source#	Name	Type	Use	Susceptibility Rating
S03	Well #3 - AFL767	Well	Seasonal	High
S05	Wellfield / S01, S04	Well Field	Permanent	Low

Part 2: Sampling Schedule for the Year 2013

Coliform Sampling (Routine)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
	2	2	2	2	2	2	2	2	2	2	2	2

* Indicates the requirement is an exception from WAC 246-290.

- If the coliform (bacteriological) sampling schedule listed at the bottom of the current Water Facilities Inventory (WFI) form for your system is different from the schedule listed above, follow the schedule on the current WFI.
- Samples must be collected from representative points throughout the distribution system.
- Repeat samples are required following an unsatisfactory sample. In addition, collect a sample from each operating groundwater sourc
- A minimum of 5 routine samples are required the month following one or more unsatisfactory samples in accordance with your system's Coliform Monitoring Plan.

Lead and Copper Distribution Sampling

- Lead and copper samples must be collected from indoor faucets within the distribution system after the water has sat unused in the pipes for at least 6 hours but no more than 12 hours.
- Sample faucets should be flushed with cold water the evening prior to collecting the sample.
- Part 2 indicates the month in which samples should be collected. Part 4 indicates the total number of sample required.
- If you are required to sample annually or once every 3 years, samples must be collected between June and September.

Chlorine Residual Sampling

- Systems that use continuous chlorination must take chlorine residual measurements daily (or at a reduced frequency approved by the department), and at the same time and location as routine and repeat coliform samples.

Disinfection Byproducts Sampling

Stage 1

- Systems that use continuous chlorination treatment must collect samples for total trihalomethanes (TTHM) and for haloacetic acids (HAA5) for each chlorination treatment facility identified in your individual disinfection byproducts (DBP) monitoring plan. Collect the samples from the distribution system at the frequency and locations identified in your DBP monitoring plan.

Chemical Sampling Requirements

- Source water chemical samples must be taken from a location as near to the source as possible, but after all treatment, and before entering the distribution system.
- Nitrate, nitrite and arsenic are included as part of a complete IOC.

Washington State Department of Health

49650 R

Water Quality Monitoring Report for the Year 2013

Month	Source	Monitoring Requirement	Test Panel
January		*No source chemical sampling required this month*	
February		*No source chemical sampling required this month*	
March		*No source chemical sampling required this month*	
April		*No source chemical sampling required this month*	
May		*No source chemical sampling required this month*	
June	~~S05~~	~~HERBICIDES~~	~~HERBT~~
June	~~S05~~	~~GENERAL PESTICIDES~~	~~PEST~~
July	~~S03~~	~~HERBICIDES~~	~~HERB~~
July	S03	IOC	IOC
July	~~S03~~ S03	~~GENERAL PESTICIDES~~ GROSS ALPHA, URANIUM RADIUM 228 & RADIUM 226	~~PEST~~ RADS
July	S03	VOLATILE ORGANIC CONTAMINANTS	VOC1
August	S05	NITRATE	NITRATE
September		HAA5	
September		TRIHALOMETHANES	THM
October		*No source chemical sampling required this month*	
November		*No source chemical sampling required this month*	
December		*No source chemical sampling required this month*	

Part 3: Waivers

- Automatically granted to all sources based on DOH assessment of source specific information, and regional and state conditions.
- Current susceptibility assessment is required for all sources to obtain a waiver. No waiver application, or fee required.
- Waivers granted for the 2011 - 2013 compliance period are listed in Part 4.

Part 4: Water Quality Monitoring Frequency

- Although waivers may be granted for your system, there may be some monitoring required as a condition of the waiver.

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Asbestos	ASB	Distribution	State Waiver Thru Dec 2019
Bacteriological	Coli	Distribution	See routine sample schedule in part 2
Dioxin	Dioxin	All sources	State Waiver Thru Dec 2013
Endothall	Endo	All sources	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S03	State Waiver Thru Dec 2013
EDB and other soil fumigants	Fumigant	S05	State Waiver Thru Dec 2013
Glyphosphate	Glyphs	All sources	State Waiver Thru Dec 2013

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

49650 R

Water Quality Monitoring Report for the Year 2013

Monitoring Group	Test Panel	Sample Location	Schedule/Status
Gross Alpha	GROSS ALPHA	S03	1 sample between Jan 2011 - Dec 2013
Halo-Acetic Acids	HAA5		1 sample between Jan 2011 - Dec 2013
Herbicides	Herbs	S03	Waiver granted ~~- 1 sample between Jan 2011 - Dec 2013~~
Herbicides	Herbs	S05	~~Sample between Jan 2011 - Dec 2013~~ waived thru 2013
Insecticides	Insect	S03	Waiver granted - No sampling required thru Dec 2013
Insecticides	Insect	S05	Waiver granted - No sampling required thru Dec 2013
Inorganic Contaminants	IOC	S03	1 sample between Jan 2011 - Dec 2013
Inorganic Contaminants	IOC	S05	1 sample between Jan 2011 - Dec 2013
Lead/Copper *	LCR	Distribution	LCR 1 Set of 10 samples between Jun 2013 - Sep 2013
Nitrate *	NIT	S03	See special note on page 4.
Nitrate *	NIT	S05	Collect 1 sample every 1 year
General Pesticides	Pest1	S03	Waiver granted ~~- 1 sample between Jan 2011 - Dec 2013~~
General Pesticides	Pest1	S05	~~sample between Jan 2011 - Dec 2013~~ waived thru 2013
Diquat	Diquat	All sources	State Waiver Thru Dec 2013
Radium 228	RAD 228	S03	1 sample between Jan 2011 - Dec 2013
Total Trihalomethane	THM		1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S03	1 sample between Jan 2011 - Dec 2013
Volatile Organic Contaminants	VOC	S05	1 sample between Jan 2011 - Dec 2013

** These contaminant monitoring groups do not have waiver options under the SDWA.*

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Water Quality Monitoring Report for the Year 2013

Part 5: Regional Water Quality Monitoring Contact

Eastern Regional Office
Phone: (509) 329-2132

For further information call the Eastern Regional Office Bryony Stasney

For questions regarding Disinfection ByProducts (DBP) monitoring, contact: Russell Mau (509) 329-2116

Special Note

Nitrate: S03, collect a raw sample prior to use if needed. Call DOH prior to use.	IF S03 is needed, follow the blending monitoring schedule, and contact DOH prior to use.

For Group A Community Systems Only: Your Consumer Confidence Report, summarizing the results of your 2012 water quality monitoring requirements is due before July 1, 2013. For further information visit www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/RegulationandCompliance/CCRReports.aspx or contact the CCR Coordinator at your Regional Office.

CHRISTOPHER E. MORRIS
MABTON, CITY OF
PO BOX 656
MABTON WA 98935

APPENDIX J

WATER RIGHTS

CG4-29212C

STATE OF WASHINGTON

APPLICATION FOR CHANGE/TRANSFER
OF WATER RIGHT

For filing with Ecology or with County Conservancy Boards

DEPT. OF ECOLOGY
Received
APR 27 2004
CENTRAL REGION OFFICE

A MINIMUM FEE OF $10.00 PAYABLE TO ECOLOGY MUST ACCOMPANY THIS APPLICATION

(Check all that apply.)

- ☐ Change purpose(s) of use
- ☐ Add purpose(s) of use
- ☐ Change point(s) of diversion/withdrawal
- ☒ Add point(s) of diversion/withdrawal
- ☐ Change/transfer place of use
- ☐ Other (i.e. consolidation, intertie, trust water)

Explain:_____

FOR OFFICE USE ONLY

CHANGE No._____ WRIA_____

DATE ACCEPTED____/____/____ BY_____

FEE $_____ REC'D ____/____/____

CHECK No. _____

SEPA: // Exempt // Not exempt

IF MORE SPACE IS NEEDED, ATTACH ADDITIONAL SHEETS (PLEASE PRINT OR TYPE CLEARLY)*

1. Applicant Information:

APPLICANT/BUSINESS NAME	PHONE NO.	FAX NO.
City of Mabton	(509)894-4096	(509)894-4813
ADDRESS P.O. Box 655		
CITY Mabton	STATE WA	ZIP CODE 98935

CONTACT NAME (IF DIFFERENT FROM ABOVE)	PHONE NO.	FAX NO.
Ildia Jackson	( ) Same	( ) Same
ADDRESS Same		
CITY Same	STATE	ZIP CODE

FOR OFFICE USE ONLY

APP. NO._____ PERMIT NO. _____ CERT. NO._____ CERT. OF CHANGE NO._____

2. Water Right Information:

WATER RIGHT OR CLAIM NUMBER	RECORDED NAME(S)
G4-29212C	City of Mabton
DO YOU OWN THE RIGHT TO BE CHANGED? ☒ YES ☐ NO IF NO, PROVIDE OWNER(S) NAME:	
HAS THE WATER BEEN PUT TO BENEFICIAL USE IN THE LAST FIVE (5) YEARS? ☒ YES ☐ NO	

Please attach copies of any documentation that demonstrates consistent, historical use of water since the right was established. Also, if you have a water system plan or conservation plan, please include a copy with your application.

3. Point(s) of Diversion/Withdrawal:

A. Existing

SOURCE	NO.	¼	¼	SEC.	TWP.	RGE.	PARCEL #	WELL TAG #
Well #4		**NW**	**NE**	**1**	**8**	**22**		**ABR606**

B. Proposed

SOURCE	NO.	¼	¼	SEC.	TWP.	RGE.	PARCEL #	WELL TAG #
Well #5		**SE**	**NE**	**1**	**8**	**22**		
DO YOU OWN THE EXISTING AND PROPOSED POINT(S) OF DIVERSION/WITHDRAWAL? EXISTING: ☒ YES ☐ NO PROPOSED: ☐ YES ☐ NO – IF NO, PROVIDE OWNER(S) NAME:								

Please include copies of all water well reports involved with this proposal. Also, if you know the distances from the nearest section corner to the above point(s) of diversion/withdrawal, please include that information in Item No. 6 (remarks) or as an attachment.

4. Purpose of Use:

A. Existing

PURPOSE OF USE	GPM or CFS	ACRE-FT/YR	PERIOD OF USE
Municipal Supply	**1,000**	**452.4**	**Continuous**

B. Proposed

PURPOSE OF USE	GPM or CFS	ACRE-FT/YR	PERIOD OF USE
Municipal Supply	**1,000**	**452.4**	**Continuous**

5. Place of Use:

A. Existing

LEGAL DESCRIPTION OF LANDS WHERE WATER IS PRESENTLY USED:							
Existing City Limits							
¼	¼	SEC.	TWP.	RGE.	COUNTY	PARCEL #	# OF ACRES

DO YOU OWN ALL THE LANDS IN THE EXISTING PLACE OF USE? ☐ YES ☒ NO – IF NO, PROVIDE OWNER(S) NAME:
City Residents, various businesses, School District and churches

B. Proposed

LEGAL DESCRIPTION OF LANDS WHERE NEW USE IS PROPOSED:							
Same							
¼	¼	SEC.	TWP.	RGE.	COUNTY	PARCEL #	# OF ACRES

DO YOU OWN ALL THE LANDS IN THE PROPOSED PLACE OF USE? ☐ YES ☒ NO – IF NO, PROVIDE OWNER(S) NAME:
City Residents, various businesses, School District and churches

Attach a detailed map of your proposed change/transfer. The map should show existing and proposed point(s) of diversion/withdrawal, place of use and any other features involved with this application. If platted property, please include a certified copy of the plat map.

Are there any ADDITIONAL WATER rights OR CLAIMS RELATED to the same property as the ONE PROPOSED FOR CHANGE/TRANSFER?
☐ YES ☒ NO – IF YES, PROVIDE THE WATER RIGHT/CLAIM NUMBER(S):

6. Remarks and Other Relevant Information:

Mabton needs a second point of withdrawal to supplement Well #4 in order to maintain adequate water service to the City residents. Well #4 production has dropped to one-half of it's original pumping capacity. Well #4 now produces 500 gpm instead of the original 1,000 gpm.

IF FOR SEASONAL OR TEMPORARY, START DATE ____/____/____ END DATE ____/____/____

7. Signatures:

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I am hereby granting staff from the Department of Ecology or the County Conservancy Board access to the above site(s) for inspection and monitoring purposes. If assisted in the preparation of the above application, I understand that all responsibility for the accuracy of the information rests with me.

Odea Jackson — 3/10/04
(Applicant) (Date)

Odea Jackson — 3/10/04
(Water Right Holder) (Date)

Odea Jackson — 3/10/04
(Land Owner(s) of Existing Place of Use) (Date)

IMPORTANT! APPLICATION FILING INFORMATION IS PROVIDED ON THE NEXT PAGE.

WE ARE RETURNING YOUR APPLICATION FOR THE FOLLOWING REASON(S):

☐ APPLICATION FEE NOT ENCLOSED ☐ MAP NOT INCLUDED or INCOMPLETE

☐ ADDITIONAL SIGNATURES REQUIRED ☐ SECTION _____ IS INCOMPLETE

☐ OTHER/EXPLANATION: _____

STAFF: _____ ***DATE:*** ____/____/____

WATER CONSERVANCY BOARD

Application for Change/Transfer
Report of Examination

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water ☒ Ground Water

DATE APPLICATION RECEIVED	PERMIT NUMBER	CERTIFICATE NUMBER	CHANGE APPLICATION NUMBER
		G4-29212C	YAKI-04-03

NAME
City of Mabton

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 655	Mabton	WA	35

Changes Proposed:

☒ Point of Diversion/Withdrawal ☒ Place of Use ☐ Purpose ☐ Temporary ☐ Other

DECISION HISTORICAL SUMMARY

Existing Use						Proposed Use					
QUANTITY, TYPE OF USE, PERIOD OF USE						QUANTITY, TYPE OF USE, PERIOD OF USE					
1,000 gpm, 452.4 ac-ft/yr, municipal , continuous						1,000 gpm, 452.4 ac-ft/yr, municipal , continuous					
Point of Diversion or Withdrawal						Point of Diversion or Withdrawal					
SOURCE			TRIBUTARY OF (IF SURFACE WATER)			SOURCE			TRIBUTARY OF (IF SURFACE WATER)		
(Type existing water source)			(Type in existing tributary)			(Type in proposed water source)			(Type in existing tributary)		
NO.	–	–	SECTION	TOWNSHIP N.	RANGE,	NO.	–	–	SECTION	TOWNSHIP N.	RANGE,
4	NW	NE	1	8	22E	4	NW	NE	1	8	22E
						5	SE	NE	1	8	22E
Place of Use						Place of Use					
LEGAL DESCRIPTION OF LANDS WHEREWATER IS PRESENTLY USED:)						LEGAL DESCRIPTION OF LANDS WHERE NEW USE IS PROPOSED					
Mabton city limits and residences outside the city limites being located south of Wandling Street, west of Allison Road, north of the Mabton West Lateral and east of Boundary Road within Section 31, T9N, R23 EWM, Section 6, T8N, R23 EWM and Section 1 T8N, R22 EWM						Water service area defined by most recent water system plan.					
NO.	–	–	SECTION	TOWNSHIP N.	RANGE,	NO.	–	–	SECTION	TOWNSHIP N.	RANGE, (

SEPA
The board has reviewed the provisions of the State Environmental Policy Act of 1971, Chapter 43.21C RCW and the SEPA rules, chapter 197-11 WAC and has determined the application is: ☒ Exempt ☐ Not exempt

Water right priority date: February 24, 1987

BOARD'S TENTATIVE DETERMINATION

MAXIMUM CUB FT/ SECOND	MAXIMUM GAL/MINUTE	MAXIMUM ACRE-FT/YR	TYPE OF USE, PERIOD OF USE				
	1,000	452.4	Municipal, continuous				
SOURCE			TRIBUTARY OF (IF SURFACE WATER)				
AT A POINT LOCATED: PARCEL NO.	–	–	SECTION	TOWNSHIP N.	RANGE	WRIA	COUNTY
	NW	NE	22E			37	Yakima
	SW	NE	22E			37	Yakima
LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED							
. Water service area defined by most recent water system plan.							
PARCEL NO.	–	–	SECTION	TOWNSHIP N.	RANGE,		

DESCRIPTION OF PROPOSED WORKS
Drill and equip Well #5.

DEVELOPMENT SCHEDULE		
BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	COMPLETE CHANGE AND PUT WATER TO FULL USE BY THIS DATE:
2005	2006	2006

REPORT

This application for an additional point of withdrawal for the City of Mabton's existing Certificate of Water Right G4-29212C was filed with the Yakima County Water Conservancy Board by the City of Mabton. Mr. Alan Rainey, P.E., L.H.G., from Spink Engineering represented the City. Spink's hydrogeological subconsultant, Kennedy-Jenks Consultants, provided an evaluation of impairment. The following report summarizes information was obtained from the applicant, individuals with relevant knowledge, review of Department of Ecology records, and analyses of pertinent data.

BACKGROUND

The City of Mabton currently has three wells, Wells #2, #3 and #4, that supply water for municipal uses. Well #2 is used only in emergency situations due to the public complaints about the hydrogen sulfide in this well.

Well #3 is high in nitrates. In 2001, the Department of Health approved mixing of Well #3 water with Well #4 water in order to keep nitrate levels below 10 mg/l (Attachment D). In 2002, the pump bowls in Well #3 had to be lowered.

Well #4 was constructed in 1987. The completed well produced 1,000 gpm. Over the next 10 years the production in the well decreased to the current production rate of 450 to 500 gpm. In order to keep the bowls submerged, they had to be lowered 60 feet in 2001.

In June and August of 2003 the water reservoir was drained when one of the well pumps failed. The City was forced to turn off all the water to the customers for several hours at a time in order to allow the reservoir to fill up for fire protection. The overall trend is that ground water levels in the area are dropping. An additional well will provide extra capacity to help keep up with peak demands. The pump for the new well will be sized to pump 500 to 550 gpm.

As indicated in the August 27, 2004 report from Kennedy-Jenks Consultants, Mabton plans to drill a new well to the same approximate depth of Well #4 in order to withdraw water from the same aquifer. Adding the new well, which would be called Well #5, is the primary purpose of this application. Well #4 is cased and sealed to approximately 420 ft, and is open between 420 ft and 740 ft. Based on geologic data for the area, this well is open to aquifers hosted by the Umatilla Member of the Saddle Mountains Basalt of the Columbia River Basalt Group.

The City also requests that the place of use be defined as "Water service area defined by most recent water system plan". This language is more consistent with the place of use allowed under the 2003 revisions to municipal water law.

INVESTIGATION

Steve Pickett of the board made a site visit on May 28, 2004. Mr. Pickett visited the proposed site for Well No. 5 and the sites of the City's existing Wells No. 2, and 4.

The applicant is requesting an additional point of withdrawal to drill and equip an additional well located in the SE1/4, NE1/4, Sec 1, T8N, R22EWM. No change in purpose of use, currently identified as municipal, is requested. No increase in "maximum gallons per minute" is requested. No change in the "maximum acre-feet per year" is requested. The effect of an additional point of withdrawal will be the withdrawal of ground water from the same water bearing strata, from another location within the current place of use.

The applicant holds two water right certificates. The first, G3-00027C, is for Wells #2 and #3. These wells were drilled and equipped prior to the enactment of the ground water code in 1945, and were brought into the state's system in 1971 at the encouragement of Ecology. The certificate has a priority date of March 3, 1971, and lists Qi = 1,400 gpm and Qa = 280 ac-ft/yr. The second certificate is the certificate for Well #4, G4-29212C. This certificate has a priority date of February 24, 1987 and lists Qi = 1,000 gpm and Qa = 452.4 ac-ft/yr. The instantaneous quantity is primary, that is, additive to the 1971 certificate. The annual quantity is described as a supplemental right, that is, the City may withdraw no more that 452.4 ac-ft/yr from the three wells identified in the two certificates.

The applicant has indicated to the board that at this time it does not intend to combine the two certificates so that the total instantaneous quantity could be withdrawn from any combination of the City's wells.

DEMONSTRATED USE

The subject water right was certificated in August 1992. For the purposes of the application for an additional point of withdrawal, the valid transferable right under Certificate of Water Right No. G4-29212C is represented by a full allotment of 1,000 gpm and 452.4 ac-ft/yr for continuous municipal supply. Water use data provided to the board indicate that the existing well has pumped up to 596 ac-ft/yr, an amount in excess of the City's annual withdrawal quantity. Although this fact does indicate that the right has been fully put to beneficial use, the City's water use exceedance is an enforcement matter that is beyond the board's purview. The applicant has indicated to the board that it is working with Ecology and Health to address this issue.

PLACE OF USE

The place of use will essentially remain unchanged, but will be reworded to the following, "Water service area defined by most recent water system plan." This language is more consistent with the 2003 municipal water law revisions to the state water code.

IMPAIRMENT ANALYSIS

The requested additional well would be located approximately 2,000 feet east of existing Well #4. A map showing the location of the proposed well relative to other City wells, as well as to other wells drilled to the same general depth as Well #4, is shown in the August 27, 2004 Kennedy-Jenks impairment analysis report. The location for the new well was selected for three reasons. First, the new well location is on land that Mabton currently owns. Second, the location was selected to help minimize interference with existing well #4. Third, sight was selected because it is feasible to connect to the system as compared to another location across town that would require a greater amount of water line and crossings of the railroad and highway.

An impairment analysis report was submitted to the applicant's consultant, Spink Engineering, by Spink's hydrogeological subconsultant, Kennedy-Jenks Consultants. The analysis, subsequently submitted the board, concluded:

"Based on our analysis of . available hydrogeologic data and information, it is our opinion that the construction and pumping of the proposed Well No. 5 (open only to Umatilla Member – lower Saddle Mountains Basalt and pumped at a rate not to exceed 1,000 gpm, or at a lesser rate in conjunction with Well No. 4 that collectively does not exceed ~~12,000~~ gpm) would not likely cause injury to existing, adjacent non-city of Mabton water wells that are open to aquifers within the lower portion of the Saddle Mountains Basalt (Umatilla Member) or in the overlying aquifers. While there is no direct, scientifically defendable data on the hydraulic properties of the aquifers within the lower portion of the Saddle Mountains Basalt in the Mabton area, observations made during the 1987 pumping test of Well No. 4 suggest that the radius of influence during pumping is limited, with the radius of influence being less than 0.14 miles."

1,000

The board concurs with the analysis of ground water impairment completed by the applicant's consultant.

The board notes that the Kennedy-Jenks evaluation does not include an evaluation of impairment to surface water. However, it is the board's experience that analyses of the effects of withdrawals from deep aquifers on surface waters of the Yakima River basin are often speculative at best, and questions whether it is necessary or useful to ask the applicant to expend additional resources for such an analysis. Because there is no change in the overall Qi and Qa,, because the additional well is located reasonably close, i.e., within 2,000 ft, to the existing well, and because the existing and proposed withdrawals are from a confined aquifer that is not in hydraulic continuity with any nearby stream, the board concludes that it is unlikely that the requested change would impair surface waters in any measurable way.

The board encourages the City to continue working with Ecology and Health on either reducing its annual withdrawals or acquiring additional water rights to mitigate the exceedance of its annual withdrawal rights. These exceedances are much more likely to have an effect on nearby wells, as well as the Yakima River basin, than the requested change.

PUBLIC INTEREST

The subject application for change/transfer is consistent with public policy objectives of the Department of Ecology to provide for efficient use of water resources and to encourage supply through transfer of existing water rights. There has been no evidence or testimony of any detrimental effects to public interest brought to the attention of the board in connection with the requested transfer.

STATE ENVIRONMENTAL ACT (SEPA)

The project described by the requested change involves a transfer 1,000 gpm of ground water, an amount less than the 2,250 gpm threshold for preparing and circulating a SEPA checklist. The requested transfer is therefore categorically exempt pursuant to WAC 197-11-800(4) of the State Environmental Policy Act.

SPECIAL CONDITIONS

The priority date, instantaneous and annual quantities, and purpose of use for Certificate of Water Right G4-29212C will not be modified.

FINDINGS

1. There is a water right eligible for an additional point of withdrawal.

2. The proposed additional point of withdrawal will not enlarge the water right.

3. The proposed additional p . of withdrawal will be for the same body of public ground water as the original certificate.

4. The proposed additional point of withdrawal would not impair existing water rights.

5. Approval of the additional point of withdrawal would not be detrimental to public interest.

RECOMMENDATIONS

The board recommends that an order approving the requested additional point of withdrawal be issued as described below.

Certificate of Water Right G4-29212C

Name City of Mabton

Priority Date February 24, 1987

Quantities and Uses 1,000 gpm, 452.4 ac-ft/yr for continuous municipal supply.

Source **Well #4** located in NW_, NE_, Sec 1, T8N, R22E, W.M. WIRA 37, Yakima County
Well #5 located in SW_, NE_, Sec 1, T8N, R22E, W.M. WIRA 37, Yakima County

PROVISIONS

The following provisions are recommended to apply to the change authorization.

1. The total instantaneous quantity that can be withdrawn from the two wells used under this right is limited to 1,000 gpm. The authorized annual quantity of 452.4 ac-ft/yr is the maximum that can be withdrawn and used under this right and ground water certificate G3-00027C.

2. Unperforated well casing shall extend and be sealed into the dense interior of the Pomona Member of the Saddle Mountain Basalt Formation and the borehole shall extend into the Mabton Interbed, allowing withdrawals from the Pomona-Umatilla interflow, the Umatilla-Umatilla interflows and the Umatilla-Mabton interflow. Such casing and sealing shall be performed in accordance with the provisions and standards of WAC Chapter 173-160-075 through Chapter 173-160-305 (Minimum Standards for Construction and Maintenance of Water Wells).

3. An approved measuring device shall be installed and maintained for the source identified herein in accordance with the rule "Requirements for Measuring and Reporting Water Use", Chapter 173-173 WAC. Water use data shall be recorded weekly and shall be submitted annually to Ecology by January 31st of each calendar year typically.

4. The rule above describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation and maintenance requirements are enclosed or available from Ecology as a document entitled "Water Measurement Device Installation and Operation Requirements".

5. At a minimum, the following information shall be included with each submittal of water use data: owner, contact name if different, mailing address, daytime phone number, WRIA, Permit

or Certificate No., so[illegible] name, annual quantity used including units, maximum rate of diversion including units, period of use, monthly meter readings including units, and peak flow including units for each month. In the future, Ecology may require additional parameters to be reported or more frequent reporting.

6. Ecology prefers web based data entry, but does accept hard copies. Ecology will provide forms and electronic data entry information.

7. Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions, but only to the extent otherwise allowed by law.

8. For the purpose of making water level measurements, installation and maintenance of an access port as described in Ground Water Bulletin No. 1 is required. Installation and maintenance of an air line and gage is also required. The air line shall be constructed of 1/4 inch minimum diameter galvanized steel pipe, or comparable material if preapproved by the department. Distance from land surface to the bottom end of the air line shall be clearly posted at the well site, accurate at all times to 0.5 feet or less. The air line, access port, and all well equipment shall be installed and maintained to provide free access for accurate measurement of water levels at all times by both methods of measurement.

9. A proof inspection will be conducted prior to final certificate issuance. The certificate will reflect the extent of the project perfected within the limitations of the permit. Aspects will include as appropriate the source(s), system instantaneous capacity, beneficial uses(s), annual quantity, acreage, place of use, and satisfaction of provisions.

Signed at Yakima, Washington

This 3rd day of November, 2004

Jeff Stevens, Acting Chair
Yakima County Water Conservancy Board

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
15 West Yakima Avenue, Suite 200 • Yakima, Washington 98902-3452 • (509) 575-2490

December 16, 2004
CERTIFIED MAIL

City of Mabton
PO Box 655
Mabton WA 98935

RE: Water Right Change Application No. CG4-29212C (YAKI-04-03)

In accordance with RCW 90.80.080 the Department of Ecology has reviewed the Record of Decision (ROD), Report of Examination and all comments, protests, objections and other relevant information submitted by the Yakima County Water Conservancy Board (Board) for the above referenced applications for change.

The Department of Ecology has **MODIFIED** the decision of the Board as follows:

1. Certificate No. G4-29212C contains the following provision "This well shall be cased and permanently sealed into the Wanapum Formation. Such sealing and casing shall be performed in accordance with the provisions and standards of WAC Chapter 173-160-100 through Chapter 173-160-140 (Minimum Standards for Construction and Maintenance of Water Wells)".

   The City completed Well No. 4 under G4-29212C in the Saddle Mountain Basalt Formation. Based on a review of the Board record and Ecology files, Ecology has determined that the intent of the original case-and-seal provision has been satisfied and Well No. 4 is adequate as constructed. The Wanapum case-and-seal provision is DELETED.

2. The following language is ADDED to Provision No. 2 of the Board record:

   "Chip samples shall be collected and chemically analyzed for confirmation of stratigraphy. Samples shall be collected starting at the first occurrence of competent basalt/bedrock underlying the surficial sedimentary overburden and continue at ten foot intervals and at significant changes in lithology to the bottom of the well. Samples shall be labeled indicating the depth zone represented. Sample size should be approximately 8 oz (1 cup; ½ lb) each or, preferably, the equivalent of minimum 1/2 full quart size zip-lock type sample bag. Split samples shall be provided to Ecology. Number of samples and specific samples to be submitted for analysis will be determined by a qualified geologist or hydrogeologist. Chip samples should be clean and dry prior to submittal for lab analysis.

   Analysis required shall be X-Ray Fluorescence Analysis (XRF) for bulk rock and mineral analyses and include the following 27 major and trace elements (Si, Al, Ti, Fe, Mn, Ca, Mg, K, Na, P, Sc, V, Ni, Cr, Ba, Sr, Zr, Y, Rb, Nb, Ga, Cu, Zn, Pb, La, Ce, Th)."

FILE COPY

This Order may be appealed pursuant to RCW Chapter 43.21B. Any person wishing to appeal this Order must file an appeal with the Pollution Control Hearings Board **within thirty (30) days of receipt of this Order**. Send the appeal to: Pollution Control Hearings Board, PO Box 40903, Olympia, Washington 98504-0903. At the same time, a copy of the appeal **must** be sent to: Department of Ecology, Water Resources Appeals Coordinator, PO Box 47600, Olympia, Washington 98504-7600.

If you have any questions or concerns on the above information, please call Dan Haller at the Department of Ecology at (509) 454-4255.

Sincerely,

Robert F. Barwin
Water Resources Program

FILE COPY

DRH:gg
041216

cc: Sylvia Cervantes, Yakima County Water Conservancy Board
Janet Carlson, Ecology Eastern Regional Office
Carroll Palmer, Director, Natural Resources Division, Yakama Nation

Enclosure: Water Measurement Device Installation and Operation Requirements
Your Right to Be Heard

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT OF THE RETURN ADDRESS. FOLD AT DOTTED LINE

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Street, Apt. No.; or PO Box No.:

City, State, ZIP+4:

PS Form 3800, June 2002 — See Reverse for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

CITY OF MABTON
PO BOX 655
MABTON WA 98935

WR/gg CBD G-[illegible]212C

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery 12-[illegible]-04

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7003 2260 0006 9878 4640

PS Form 3811, August 2001 Domestic Return Receipt 102595-02-M-1540

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
15 West Yakima Avenue, Suite 200 • Yakima, Washington 98902-3452 • (509) 575-2490

May 14, 2007

City of Mabton
PO Box 655
Mabton WA 98935

RE: Water Right Change Application No. CG4-29212C (YAKI-04-03)

This modification order **SUPERSEDES** the previous order dated, December 16, 2004. The Department of Ecology (Ecology) received information from the City of Mabton and/or its representatives and Department of Health regarding source approval to bring a new well (well No. 5) on-line with the current water system. This new well was approved in the above referenced water right change decision, however, the ROE contained an error of the well location, therefore, this modification order will correct all references to the new well location. The original order issued in accordance with RCW 90.80.080, which modified the Yakima County Water Conservancy Board's Report of Examination (ROE) and Record of Decision (ROD).

The Department of Ecology has **MODIFIED** the decision of the Board as follows:

1. The location of Well No. 5 was incorrectly noted as being within the SW¼NE¼ of Section 1, T. 8 N., R. 22 E.W.M. in the Recommendations section and the BOARD'S TENTATIVE DETERMINATION section of the ROE. All references to the well location being within the SW¼NE¼ of Section 1, T. 8 N., R. 22 E.W.M are DELETED and REPLACED with "SE¼NE¼ of Section 1, T. 8 N., R. 22 E.W.M" consistent with the water right change application, the public notice and source approval documents.

2. Certificate No. G4-29212C contains the following provision, "This well shall be cased and permanently sealed into the Wanapum Formation. Such sealing and casing shall be performed in accordance with the provisions and standards of WAC Chapter 173-160-100 through Chapter 173-160-140 (Minimum Standards for Construction and Maintenance of Water Wells)".

   The City completed Well No. 4 under G4-29212C in the Saddle Mountain Basalt Formation. Based on a review of the Board record and Ecology files, Ecology has determined that the intent of the original case-and-seal provision has been satisfied and Well No. 4 is adequate as constructed. The Wanapum case-and-seal provision is DELETED.

FILE COPY

3. The following language is ADDED to Provision No. 2 of the Board record:

"Chip samples shall be collected and chemically analyzed for confirmation of stratigraphy. Samples shall be collected starting at the first occurrence of competent basalt/bedrock underlying the surficial sedimentary overburden and continue at ten foot intervals and at significant changes in lithology to the bottom of the well. Samples shall be labeled indicating the depth zone represented. Sample size should be approximately 8 oz (1 cup; ½ lb) each or, preferably, the equivalent of minimum 1/2 full quart size zip-lock type sample bag. Split samples shall be provided to Ecology. Number of samples and specific samples to be submitted for analysis will be determined by a qualified geologist or hydrogeologist. Chip samples should be clean and dry prior to submittal for lab analysis.

Analysis required shall be X-Ray Fluorescence Analysis (XRF) for bulk rock and mineral analyses and include the following 27 major and trace elements (Si, Al, Ti, Fe, Mn, Ca, Mg, K, Na, P, Sc, V, Ni, Cr, Ba, Sr, Zr, Y, Rb, Nb, Ga, Cu, Zn, Pb, La, Ce, Th)."

You have the right to appeal this order to the Pollution Control Hearings Board. Pursuant to Chapter 43.21B RCW, your appeal must be filed with the Pollution Control Hearings Board, and served on the Department of Ecology, within thirty (30) days of the date of your receipt of this document.

To appeal this order, your notice of appeal must contain a copy of the Ecology order you are appealing.

Your appeal must be mailed to:
The Pollution Control Hearings Board
PO Box 40903
Lacey WA 98504-0903

OR

Hand Deliver your appeal to:
The Pollution Control Hearings Board
4224 – 6th Ave SE Rowe Six, Bldg 2
Lacey WA 98503

Your appeal must also be served on:
The Department of Ecology
Appeals Coordinator
PO Box 47608
Olympia WA 98504-7608

In addition, send a copy to:
G. Thomas Tebb, L.E.G.
Department of Ecology
15 W Yakima Ave Ste 200
Yakima WA 98902-3452

If you have any questions or concerns on the above information, please call Scott Turner at the Department of Ecology at (509) 457-7106.

Sincerely,

G. Thomas Tebb, L.E.G.
Section Manager
Water Resources Program

GTT:MMD:gg/070530

cc: Sylvia Cervantes, Yakima County Water Conservancy Board
Janet Rajala, Ecology Eastern Region Office
Philip Rigdon, Deputy Director, Natural Resources Division, Yakama Nation

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT OF THE RETURN ADDRESS, FOLD AT DOTTED LINE

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7004 1160 0002 6158 3338

U.S. Postal Service™
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OFFICIAL USE

Postage	$
Certified Fee	
Return Receipt Fee (Endorsement Required)	
Restricted Delivery Fee (Endorsement Required)	
Total Postage & Fees	$

Postmark Here

Sent To City of Mabton

Street, Apt. No.; or PO Box No.

City, State, ZIP+4

PS Form 3800, June 2002 — See Reverse for Instructions

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

CITY OF MABTON
PO BOX 655
MABTON WA 98935

WR/gg SuperYAKI-04-03 CG4-29212C

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Cunasoo ☐ Agent ☐ Addressee

B. Received by *(Printed Name)*

C. Date of Delivery 5-15-07

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number
(Transfer from service label) 7004 1160 0002 6158 3338

PS Form 3811, February 2004 — Domestic Return Receipt — 102595-02-M-1540

SPINK ENGINEERING CIVIL & MUNICIPAL ENGINEERS
601 Knight Street • Richland, Washington 99352 • (509)9461-581 • Fax (509)946-6483

December 19, 2008

RECEIVED
DEC 22 2008
DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Melissa Downes
Water Resources Program
Department of Ecology
15 W. Yakima Ave, Suite 200
Yakima, WA 98902-3452

RE: Proof of Appropriation of Water
City of Mabton Water Right ~~CG4-2912C~~ CG4-29212C
Job #02-135

Dear Ms. Downes:

On behalf of the City of Mabton, I am submitting one copy of the "Proof of Appropriation of Water" form as requested. Please note the annual volume of water withdrawn exceeds the amount authorized by the water rights. Your office was informed of this situation during the review of the City's Comprehensive Water Plan. The plan was approved on September 19, 2005.

Mabton is following through with the goals outlined in the water plan. Currently, Mabton is looking for funds to purchase a water right that will provide the City with an additional 80 ac-ft annually. The City has also been in contact with a local farmer regarding possible excess annual volume for purchase. In January, Spink Engineering will begin a study on potential alternatives for irrigation water in Mabton, especially large areas within the City (parks and schools).

Please call if you have any questions or need more information.

Sincerely:

Alan Rainey

Alan Rainey, P.E.
Spink Engineering

cc: Velva Herrera, City of Mabton

02135ltr.15WRapproiation.wpd

WASHINGTON STATE DEPARTMENT OF ECOLOGY

OKV
CG 3-3-09
RECEIVED
DEC 22 2008
Reviewed by:
DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PROOF OF APPROPRIATION OF WATER

PERMIT NUMBER	CHANGE APPROVAL NUMBER
CG4-2912 C	CG4-~~2912C~~(YAKI-04-03) CG 4-29212 C

NAME OF PERMITTEE	CONTACT NAME (IF DIFFERENT)
CITY OF MABTON	Velva Herrera

MAILING ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 655	Mabton	WA	~~99352~~ 98935

PHONE NUMBER	FAX NUMBER
(509)894-4096	(509)894-4813

SOURCE(S) OF WATER	LOCATION OF SOURCE(S) NO.	¼	¼	SECTION	TOWNSHIP N.	RANGE, (E/W)M
Well #4		NW	NE	1	8	22
Well #5		SE	NE	1	8	22

LIST ALL PURPOSES WATER IS USED FOR:
Continuous Municipal Supply

DATE WATER WAS COMPLETELY APPLIED TO BENEFICIAL USE	TIME OF YEAR WATER IS USED:	IF SEASONALLY, LIST THE START AND END DATE
Well #4: 9/20/1988 Well #5: 10/ /2007	☒ Continuous/Year round ☐ Seasonal	Start: End:

DESCRIBE HOW CONSTRUCTION AND DEVELOPMENT RELATED PROVISIONS (AS REQUIRED BY PERMIT) HAVE BEEN OR ARE TO BE MET (USE ADDITIONAL SHEET OF PAPER IF NECESSARY)
Well #4 was constructed and put into use on 9/20/1988
Well #5 was constructed and put into use on 10/ /2007

DESCRIPTION OF SPECIFIC AREA ON WHICH WATER IS BENEFICIALLY USED(USE ADDITIONAL SHEET OF PAPER IF NECESSARY)
Mabton City Limits

NO.	¼	¼	SECTION	TOWNSHIP N.	RANGE, (E/W)M
—	—	—	—	—	—

PHYSICAL WITHDRAWAL OR DIVERSION INFORMATION

For Pump Designed Water System Information: Well #4

TYPE OF PUMP: ☐ Submersible ☒ Turbine ☐ Centrifical ☐ Other _____

MAKE	MODEL #	SERIAL #	HORSEPOWER
Layne	SAS - 95A6	—	125
MOTOR	**BHP**	**SPEED**	**RPM**
US Electric Motors	—	—	1,760

☒ Water lubricated ☐ Oil Lubricated

BOOSTER PUMP ☐ Yes ☒ No	BREAK HORSEPOWER	PRESSURE	OPEN DISCHARGE ☒ Yes ☐ No
		—	

PUMP DISCHARGE HEAD PRESSURE	DISCHARGE PIPE DIAMETER
30 psi	8-inch

Ecology Unique Well Identification Number ABR606 [Include a copy of the well log(s)]

PUMP SETTING (DEPTH)	STATIC WATER LEVEL	DYNAMIC (PUMPING) LEVEL
366	feet below land surface	feet below land surface

ACCESS PORT INSTALLED?	AIRLINE INSTALLED?	AIRLINE LENGTH
☒ Yes	☒ Yes	380 Ft.

For Pump Designed Water System Information: Well #5

TYPE OF PUMP: ☐ Submersible ☒ Turbine ☐ Centrifical ☐ Other _____

MAKE	MODEL #	SERIAL #	HORSEPOWER
FlowServe	10EML	—	60
MOTOR	**BHP**	**SPEED**	**RPM**
Emerson	—	—	1,780
☒ Water lubricated ☐ Oil Lubricated			
BOOSTER PUMP ☐ Yes ☒ No	**BREAK HORSEPOWER**	**PRESSURE**	**OPEN DISCHARGE** ☒ Yes ☐ No
PUMP DISCHARGE HEAD PRESSURE	**DISCHARGE PIPE DIAMETER**		
152 psi	8-inch		

Ecology Unique Well Identification Number ~~ABR606~~ [Include a copy of the well log(s)]

PUMP SETTING (DEPTH)	STATIC WATER LEVEL	DYNAMIC (PUMPING) LEVEL
259.5	76 feet below land surface	334 feet below land surface
ACCESS PORT INSTALLED?	**AIRLINE INSTALLED?**	**AIRLINE LENGTH**
☐ Yes	☐ Yes	Ft.

For Non-Pump Designed Water Systems

METHOD OF WATER DIVERSION		
N/A	**SCREEN MESH SIZE** N/A	**METHOD OF CONTROL** N/A

Ecology is an equal-opportunity employer. If you have special accommodation needs or require this publication in an alternate format, please contact Water Resources Program at (360) 407-6600 or TTY 711 or 1-800-833-6388.

USE OF WATER FOR:

1. Irrigation (Please include map of all irrigated lands):

TYPE OF SYSTEM	NUMBER OF SPRINKERS OR EMMITERS	SPRINKLER/EMMITER MAKE	MODEL & RATED DISCHARGE
N/A	—	—	—
SIZE NOZZLE/EMMITER OPENINGS	**AVERAGE PRESSURE AT SPRINKLER/EMMITER HEADS**	**NUMBER OF ACRES DEVELOPED**	**TYPE OF CROP(S)**
—	—	—	—

2. Municipal or Domestic Supply

NUMBER OF DOMESTIC UNITS CURRENTLY SERVED:	NUMBER OF DOMESTIC UNITS TO BE SERVED	POPULATION CURRENTLY SERVED
671	632	

ALSO, provide the following information, if applicable:

☒ Department of Health public water system identification number. 49650R

☒ Map of the delivery system (provide copy if water system is done)

☐ Map of present service area and lots presently using water (Non-Municipal Users).

☐ If platted property, provide copy of the file plat map or file reference number Non-Municipal Users).

☐ Other incidental beneficial uses associated with the domestic supply (Non-Municipal Users).

3. Industrial or Commercial

TYPE OF INDUSTRY OR COMMERCIAL PROCESS
Restaurants, grocery stores, gas station, nursery

If a waste discharge permit is required for the facility, include a reference to the permit number N/A

4. Other Use of Water (describe): NONE

WATER USE AND *MEASUREMENT

Well #4

IS A FLOW METER OR MEASURING DEVICE NSTALLED? ☒ Yes ☐ No	LOCATION OF METER(S) OR MEASURING DEVICE(S) In Well House #4, on discharge of well		
MAKE —	SERIAL NUMBER —	INSTALLATION DATE 06/1988	INSTALLED BY: Contractor: Walker Young
METER READING —	DATE —		

*Include copy of meter specifications

Well #5

IS A FLOW METER OR MEASURING DEVICE NSTALLED? ☒ Yes ☐ No	LOCATION OF METER(S) OR MEASURING DEVICE(S) In Well House #5, on discharge of well		
MAKE McCrometer	SERIAL NUMBER 07-03288-06	INSTALLATION DATE 6/2007	INSTALLED BY: Contractor: Fowler Construction
METER READING 52,939,700	DATE 12/18/2008		

*Include copy of meter specifications

Actual amount withdrawn or diverted from permanent system on an instantaneous and annual basis. Please include meter data or describe method used to estimate annual volume.

CUBIC FEET PER SECOND	ACRE FEET PER YEAR	GALLONS PER MINUTE	TOTAL GALLONS PER YEAR
	541	1,000	176,385,000

If the existing water use as indicated by meter data, etc., is less than you anticipate to be the full extent of the water right which you are reporting through submission of this form, please explain on a separate sheet.

I, Mayor Velva Herrera, do certify that I have completed appropriation of water under Water Right Permit or approved water right change number, CG4-2912 C. This notice and attached documents are true and accurate statements and describe and support my assertion that I have satisfied the terms of the permit/change in compliance with the law.

Permittee(s) Signature

12-18-08
Date

State of Washington
County of Yakima

Signed and sworn to (or affirmed) before me on Dec. 18, 2008 *by* Charles A. Fleshe

(Signature)

Assistant Superintendent
(Title)

My appointment expires 1/23/09

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. B
Permit No. 54-29212P

(1) OWNER: Name City of Mabton Address P.O. Box 655 Mabton, WA. 98935

(2) LOCATION OF WELL: County Yakima NW ¼ NE ¼ Sec. 1 T. 8 N. R. 22 E.W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) 4
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☒ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: 9 7/8" Diameter of well 15" 0-437 ft, 12" 437-594 and 10" 584-740.6 inches.
Drilled 740.6 ft. Depth of completed well 740.6 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 16" Diam. from 0 ft. to 134 ft.
Threaded ☐ 12" Diam. from 418 ft. to 437.7 ft.
Welded ☒ 10" Diam. from 411 ft. to 594 ft.
8" 563 729

Perforations: Yes ☒ No ☐
Type of perforator used Factory
SIZE of perforations 5/32 in. by 3 in.
perforations from 563 ft. to 726 ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☒
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 19 ft.
Material used in seal Bentonite & Cement
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 67 ft. below top of well Date 11-8-87
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? State of Washington
Yield: gal./min. with ft. drawdown after hrs.
" "
" see attached

RECEIVED
NOV 25 1987
DEPARTMENT OF ECOLOGY
CENTRAL REGIONAL

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
...	...	see attached			

Date of test
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 66 Was a chemical analysis made? Yes ☒ No ☐
*SEE ATTACHED

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Br sand	0	20
Br sandy clay	20	48
Cemented gravel	48	50
Gravel	50	62
Br sand clay	62	67
Gravel	67	129
Basalt grey	129	179
Br broken basalt	179	191
Br clay & basalt	191	203
Green clay	203	217
Gray clay & blue	217	259
Green clay	259	271
Gray clay	271	286
Br basalt	286	297
Med. black basalt	297	304
Black basalt	304	319
Trace of red	319	320
Black basalt	320	369
Hard grey basalt	369	418
Black basalt	418	423
Grey basalt	423	438
Black broken	438	442
Grey basalt	442	444
Black basalt	444	446
Grey basalt	446	459
Black broken	459	462
Med grey basalt	462	486
Very black broken	486	503
Black broken	503	517
Grey basalt	517	593
Black broken pyrite	593	610
Black basalt	610	667
Black basalt	667	673
Cracks in rock, black	673	677
Hard basalt	677	689
Fractured basalt	689	710

Work started May 26 19 87 Completed Nov. 6 19 87

WELL DRILLER'S STATEMENT: (continued)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME L & L Drilling, Inc. (Person, firm, or corporation) (Type or print)
Address P.O. Box 167 Wilson Creek, WA. 98860

[Signed] Larry Wehley (Well Driller)

License No. 0518 Date Nov. 11 19 87

(USE ADDITIONAL SHEETS IF NECESSARY)

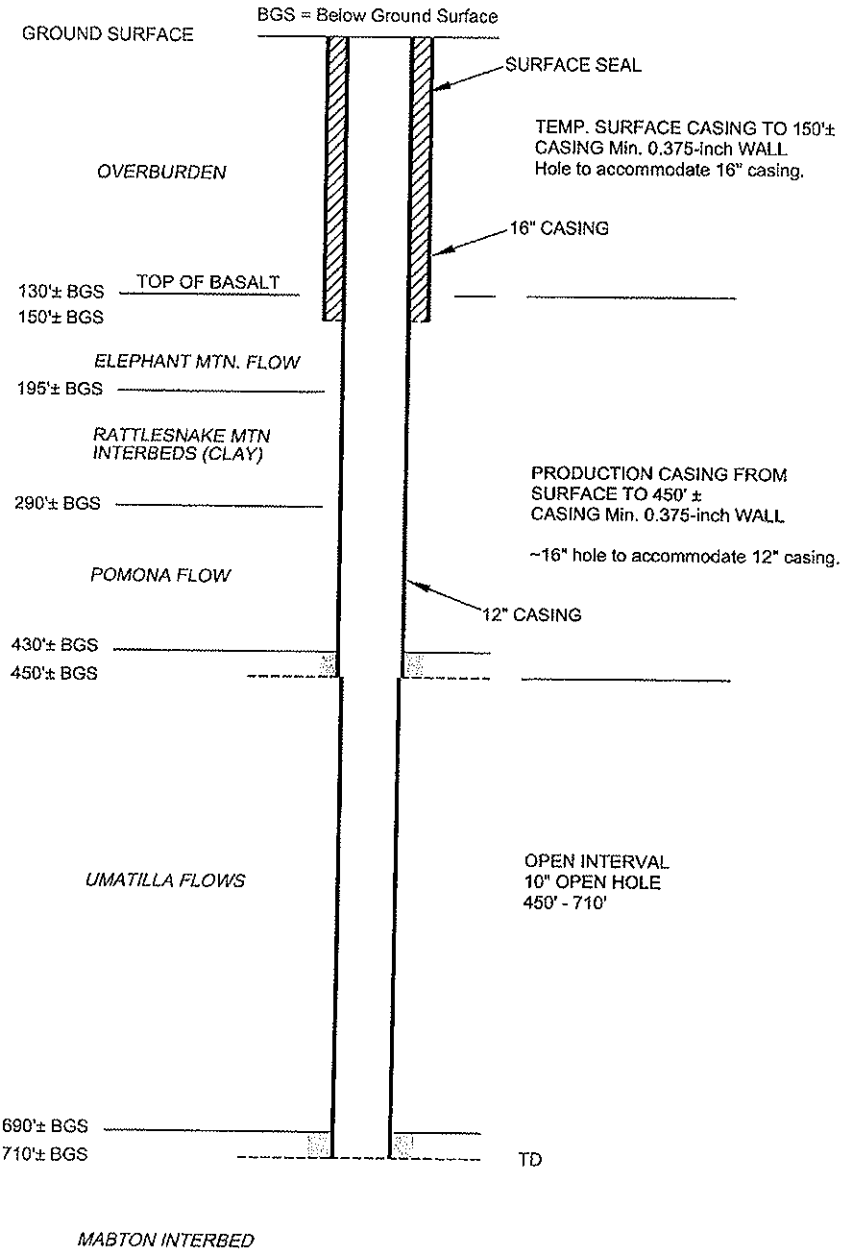
ECY 050-1-20

SJ

Well #4

CITY OF MABTON
WELL #5

GENERAL SCHEMATIC OF WELL DESIGN



February 1, 2006
02-135Well.dwg

Please print, sign and return to the Department of Ecology

Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

STATE OF WASHINGTON DEPARTMENT OF ECOLOGY

Construction/Decommission

☐ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W210571

Current Notice of Intent No. W210571

Unique Ecology Well ID Tag No. ALF995

Water Right Permit No. G4-29212C

Property Owner Name City of Mabton

Well Street Address Highway 12 & 3rd St

City Mabton County Yakima

Location SE 1/4-1/4 NE 1/4 Sec 1 Twn 8 R 22 ☑ E ☐ W WWM

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned ☐ Deepened *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 12 inches, drilled 710 ft. Depth of completed well 710 ft.

CONSTRUCTION DETAILS

Casing ☒ Welded 16" Diam. from 0 ft. to 135 ft.

Installed: ☐ Liner installed 12" Diam. from 72 ft. to 425 ft.

☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 135 ft.

Material used in seal Cement Grout

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Not allowed Depth of strata _____

Method of sealing strata off Cement grout at 425'

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 76' ft. below top of well Date 06-20-06

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Layne & Bowler

Yield: 500 gal./min. with 187 ft. drawdown after 1 hrs. (1hr 18 min.)

Yield: 680 gal./min. with 192 ft. drawdown after 1 hrs.

Yield: 800 gal./min. with 325 ft. drawdown after 1 hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
1:35	401'	1:45	82'	2:00	91'2"
2:05	80'6"				

Date of test 06-20-06

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

Artesian flow _____ g.p.m Date _____

Temperature of water 57° Was a chemical analysis made? ☒ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Silt Fine Sand & Gravel	0	17
Sand Stone small gravel	17	50
Silt Stone Sand gravel	50	135
Grey Basalt Hard	135	165
Brown Clay	165	180
Blue Green Clay	180	200
Blue Green Clay Stone	200	220
Ash, Clay Stone & Ash		
Ash Blue Small	220	250
amount Clay		
Blue Green Clay Stone	250	280
Sand Stone Conglomerate		
Black to Grey Basalt	280	300
Grey Basalt	300	366
Black Basalt	366	416
Grey Basalt	416	470
Brown Green Claystone	470	480
Black Broken	480	560
Grey Basalt	560	675
Black Broken	675	710
Basalt Claystone		
12" casing was cemented into Basalt at 425'		

4-10-06

Start Date [redacted] Completed Date 7-12-06

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) Robert DeBolt

Driller/Engineer/Trainee Signature Robert DeBolt

Driller or trainee License No. 2800

Drilling Company Blue Star Enterprises North West

Address 2019 Butler Loop

City, State, Zip Richland WA 99354

Contractor's Registration No. Blueswe 965 KG Date 8-28-06

IF TRAINEE, Driller's Licensed No. 28447

Driller's Signature [redacted]

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

WELL #5

Log of Borehole: City of Mabton Well No. 5

Also known as:

Project: City of Mabton Well No. 5 Well ID:

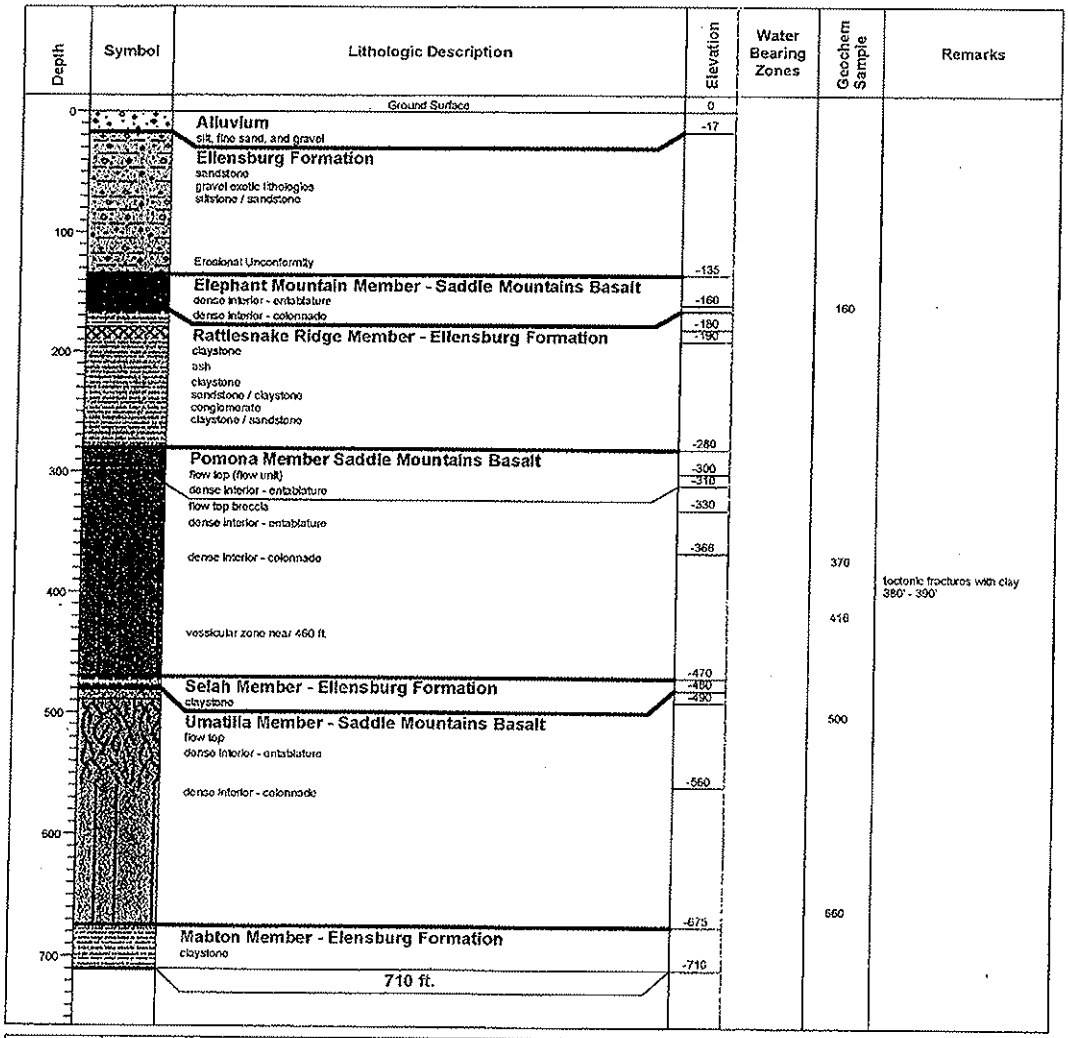
Location:

Geologist: Terry L. Tolan, LHG

Kennedy/Jenks Consultants

Engineers & Scientists

Kennedy/Jenks Consultants
1020 N. Center Parkway, Suite F
Kennewick, Washington 99336
509-734-9763
FAX 509-734-9764
www.kennedyjenks.com



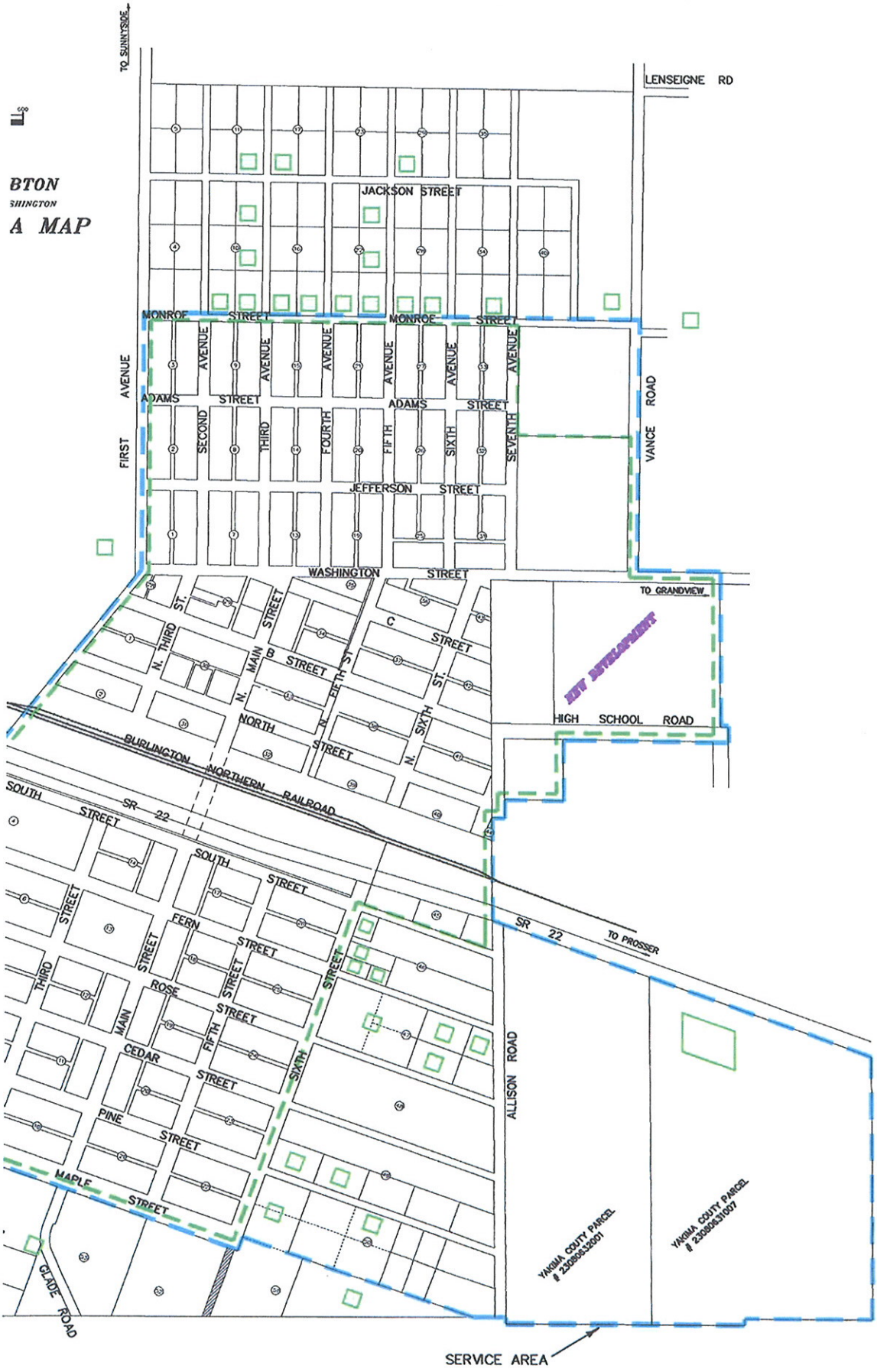
Drilled By: Blue Star Drilling

Drill Method: Air Rotary

Drill Date: May - June 2006

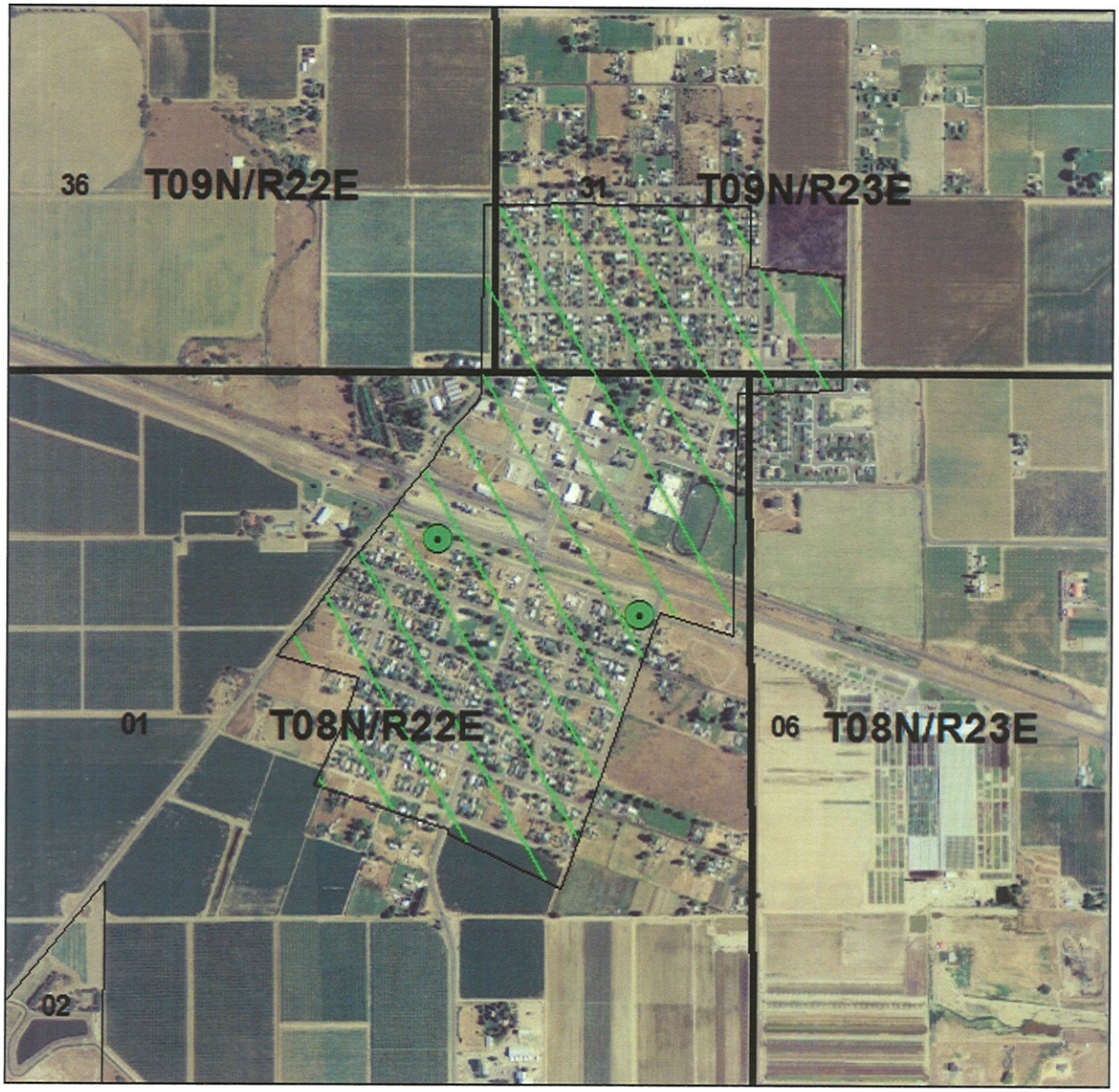
Total Depth: 710 ft.

BTON
SHINGTON
A MAP



LEGEND

Change Authorization No. CG4-29212C



0 700 1,400 2,800 Feet

N
W E
S

2011 Aerial Photo

Legend

- CG4-29212C
- CG4-29212C
- sections_2000
- township_2000

G3-00027C

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF WATER RIGHT

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
March 3, 1971	11644	G3-000279	G3-000276

NAME
CITY OF MABTON

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 655	Mabton,	Washington	98935

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown.

PUBLIC WATER TO BE APPROPRIATED

SOURCE
Two (2) wells

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	1400	280

QUANTITY, TYPE OF USE, PERIOD OF USE
To be used continuously for a municipal supply.

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
No. 1: 880 feet north and 590 feet east; No. 2: 710 feet north and 530 feet east; both from center of fraction 1.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NE¼	1	8	22 E.	37	Yakima

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)
	13	First Addition to the City of Mabton

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

City of Mabton

PROVISIONAL

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020.

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.180.

Given under my hand and the seal of this office at Yakima, *Washington, this* 3rd *day of* May, *19* 78.

Department of Ecology

by Russell K. Taylor

Russell K. Taylor, Regional Manager

ENGINEERING DATA

OK

1e

FOR COUNTY USE ONLY

S.F. No. 319-B—OS—6-67.

$10.00 examination fee should accompany each application.

STATE OF WASHINGTON
DEPARTMENT OF WATER RESOURCES
Division of Water Management

PRIORITY
Date 3-3-71
Time 11 AM
Accepted [illegible]

RECEIVED
MAR 3 1971
A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

APPLICATION FOR A PERMIT

To Appropriate Public Ground Waters
OF THE STATE OF WASHINGTON

Application No. G. W. 11644

I, TOWN OF MABTON
(Name of applicant)

of P. O. Box 655, Mabton, Washington 98935
(Complete post office address)

do hereby make application for a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights. This application is made under the provisions of Chap. 263 of the Session Laws of 1945, and amendments thereto of the State of Washington and subject to the rules and regulations of the Department of Water Resources.

1. *The proposed appropriation will be from* 2 wells
(Well, tunnel, infiltration trench)

located Mabton, Washington
(Give approximate distance and direction from nearest city or town)

Area ..... (Leave blank) *Sub-area* ..... (Leave blank)

Zone ..... (Leave blank)

Applicant's name or number of well or other works, if any City of Mabton

2. *The quantity of water which applicant intends to withdraw for beneficial use is* ~~1100 - 300~~ 1400 total USE

gallons per minute; ..... *acre feet per year.*

3. *The use or uses to which water is to be applied*

~~Domestic,~~ Municipal Supply
(Domestic supply, irrigation, municipal, manufacturing, industrial use, etc.)

4. *The time during which water will be required each year* ~~continous~~ continuously

5. *Location of well or other works for withdrawal of water: In county of* Yakima

(a) #1 North 880 feet, East 590 feet, ~~from center sec. 1, T.8N. R22E WM~~
#2 North 710 feet, East 530 feet, from center sec. 1, ~~T.8N. R22E WM~~
(Give distance and bearing from nearest corner of section or legal subdivision)

being within the NE 1/4 (Give smallest legal subdivision) *of Sec.* 1, *Twp.* 8 *N., Rge.* 22E (E. or W.)

or ~~(b) If within limits of recorded platted property, town or city: Lot~~ ....., *Block* 13,

of The plat of First Addition to the Town of Mabton
(Give name of plat or addition) (If within town or city, give name)

(c) Show this location on accompanying section plat. Other adequate maps or drawings will be acceptable.

6. DESCRIPTION OF WORKS:

(a) Well will be drilled (Dug or drilled) and have a diameter of 8" - 6" inches and an estimated depth of 1100 - 1000 ft.

(b) Tunnels or trenches to be described: (Attach additional sheets if needed for full description.)

(c) Distribution system to be described:

City System

(d) If pumps are to be used, give size and type:

(e) Give capacity and type of motor or engine to be used:

(f) If the location of the well, tunnel, or other works is less than one-fourth mile from a natural stream or stream channel, give the distance to the nearest point on each of such channels and the difference in elevation between the stream bed and the ground surface at the source of development:

(g) Ownership of each existing well or other works from which ground water is withdrawn within a radius of one-quarter mile and the distance and direction from well or other works being reported herein:

(Name)	(Direction)	(Distance)
(Name)	(Direction)	(Distance)
(Name)	(Direction)	(Distance)

SUPPLY THE FOLLOWING INFORMATION ACCORDING TO USE PROPOSED:

7. For Municipal Supply: To supply the city, town, or community of Mabton, in the county of Yakim, having a present population of 958, and an estimated population of ....., in 19.....

8. For Irrigation: Number of acres to be irrigated ..... acres.

9. *Legal Description of Property on which water is to be used for all purposes other than municipal supply:*

(Copy legal description from deed)
(If more space is required, attach separate sheet)

~~Block 3 City Plat~~
~~Area Served by the~~ CITY
OF MABTON

5/5/70

(On accompanying plat show location of the existing wells or works)

10. *What interest do you have in the above described property?* Owner

(Owner, lessee, contract buyer, etc.)

11. *Do you have any other water rights appurtenant to the above described property?* no

If so, from what source?

12. *Construction work will begin on or before* 1935 - 1955

13. *Construction work will be completed on or before* 1936 - 1956

14. *Water will be put to complete beneficial use on or before* 1936 - 1956

Town of Mabton
Yvonne Silbaugh, City Clerk Treasurer
(Signature of applicant)

15. *Name and address of owner of land on which well or works are located:*

Town of Mabton (Name) — P.O. Box 655, Mabton, Wash. (Address)

Yvonne Silbaugh, City Clerk Treasurer
(Signature of legal landowner)

Signed in the presence of us as witnesses:

Jerry O Cooley (Name) — 518 5th 3rd (Address of witness)

Annie Van Nostern (Name) — Box 207 (Address of witness)

STATE OF WASHINGTON,
COUNTY OF THURSTON. } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion as follows:

In order to retain its priority, this application must be returned to the Department of Water Resources, with corrections, on or before ....., 19.....

WITNESS my hand this ..... *day of* ....., 19.....

Division of Water Management.
Department of Water Resources.

DIRECTIONS FOR PREPARING APPLICATIONS

1. Initial examination fee of $10.00 should accompany each application. If additional fee is required, you will be notified.

2. Write plainly in ink or use typewriter.

3. Read carefully all questions. Answer only those that apply to your project.

4. Under Question 2 estimate in gallons per minute and acre-feet per year the quantity of water that will be required for your proposed use.

5. A map showing the location of well or other works and place of use, must be made on the enclosed section plat. If for irrigation, show the approximate area to be irrigated. Show also location of other existing wells or other works for withdrawing ground water within a radius of one-quarter mile.

6. In answering Question 5, give the distance and direction of location of well or other construction works for withdrawal of water from the nearest 40-acre corner or other legal subdivision, as

"320 feet north and 1100 feet east from the southwest corner of Sec. 1, Twp. 13 N., Rge. 2 E.W.M.," or

"North 36° 20' east 500 feet from the northeast corner of NW¼ of SW¼ of Sec. 33, Twp. 12 N., Rge. 3 E.W.M.," or

If within the limits of incorporated town or city:

"Lot 4, Block 6 of Churchill's Addition to the City of Spokane, Washington."

7. Be sure to give on the map brief directions for driving to the location of the well or other works from some town or easily located point on a state highway. This is for our convenience in making the examination.

8. If you have been using ground water since before June 7, 1945, it will not be necessary to secure a permit from the state for this purpose.

9. Sign application on the line indicated under Section 14.

SCHEDULE OF FEES DUE IN CONNECTION WITH OBTAINING GROUND WATER RIGHTS

Examination Fees: There is a minimum fee of $10.00 for each application received. This fee covers all withdrawals up to and including 2250 gallons per minute. There is an additional examination fee of $2.00 for each 450 gallons per minute, or fraction thereof, over 2250 gallons per minute.

Fees for Filing and Recording Permits: There is a minimum fee of $5.00 for filing and recording a permit.

For irrigation, permit fees are as follows:

40¢ per acre, up to and including 100 acres;

20¢ per acre over 100 acres to 1,000 acres, inclusive;

10¢ per acre over 1,000 acres.

Permit fee for other uses: Twice the examination fee.

Fee for filing and recording certificate: There is a minimum fee of $5.00.

1/8/22

899 4096

REPORT OF INSPECTION

Proof of Appropriation

Telecom

Application No 11644 Permit No 6300027 Date of Inspection 3/23/78

Name Town of Mabton Address _____ County Yakima

Advertised Legal Sub. Blk 13 Plat of First Add to Mabton

Section 1, Township 8 North, Range Yakima 22 W.M.

Status of Development

Terms of Permit	Reported in Proof	As Developed
Source 2 wells		2 Wells
Quantity 1400 GPM		1400 GPM
Point of Diversion Same as permit		
Use municipal supply	"	"
Acreage		
System		
Fish and Game Provisions		
Place of Use Town of Mabton	Same As Permit	

Inspected by: [signature]
Telecom

Remarks and Recommendations:

#2 75 HP Turbin 1000 gpm
#1 40 HP Turbin 400 gpm
As reported by superintendent on 3/23/78

ok for cert

Report of Examination on Ground Water

Received date March 3, 1971 Date of exam. August 18, 1971 Appl. No. 11644

Name Town of Mabton Address P.O. Box 635, Mabton, WA 98935

Type of works Two (2) wells Dimensions 8" x 1100' and 6" x 1004'

Progress of works Completed

Quantity applied for 1400 g.p.m. acre-feet per year

Legal sub Block 13 / of the plat of First Addition to the Town of Mabton Sec. 1 Twp. 8 N. Rge. 22 E. County Yakima

Use Municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population 950 as of Present

Industrial

Time pump will be operated Continuously

Other water rights appurtenant to this land

Proximity to existing works, springs, wells, or streams

Area Sub-area Zone

RECOMMENDATIONS

Approved for 1400 g.p.m. 280 acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons.)

The field investigation for this application was made by A. H. King, Watermaster, Eastern Washington Region.

"The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The applicant may, for his own convenience, wish to install an airline and gage in addition to the access port."

"A suitable measuring device shall be installed and maintained in accordance with WAC 508-64-020 through WAC 508-64-040." (Installation, operation and maintenance requirements attached hereto.)

Use of the waters to be appropriated under this application will be for a public water supply. State Board of Health rules require every owner of a public water supply to obtain written approval from the Assistant Secretary, Division of Health prior to any new construction or alterations of a public water supply. The applicant is advised to contact the Washington State Division of Health, Public Health Bldg. No. 4, Thurston Airdustrial Center, Olympia, with regard to the need for compliance.

The annual withdrawal rate, 280 acre-feet, is based upon a per capita demand of 250 gallons per person per day and a population of 1000.

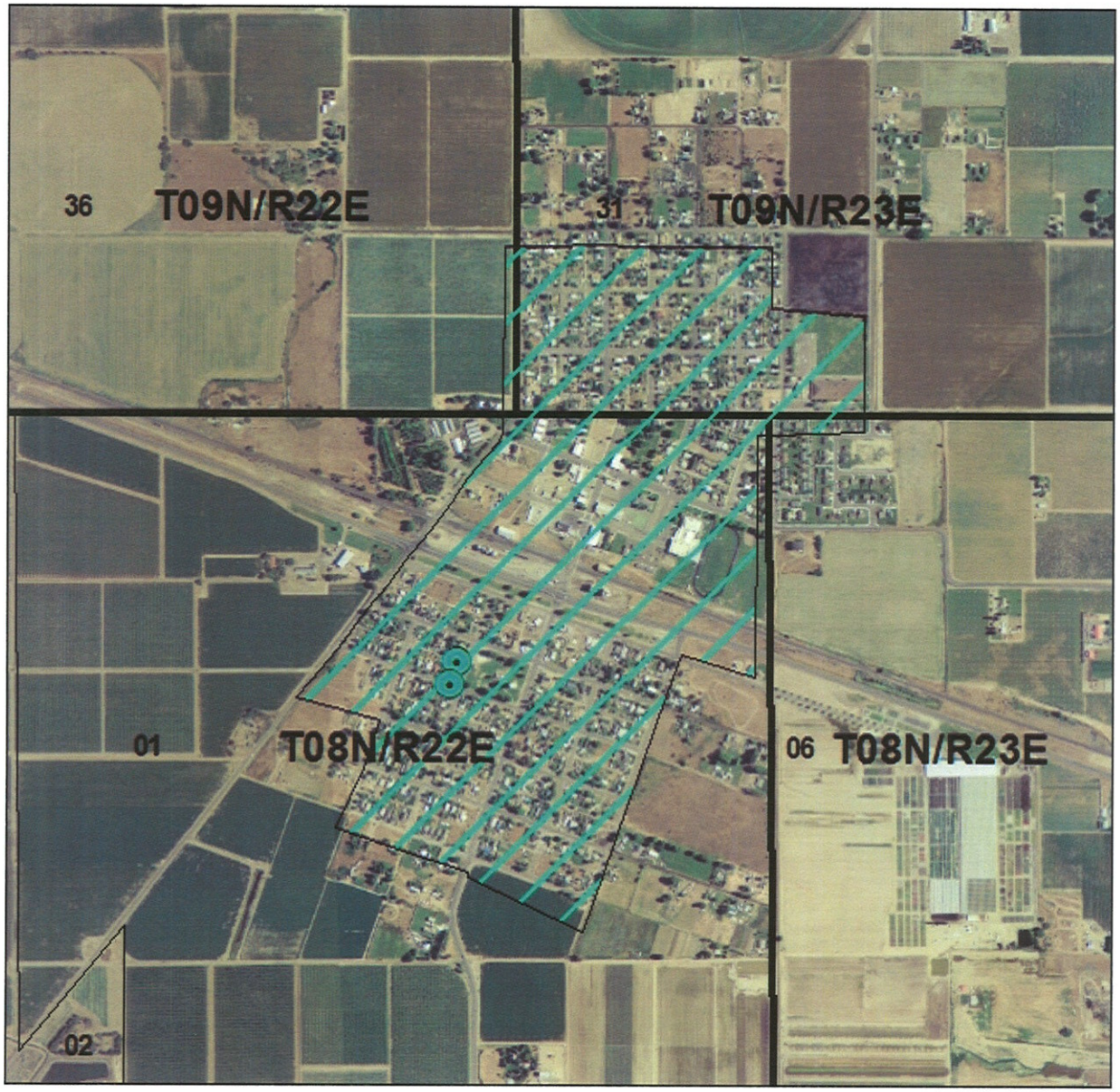
Applicant claims that these wells have been in use since the mid 1930's and may enjoy a vested right for the usage of water. Therefore, in order to prevent the establishment of duplicatory rights, permit shall be conditioned by the following: "The total annual withdrawal shall be limited to 280 acre-feet, less any amount utilized under existing rights."

Additionally, the permit when issued shall carry the following provision: "Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including those administered by local agencies under the Shoreline Management Act of 1971."

Signed at Olympia, Washington,
this 29 day of Dec., 1972.

WILLIAM R. SMITH, Geologist
Department of Ecology

Ground Water Certifcate No. G3-00027C



0 700 1,400 2,800 Feet

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2011 Aerial Photo

Legend

- G3-00027C
- G3-00027C
- sections_2000
- township_2000

G3-00381C

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF WATER RIGHT

[ ] [illegible]

[X] [illegible]

CERTIFICATE NUMBER	PERMIT NUMBER	APPLICATION NUMBER	PRIORITY DATE
G3-00381C	G3-00381P	11937	June 2, 1971

NAME
TOWN OF MABTON

P. O. Box 655	Mabton,	Washington	98[illegible]

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of [illegible] of a right [illegible] public waters [illegible] Washington as herein defined, and under and spe[illegible] subject to [illegible] Department of Ecology, and that said righ[illegible] said waters [illegible] State of Washington, and is here[illegible] firmed by the Department of Ecology [illegible]

PUBLIC WATER TO BE APPROPRIATED

SOURCE
a well

	15	2

15 gallons per minute; 2 acre-feet per year for continuous municipal supply

LOCATION OF DIVERSION WITHDRAWAL

200 feet south and 20 feet east from the north quarter of Sec. 31

[illegible]	31	9	23 E.	37	Yakim

RECORDED PLATTED PROPERTY

LEGAL DESCRIPTION OF PROPERTY WATER TO BE USED ON

Area served by Town of Mabton.

PROVISIONS

Certificate holder shall maintain an access port as described in Ground Water Bulletin No. 1.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in 90.14.180

Given under my hand and the seal of this office at Olympia, Washington, this **16th**

day of September *19* 74

JOHN A. BIGGS, *Director*
Department of Ecology

by
R. Jerry Rollin, Assistant Director

ENGINEERING DATA

FOR COUNTY USE ONLY

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF WATER RIGHT

[ ] [illegible]

[X] [illegible]

CERTIFICATE NUMBER	PERMIT NUMBER	[illegible]	PRIORITY DATE
G3-00381C	G3-00381P	11937	June 2, 1971

TOWN OF MABTON

P. O. Box 655 Mabton, Washington 98935

[illegible] to the satisfaction of the Department of Eco[illegible] and under and specific[illegible] and that said right to [illegible] Washington and is hereby [illegible]

PUBLIC WATER TO BE APPROPRIATED

a well

15 2

15 gallons per minute; 2 acre-feet per year for continuous municipal supply

LOCATION OF DIVERSION AITHDRAWAL

200 feet south and 20 feet east from the north quarter of Sec. 31

NW¼NE¼	31	9	23 E.	37	Yakima

RECORDED PLATTED PROPERTY

LEGAL DESCRIPTION OF PROPERTY WATER TO BE USED ON

Area served by Town of Mabton.

PROVISIONS

Certificate holder shall maintain an access port as described in Ground Water Bulletin No. 1.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided 90.14.180

Given under my hand and the seal of this office at Olympia Washington, this **16th** *day of* December , 19 74 .

JOHN A. BIGGS *Director*
Department of Ecology

ENGINEERING DATA
OK WRA

BY
R. Jerry Bollen, Assistant Director

FOR COUNTY USE ONLY

S. F. No. 7254—(Rev. 6-71)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Permit to Appropriate Public Waters of the State of Washington

Book No. ——— of Ground Water Permits, on page 1 G3-001817 under Application No. 11937

TOWN OF HABTON

of Habton, Washington

is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

Priority date of this permit is June 2, 1971

Source(s) of the proposed ground water appropriation is/are a well

The quantity of water appropriated shall be limited to the amount which can be beneficially applied and not to exceed 15 gallons per minute; 2 acre-feet per year, to be used for the following purposes: municipal supply

, as more definitely set out below.

Approximate location(s) of the point(s) of withdrawal is are: 200 feet south and 20 feet east from the NW corner of Sec. 31

being within NW¼NE¼

of Sec. 31 Twp. 9 N., Rge 23 E. W.M. Yakima County.

The use, or uses, to which water is to be applied:

~~Domestic~~/municipal supply: 15 gallons per minute; 2 acre-feet per year, during entire year.

Irrigation: gallons per minute; acre-feet per year from

to each year, for the irrigation of acres.

Other use(s) gallons per minute, acre-feet per year, from

to each year, for

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by Town of Habton.

ADDITIONAL LIMITATIONS AND PROVISIONS: The installation and maintenance of an access port as described in Ground Water Bulletin No. ' shall be required prior to issuance of final Certificate of Water Right.

DESCRIPTION OF PROPOSED WORKS:

The well will be **drilled** (Dug or drilled) and have a diameter of **3** inches, and depth of **25** feet.

Description of tunnel or infiltration trench:

DEVELOPMENT SCHEDULE:

Construction work shall begin on or before **started**

and shall thereafter be prosecuted with reasonable diligence and completed on or before **completed**

and complete application of water to proposed use shall be made on or before **April 1, 1974**

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance

Given under my hand and the seal of this office at Olympia, Washington, this **2nd**

day of **May** , 19 **73**

JOHN A. BIGGS, *Director*
Department of Ecology

by
R. JERRY BOLLEN
Office of Operations

ENGINEERING DATA
OK *DF*

S. F. No. 110-B—GS—6-07.

$10.00 examination fee should accompany each application.

STATE OF WASHINGTON
DEPARTMENT OF WATER RESOURCES
Division of Water Management

PRIORITY
Date 6-2-71
Time 10 AM
Accepted [illegible]

APPLICATION FOR A PERMIT

To Appropriate Public Ground Waters
OF THE STATE OF WASHINGTON

RECEIVED
MAR 24 1971
A. M. P. M.
7 8 9 10 11 12 1 2 3 4 5 6

Application No. G. W. 11937

I, Town of Mabton
(Name of applicant)

of P. O. Box 655, Mabton, Washington 98935
(Complete post office address)

do hereby make application for a permit to appropriate the following described public ground waters of the State of Washington, subject to existing rights. This application is made under the provisions of Chap. 263 of the Session Laws of 1945, and amendments thereto of the State of Washington and subject to the rules and regulations of the Department of Water Resources.

1. *The proposed appropriation will be from* Well
(Well, tunnel, infiltration trench)

located 1 mile north of Mabton on Cemetery Road
(Give approximate distance and direction from nearest city or town)

Area (Leave blank) *Subarea* (Leave blank)

Zone (Leave blank)

Applicant's name or number of well or other works, if any Mabton

2. *The quantity of water which applicant intends to withdraw for beneficial use is* 15 *gallons per minute,* [illegible] *per year*

3. *The use or uses to which water is to be applied* ~~Municipal~~ Municipal Supply

(Domestic supply, irrigation, municipal, manufacturing, industrial use, etc.)

4. *The time during which water will be required each year* continuously

5. *Location of well or other works* [illegible] Yakim
[illegible]

(a) [illegible]
(Give distance and bearing from nearest corner of section or legal subdivisions)

being within the [illegible] *of Sec.* [illegible] *Twp.* [illegible] *N., Rge.* (E. or W.)

or (b) *If within limits of recorded platted property, town or city, Lot* [illegible] *, Block* [illegible]

of [illegible]
(Give name of platted subdivision) (If within limits of city, give name)

(c) *Show the location on accompanying section plat. Other adequate maps or drawings will be acceptable.*

Application Refused
3-24-71

6. DESCRIPTION OF WORKS:

(a) Well will be drilled (Dug or drilled) and have a diameter of 3 inches and an estimated depth of 25 feet.

(b) Tunnels or trenches to be described: (Attach additional sheets if needed for full description.)

(c) Distribution system to be described:

(d) If pumps are to be used, give size and type:

1 hr electric shallow well

(e) Give capacity and type of motor or engine to be used:

(f) If the location of the well, tunnel, or other works is less than one fourth mile from a natural stream or stream channel, give the distance to the nearest point on each of such channels and the difference in elevation between the stream bed and the ground surface at the source of development:

(g) Ownership of each existing well or other works from which ground water is withdrawn within a radius of one-quarter mile and the distance and direction from well or other works being reported herein:

Name	Direction	(Distance)
Name	Direction	(Distance)
Name	Direction	(Distance)

SUPPLY THE FOLLOWING INFORMATION ACCORDING TO USE PROPOSED:

7. For Municipal Supply: To supply the city, town, or community of [redacted], in the county of [redacted] having a present population of [redacted] and an estimated population of [redacted] in 19[redacted]

8. For Irrigation: Number of acres to be irrigated [redacted] acres

9. Legal Description of Property on which water is to be used for all purposes other than municipal supply:

(Copy legal description from deed)
(If more space is required, attach separate sheet)

20feet from west line, 200 feet from north line of the North-west quarter of the North-west quarter of the North-east quarter of Section thirty one, (31) , Township none (9), North, Range twenty-three (23) E.W.M. containing ten acres more or less according to government survey thereof, situated in yakima county, Washington.

AREA SERVED BY TOWN of MABTON

(On accompanying plat show location of the existing wells or works)

10. What interest do you have in the above described property?

(owner, lessee, contract buyer, etc.)

11. Do you have any other water rights appurtenant to the above described property? No

If so, from what source?

12. Construction work will begin on or before

13. Construction work will be completed on or before

14. Water will be put to complete beneficial use on or before

(Signature of applicant)

15. Name and address of owner of land on which well or works are located:

Town of Mabton
(Name)

P. O. Box 655, Mabton, Wash. 98935
(Address)

(Signature of legal landowner)

Signed in the presence of us as witnesses:

(Address of witness)

(Address of witness)

STATE OF WASHINGTON
COUNTY OF THURSTON

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion as follows:

In order to retain its priority, this application must be returned to the Department of Water

WITNESS my hand this

Director, Water Management,
Department of Water Resources

Report of Examination on Ground Water

Received date June 2, 1971 Date of exam. September 6, 1972 Appli. No. 11937

Name Town of Mabton Address P. O. Box 655, Mabton, WA 98935

Type of works a well Dimensions 3" x 25'

Progress of works started

Quantity applied for 15 g.p.m acre-feet per year

Legal sub-[illegible] Sec 11 Twp [illegible] Rge. 23 E County Yakima

Use municipal supply

Irrigation-acreage: Present Planned Feasible

Municipal: Population as of

Industrial

Time pump will be operated

Other water rights appurtenant to this land

Proximity to existing works, springs, wells, or streams

Area Sub-area Zone

RECOMMENDATIONS

Approved for 15 g.p.m 2 acre feet acre-feet per year, subject to existing water rights. (1 acre-foot 325,850 gallons)

The field investigation for this application was made by A. H. King, Watermaster, Eastern Washington Region. The applicant intends to use this development for washing down sewage disposal plant, domestic requirements for employees, lawn sprinkling for approximately 1/4 acre. For these uses a total of 2 acre feet should be adequate.

The installation of an access port as described in attached Ground Water Bulletin No. 1 shall be required prior to issuance of final certificate of water right. The applicant may, for his own convenience, wish to install an airline and gage in addition to the access port.

Signed at Yakima, Washington.
this [illegible] day of [illegible], 1972.

A. H. King, Water Resources Inspector
Department of Ecology

Report of Examination on Ground Water

Received date June 2, 1971 Date of exam. [illegible] Appl. No. 11937

Name Town of Mabton Address P. O. Box 655, Mabton, Wa. 98935

Type of works a well Dimensions 3" x 25'

Progress of works [illegible]

Quantity applied for 15 g.p.m. acre-feet per year

Legal sub. NW¼NE¼ Sec. 31 Twp. 9N Rge. 23E County Yakima

Use ~~sewage disposal~~ [illegible] [illegible] 8-4-71 [illegible]

Irrigation-acreage: Present Planned Feasible

Municipal: Population as of

Industrial

Time pump will be operated continuously

Other water rights appurtenant to this land no

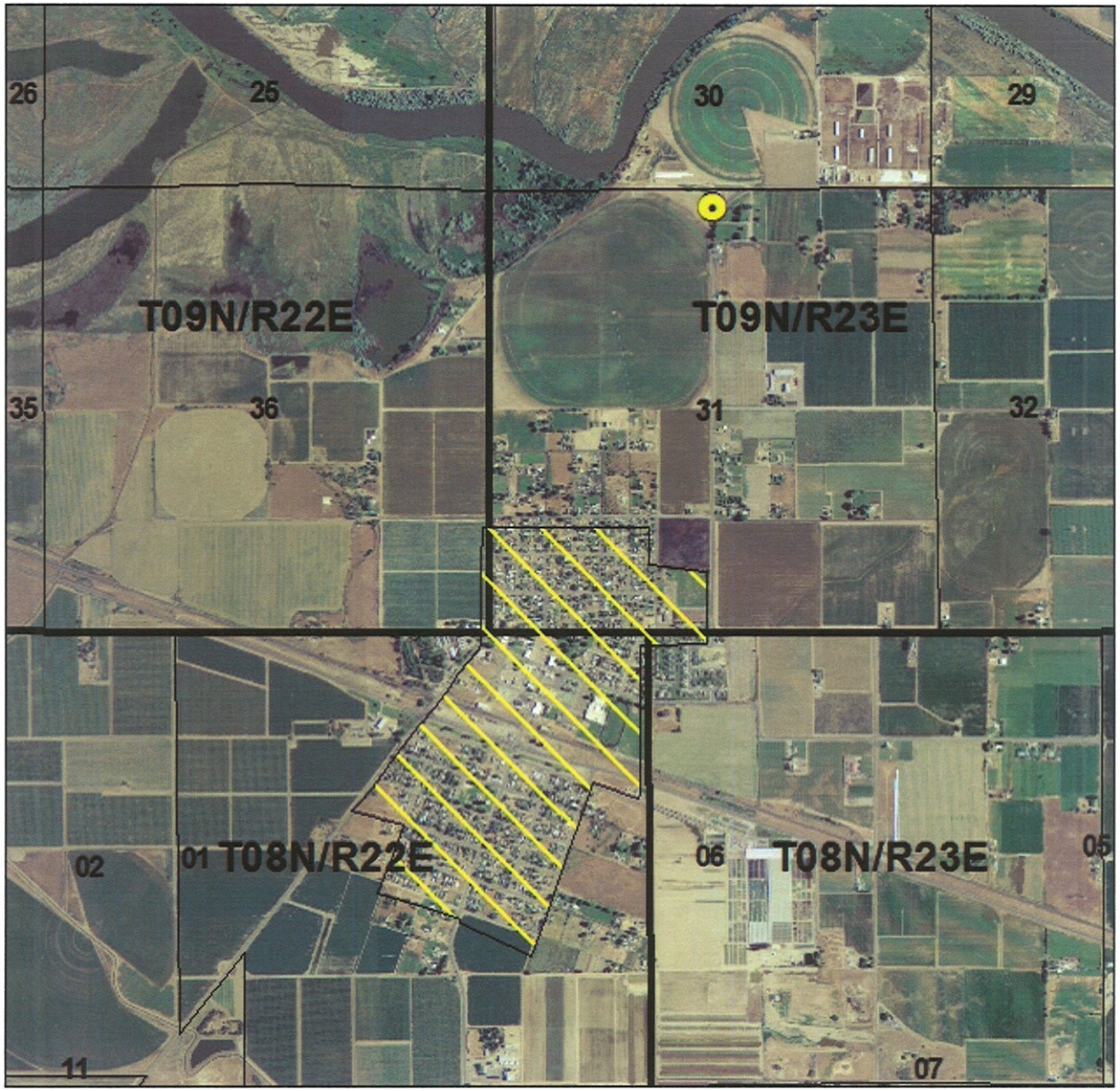
Proximity to existing works, springs, wells, or streams

Area Sub-area Zone

RECOMMENDATIONS

Approved for [illegible] g.p.m [illegible] acre-feet per year, subject to existing water rights (1 acre-foot 325,850 gal[illegible]

Ground Water Certifcate No. G3-00381C



0 1,100 2,200 4,400 Feet

N
W E
S

2011 Aerial Photo

Legend

- G3-00381C
- G3-00381C
- sections_2000
- township_2000

G4-29212C

State of Washington
Department of Ecology

APPLICATION FOR PERMIT
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ SURFACE WATER ☒ GROUND WATER

RECEIVED
FEB 26 1987
DEPARTMENT OF ECOLOGY
CENTRAL REGION

$10.00 MINIMUM STATUTORY EXAMINATION FEE REQUIRED WITH APPLICATION

(GRAY BOXES FOR OFFICE USE ONLY)

APPLICATION NO.	W.R.I.A.	COUNTY	PRIORITY DATE	TIME	ACCEPTED
G 429212	37	YAKIMA	2.24.87		BP

APPLICANT'S NAME — PLEASE PRINT

City of Mabton

Bus. Tel. 894-4096
Home Tel.
Other Tel.

ADDRESS (STREET) | (CITY) | (STATE) | (ZIP CODE)

P. O. Box 655, (305 Main St.) | Mabton | Wa | 98935

DATE & PLACE OF INCORPORATION IF APPLICANT IS A CORPORATION

Municipal corporation 1905

1. SOURCE OF SUPPLY

IF SURFACE WATER

SOURCE (NAME OF STREAM, LAKE, SPRING, ETC.) (IF UNNAMED, SO STATE)

TRIBUTARY

IF GROUND WATER

SOURCE (WELL, TUNNEL, INFILTRATION TRENCH, ETC.)

A Well

SIZE AND DEPTH

from 16" to 8" casings, approx. 1,200 deep

2. USE

USE TO WHICH WATER IS TO BE APPLIED (DOMESTIC SUPPLY, IRRIGATION, MINING, MANUFACTURING, ETC.)

Domestic water supply

ENTER QUANTITY OF WATER REQUESTED USING UNITS OF:	CUBIC FEET PER SECOND (CFS)	OR	GALLONS PER MINUTE (GPM)	ACRE FEET PER YEAR
			approx. 1,000	n/a

TIMES DURING YEAR WATER WILL BE REQUIRED

Year around

(CONTINUOUS MUNICIPLE SUPPLY)

IF IRRIGATION, NUMBER OF ACRES	IF DOMESTIC USE, NUMBER OF UNITS BY TYPE, E.G. 1-HOME, 1-MOBILE HOME, 2-CAMPSITES, ETC.	IF MUNICIPAL USE, ESTIMATED POPULATION 20 YEARS FROM TODAY
		1,535

DATE PROJECT WAS OR WILL BE STARTED	DATE PROJECT WAS OR WILL BE COMPLETED
approx June 87	approx March 88

3. LOCATION OF POINT OF DIVERSION/WITHDRAWAL

IF IN PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)	SECTION	TOWN	RANGE	ALSO, PLEASE ENCLOSE A COPY OF THE PLAT AND MARK THE POINT(S) OF WITHDRAWAL OR DIVERSION
2or3	4	1st addition to Mabton	1	8	22EWM	

OR

THE NW¼ NE¼ SEC. 1, T. 8 N., R. 22 EWM, YAKIMA

IF NOT IN PLATTED PROPERTY

ON ACCOMPANYING SECTION MAPS, ACCURATELY MARK AND IDENTIFY EACH POINT OF DIVERSION. SHOW NORTH-SOUTH AND EAST-WEST DISTANCES FROM NEAREST SECTION CORNER OR PROPERTY CORNER.

ALSO, ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	COUNTY

DO YOU OWN THE LAND ON WHICH THIS SOURCE IS LOCATED. IF NOT, INSERT NAME & ADDRESS OF OWNER

yes

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

ATTACH A COPY OF THE LEGAL DESCRIPTION OF THE PROPERTY (ON WHICH THE WATER WILL BE USED) TAKEN FROM A REAL ESTATE CONTRACT, PROPERTY DEED OR TITLE INSURANCE POLICY, OR, COPY CAREFULLY IN THE SPACE BELOW.

Within the boundaries of the Mabton City limits plus the following

WHAT IS YOUR INTEREST IN THE PROPERTY ON WHICH THE WATER IS TO BE USED (PROPERTY OWNER, LESSEE, CONTRACT PURCHASER, ETC.)

City Municipal water system

ARE THERE ANY EXISTING WATER RIGHTS RELATED TO THE LAND ON WHICH THE WATER IS TO BE USED (INCLUDING WATER PROVIDED BY IRRIGATION DISTRICTS OR DITCH COMPANIES) [X] YES [ ] NO

IF YES, FROM WHAT SOURCE (i.e. SURFACE OR GROUND WATER) AND UNDER WHAT AUTHORITY

Ground Water by the City of Mabton

6. DESCRIPTION OF SYSTEM PROPOSED OR INSTALLED

(FOR EXAMPLE: SIZE OF PUMP, CAPACITY OF PUMP, PUMP MOTOR HORSE POWER, PIPE DIAMETER, NUMBER OF SPRINKLERS, ETC.)

- 50-100 horse pump depending on the depth of water source
- Approx. 1,000 gpm depending on the amount of water found
- 6" line from the source to the 8" main line

REMARKS

7. We currently have two operational wells but one of them is contaminated and not in use. This leaves us with one that is about 50 years old. The proposed new well is necessary so that we can continue serving our residents.

IF 10 ACRE-FEET OR MORE OF WATER IS TO BE STORED AND/OR IF THE WATER DEPTH WILL BE 10 FEET OR MORE AT THE DEEPEST POINT, A STORAGE PERMIT MUST BE FILED IN ADDITION TO THIS PERMIT. THESE FORMS CAN BE SECURED, TOGETHER WITH INSTRUCTIONS, FROM THE DEPARTMENT OF ECOLOGY.

SIGNATURES

City Administrator APPLICANT'S SIGNATURE

City of Mabton LEGAL LANDOWNERS NAME (PLEASE PRINT)

Same - City of Mabton LEGAL LANDOWNER'S SIGNATURE (OWNER OF PROPERTY DESCRIBED IN ITEM NUMBER 5)

P. O. Box 655, Mabton, Wa 98935 LEGAL LANDOWNER'S ADDRESS

FOR OFFICE USE ONLY

STATE OF WASHINGTON }
DEPARTMENT OF ECOLOGY } SS.

This is to certify that I have examined this application together with the accompanying maps

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

CERTIFICATE OF WATER RIGHT

☐ Surface Water (issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 24, 1987	G4-29212	G4-29212P	G4-29212C

NAME
City of Mabton

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
PO Box 655 (305 Main Street)	Mabton	Washington	98935

This is to certify that the herein named applicant has made proof to the satisfaction of the Department of Ecology of a right to the use of the public waters of the State of Washington as herein defined, and under and specifically subject to the provisions contained in the Permit issued by the Department of Ecology, and that said right to the use of said waters has been perfected in accordance with the laws of the State of Washington, and is hereby confirmed by the Department of Ecology and entered of record as shown, but is limited to an amount actually beneficially used.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
a well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	1000	452.4 *

QUANTITY, TYPE OF USE, PERIOD OF USE

For continuous municipal supply.
* 280 acre-feet are supplemental to Ground Water Certificate No. G3-00027C.

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION-WITHDRAWAL

500 feet east and 1250 feet south from the north quarter corner of Section 1.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW¼NE¼	1	8	22 E.	37	Yakima

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Mabton City limits and residences outside the city limits being located south of Wandling Street, west of Allison Road, north of the Mabton West Lateral and east of Boundary Road within Section 31, T. 9 N., R. 23 E.W.M., Section 6, T. 8 N., R. 23 E.W.M., and Section 1, T. 8 N., R. 22 E.W.M.

PROVISIONS

Installation and maintenance of an access port as described in Ground Water Bulletin No. 1 is required. An air line and gage may be installed in addition to the access port.

All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under RCW 18.104 (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells).

This well shall be cased and permanently sealed into the Wanapum Formation. Such sealing and casing shall be performed in accordance with the provisions and standards of WAC Chapter 173-160-100 through Chapter 173-160-140 (Minimum Standards for Construction and Maintenance of Water Wells).

The authorized annual quantity of 452.4 acre-feet per year is the maximum that can be withdrawn and used under this right and Ground Water Certificate No. G3-00027C.

The right to the use of the water aforesaid hereby confirmed is restricted to the lands or place of use herein described, except as provided in RCW 90.03.380, 90.03.390, and 90.44.020.

This certificate of water right is specifically subject to relinquishment for nonuse of water as provided in RCW 90.14.160.

Given under my hand and the seal of this office at Yakima, Washington,

this 4th *day of August, 1992.*

Department of Ecology

ENGINEERING DATA
OK
22x103 CC:ska

by
Doug Clayssing, Section Manager

FOR COUNTY USE ONLY

file

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 24, 1987	G4-29212	G4-29212P	

NAME
CITY OF MABTON

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 655 (305 Main Street)	Mabton,	Washington	98935

The applicant is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

PUBLIC WATER TO BE APPROPRIATED

SOURCE
A well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	1000	452.4 *

QUANTITY, TYPE OF USE, PERIOD OF USE
Continuous municipal supply.

* 280 acre-feet are supplemental to G3-00027C.

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION-WITHDRAWAL
500 feet east and 1250 feet south from the north quarter corner of Section 1

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW¼NE¼	1	8	22 E.	37	Yakima

RECORDED PLATTED PROPERTY

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DESCRIPTION OF PROPOSED WORKS

A well, depth and size to be determined.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
June 1, 1988	June 1, 1989	June 1, 2000

PROVISIONS

Installation and maintenance of an access port as described in Ground Water Bulletin No. 1 is required. An air line and gage may be installed in addition to the access port.

All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under RCW 18.104 (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells).

This well shall be cased and permanently sealed into the Wanapum Formation. Such sealing and casing shall be performed in accordance with the provisions and standards of WAC Chapter 173-160-100 through Chapter 173-160-140 (Minimum Standards for Construction and Maintenance of Water Wells).

During the construction of the well, rock samples will be collected every 10 feet, labelled and retained for the Department of Ecology.

The authorized annual quantity of 452.4 acre-feet per year is the maximum that can be withdrawn and used under this right and Ground Water Certificate No. G3-00027C.

A proof inspection will be conducted prior to issuing the final certificate.

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Yakima, *Washington, this* 22nd *day of* May, *19* 87.

Department of Ecology

by RUSSELL K. TAYLOR, P.E., REGIONAL MANAGER

ENGINEERING DATA OK

ska

REPORT OF EXAMINATION
PROOF EXAMINATION

CITY OF MABTON
PHONE 894-4096

Permit Number G4-29212

Date 4-23-92 Examiner's Name C. Caspar & G. Weston

Source: Ground Water Surface Water

Stream Flow Measurement: _____

Location of Point of Withdrawal or Diversion: per permit

Purpose of Use: Municipal per permit

Number of Acres Developed: /

Type of Crop: /

Legal Description of Developed Land: Per permit

Type of Pump: Sub. Turb. Cent. Other

Pump Motor: Make 125 HP

Speed (rpm): _____ Water lub. Oil lub.

Access Port _____ Air line ✓

Well Head Seal ✓ Measuring Device _____ Type _____

Type of Distribution System: Pressure 40-45 psi Open

Discharge Pressure: 40-45 8" pipe

Booster Pump: Yes No HP

Discharge Pipe Diameter: N/A

Number of Sprinklers: 1000 gpm

Model and Make of Sprinklers _____

Pressure at Sprinkler Head: _____

Size of Sprinkler Nozzle: _____

Static Water Level: 67 per Well Report

REMARKS: OK for Cert per permit

file

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

REPORT OF EXAMINATION
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
February 24, 1987	G4-29212		

NAME
CITY OF MABTON

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 655 (305 Main Street)	Mabton,	Washington	98935

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
A well

TRIBUTARY OF (IF SURFACE WATERS)

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	1000	452.4 *

QUANTITY, TYPE OF USE, PERIOD OF USE
Continuous municipal supply.

* 280 acre-feet are supplemental to G3-00027C.

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION—WITHDRAWAL
500 feet east and 1250 feet south from the north quarter corner of Section 1

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
NW¼NE¼	1	8	22 E	37	Yakima

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DESCRIPTION OF PROPOSED WORKS

A well, depth and size to be determined.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
June 1, 1988	June 1, 1989	June 1, 2000

REPORT

Background

On February 24, 1987, the City of Mabton filed an application to appropriate public ground waters. The application was accepted, assigned number G4-29212 and public notice was made. The 30-day protest period expired with no protests being received.

Investigation

A field inspection was conducted by the author on April 21, 1987. Based on this inspection, conversations with Mr. Robert Spink, Engineer for the City, and Ms. Jo Marie Balfour, City Administrator and a review of WDOE office records, the following data were collected:

The City of Mabton has requested the withdrawal of 1,000 gallons per minute (gpm) for a continuous municipal supply. The city currently supplies water within the Mabton City limits and to 43 residences located outside the city limits. In 1985, the population was estimated to be 1,330 people with an average daily water consumption of 350,000 gallons. By the year 2000, it is estimated that the population will approach 1,535 people and water service will be expanded to a Comprehensive Service area. This area includes portions of Section 31, T. 9 N., R. 23 E.W.M., Section 6, T. 8 N., R. 23 E.W.M. and Section 1, T. 8 N., R. 22 E.W.M., lying southeasterly of Boundary Road.

In the past, the municipal water supply has been provided by four wells, one of which has been abandoned. Ground Water Certificate No. G3-00381C was issued to the City in 1974 authorizing the withdrawal of 15 gpm, 2 acre-feet per year for a domestic supply and for wash down at the sewage disposal plant. The well is a 3-inch diameter, 25-foot deep well that is located approximately 300 feet east and 200 feet south from the north quarter corner of Section 31, being within the NW1/4 NE1/4 of Section 31, T. 9 N., R. 23 E.W.M. There is no well report available for this well that is utilized solely for the operation of the sewage disposal plant.

A 1,141-foot deep well, that was called Well No. 1, was used as the major water source until the 1950's when it was abandoned. It is located approximately 750 feet north and 550 feet east from the center of Section 1, being within the SW1/4 NE1/4 of Section 1, T. 8 N., R. 22 E.W.M. No well report is available for the well. This abandoned well is located between the two wells that currently supply water for the city. There was no water right for this well.

Ground Water Certificate No. G3-00027C was issued in 1972 authorizing the withdrawal of 1,400 gpm, 280 acre-feet per year from two wells. One well, known as Well No. 2 by the City, was drilled in 1935. It is located approximately 880 feet north and 590 feet east from the center of Section 1, being within the SW1/4 NE1/4 of Section 1, T. 8 N., R. 22 E.W.M. It is an 8-inch diameter well that is 1,180 feet deep and is currently the main source of municipal water for the City. In 1975, a 75 horsepower pump was installed in the well which produces 800 gpm. There is no well report available for this well. According to Mr. Spink, the static water level was approximately 52 feet below land surface in 1955, however it is currently at 84 feet. Based on data from the City of Mabton 1985 Water Study which included pump tests on Wells No. 1, 2 and 3, Well No. 2 obtains water from the Wanapum formation and displays a degree of interference with Well No. 1. Methane gas is pumped from this well which requires the use of a gas eliminator device before the water is pumped into the storage tank. The well was pump tested in 1974 at 1,500 gpm with a 36 foot drawdown. The temperature of the water is 71° F.

The second well authorized by Ground Water Certificate No. G3-00027C and known as Well No. 3, was completed in 1957 and is located approximately 710 feet north and 530 feet east from the center of Section 1, being within the SW1/4 NE1/4 of Section 1, T. 8 N., R. 22 E.W.M. It is a 16-inch diameter, 1,004-foot deep well that is cased with 16-inch casing to a depth of 130 feet and with 12-inch casing from 120 to 307 feet. The casing is perforated from a depth of 96 feet to a depth of 115 feet and again from 295 to 305 feet. The static water level is 35 feet below land surface and has remained relatively constant. This well is drilled through top soil, sand and gravel, clay, sand and gravel, basalt, clay, sandstone, shale, layers of basalt and terminates in sand. The 1985 Water Study indicates that water is derived from the two zones of perforations with no significant contribution being made by the remainder of the well below the 307-foot casing. The temperature of the water in this well is 56° F., which is 15° colder than that in Well No. 2. The water is contaminated by high nitrate levels which range from 11.3 to 13.3 milligrams per liter. Sustained pumping of the well did not lower the nitrate content in the water. The water does not contain methane gas as does the water from Well No. 2. When pumped, Well No. 3 has no influence on Well No. 2 even though they are only 200 feet apart. Based on these data, it appears that Well No. 3 obtains water from the Ellensburg and Saddle Mountain formations. The well is equipped with a 40 horsepower pump and produces approximately 338 gpm. It was pump tested in 1974 at 425 gpm with a 81 foot draw down.

Although Ground Water Certificate No. G3-00027C authorizes the withdrawal of 1,400 gpm, the actual amount being pumped under the certificate does not exceed 1,138 gpm. A superseding certificate will issue for Ground Water Certificate No. G3-00027C authorizing the actual instantaneous quantity being utilized.

The City of Mabton municipal water supply is utilized for both in-house domestic purposes and for the irrigation of lawns and gardens since no other source of irrigation water is available. The current water supply is not adequate for the existing needs unless the nitrate contaminated water from Well No. 3 is used. The city is, therefore, required to notify the public when the nitrate level of the water supply is elevated by heavy use of Well No. 3. In order to obtain enough uncontaminated water to satisfy current demands and to address the water requirements for the future growth of Mabton, the City has filed the subject application to obtain authorization to drill a new well. They hope to obtain an additional 1,000 gpm from this well, which will be used in addition to the 1,138 gpm being pumped from Wells No. 2 and 3. By storing water from all three wells in the City's 800,000 gallon storage facility, the nitrate content of water from Well No. 3 will be diluted to acceptable levels. The City has received approval from DSHS for the construction and testing of a fourth well.

The proposed well will be located approximately 500 feet east and 1,250 feet south of the north quarter corner of Section 1, being within the NW1/4 NE1/4 of Section 1, T. 8 N., R. 22 E.W.M. It will be drilled within Lot 2 or Lot 3 of Block 4 of the First Addition of Mabton, which is at the corner of Boundary Road and South Street near the Harkin and Larkin Restaurant. The well will be located at least 1,400 feet from the other city wells. The City proposes to drill a 16-inch diameter well that will be 8 inches in diameter at the bottom. It will be drilled by Larry Webley to a depth of approximately 1,200 feet. In order to protect the shallower aquifers used by domestic wells in the area and to prevent contamination of the well by shallow contaminated ground water, the well will be a cased and sealed into the Wanapum formation.

Rock samples collected during the construction of a deep well can be used to further the understanding of the geology and hydrogeology of the area. During the construction of the City of Mabton well, rock samples will be collected every 10 feet, labelled and retained for analysis for the Department of Ecology. Collection bags will be provided by the Department.

There is one certificate of water right within a mile radius of the proposed well. Ground Water Certificate No. 534-D was issued to Northern Pacific Railway Company authorizing the withdrawal of 83 gpm, 13.5 acre-feet per year for a water supply for locomotives. The well is located approximately 730 feet north and 1,150 feet west from the southeast corner of the NW1/4 NE1/4 of Section 1, being within the NW1/4 NE1/4 of Section 1, T. 8 N., R. 22 E.W.M. The authorized place of use is the station grounds of the Northern Pacific Railway Company at Mabton. The well is an 8-foot diameter, 71-foot deep well that is located approximately 1,000 feet from the site of the proposed City well. It is likely that this right has relinquished due to non-use.

There are two domestic wells on record within a mile radius of the applicant's proposed well. They are a 100-foot deep well and a 143-foot deep well. Both wells penetrate the Ellensburg formation also utilized by Well No. 3. The proposed well will be cased through this zone.

Based on the consumption of water for the City of Mabton during 1985, the per capita consumption is approximately 263 gallons per day. In the year 2000, the population is estimated to become 1,535 people with the same per capita consumption. The annual water requirement for the city at that time should not exceed 452.4 acre-feet. Since Ground Water Certificate No. G3-00027C authorizes the use of 280 acre-feet per year, this right shall authorize an additional 172.4 acre-feet and be supplemental to the remaining 280 acre-feet. As the total annual quantity will not be required until the population has reached 1,535, the City will be given until the year 2000 to put the water to full beneficial use under the permit.

Conclusions

Based on these data, the following conclusions are made:

Water is available for the proposed beneficial use. Due to the depth of casing and the distance from neighboring wells, there should be no impairment of existing rights. Granting a permit is not contrary to the public interest.

Recommendations

The instantaneous quantity of 1,000 gpm and the annual quantity of 452.4 acre-feet per year for a continuous municipal supply are recommended for approval.

Installation and maintenance of an access port as described in Ground Water Bulletin No. 1 is required. An air line and gage may be installed in addition to the access port.

All water wells constructed within the state shall meet the minimum standards for construction and maintenance as provided under RCW 18.104 (Washington Water Well Construction Act of 1971) and Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Water Wells).

This well shall be cased and permanently sealed into the Wanapum Formation. Such sealing and casing shall be performed in accordance with the provisions and standards of WAC Chapter 173-160-100 through Chapter 173-160-140 (Minimum Standards for Construction and Maintenance of Water Wells).

During the construction of the well, rock samples will be collected every 10 feet, labelled and retained for the Department of Ecology.

The authorized annual quantity of 452.4 acre-feet per year is the maximum that can be withdrawn and used under this right and Ground Water Certificate No. G3-00027C.

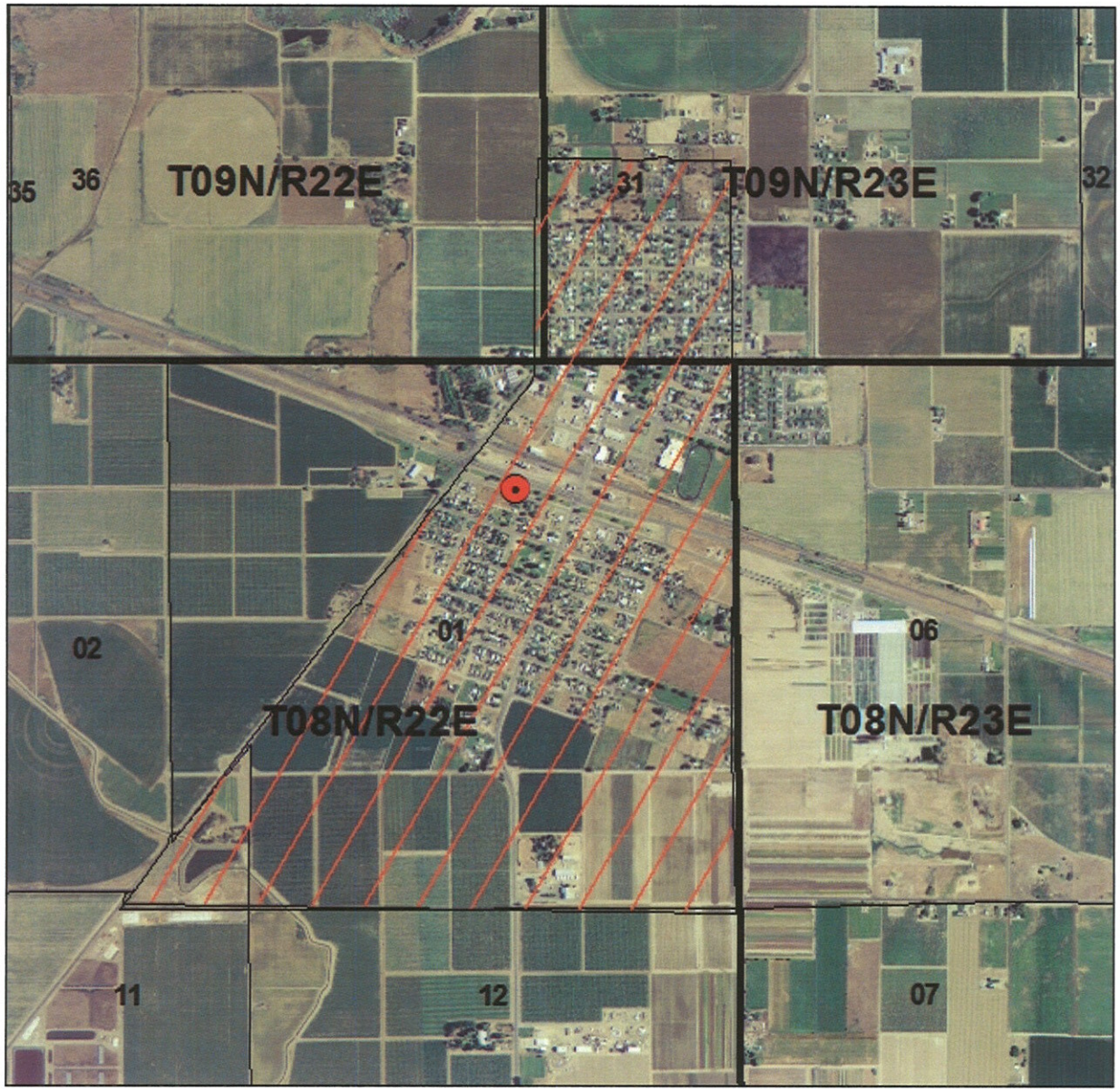
A proof inspection will be conducted prior to issuing the final certificate.

REPORT BY: Darlene M. Frye DATE: May 8, 1987
Darlene M. Frye

APPROVED BY: Howard R Vandt for DATE: 5-6-87
Doug Clausing, Regional Supervisor

ska

Ground Water Certifcate No. G4-29212C



0 900 1,800 3,600 Feet

N
W E
S

2011 Aerial Photo

Legend

- G4-29212C
- G4-29212C
- sections_2000
- township_2000

APPENDIX K

EMERGENCY RESPONSE PLAN

APPENDIX K

EMERGENCY RESPONSE PLAN

The following section describes means and methods for the City to cope with emergency situations affecting its water utility. It includes a list of important telephone numbers for emergencies, some general considerations that should be kept in mind by City staff during an emergency, and specific emergency response plans. This Plan was created under the guidance of Department of Health Publication #331-211. In an effort to protect the citizens of Mabton, information from some of the sections has been omitted to protect the water system.

SECTION 1
EMERGENCY RESPONSE MISSION AND GOALS

Mission Statement	In an emergency, the mission of the Mabton water system is to protect the health of our customers by being prepared to respond immediately to a variety of events that may result in contamination of the water or disruption of supplying water.
Goal 1	Be able to quickly identify an emergency and initiate timely and effective response action.
Goal 2	Be able to quickly notify local, state, and federal agencies to assist in the response.
Goal 3	Protect public health by being able to quickly determine if the water is not safe to drink or use and being able to immediately notify customers effectively of the situation and advise them of appropriate protective action.
Goal 4	To be able to quickly respond and repair damages to minimize system down time.

SECTION 2
SYSTEM INFORMATION

System identification number	49650 R	
System name and address	City of Mabton 305 Main St. Post Office Box 655 Mabton, WA 98935	
Directions to the system	See Figure 1-1 of the Water System Plan.	
Basic description and location of system facilities	The location of City facilities are shown in Figure 1-1 of the Water System Plan. The City is located along SR 22 approximately 7 miles north of Sunnyside, WA	
Location/Town	Mabton, WA	
Population served and service connections from Division of Drinking Water records (projected for 2010)	2,165 people	682 ERUs
System owner	City of Mabton	
Name, title, and phone number of person responsible for maintaining and implementing the emergency plan.	Chris Morris, Public Works Lead Employee (509)-439-4077	(509) 894-4096 City Hall

SECTION 3
CHAIN OF COMMAND

Name and Title	Responsibilities During Emergency
Hon. Angel Reyna Mayor	Responsible for guiding City Council in decision-making, should the water department require its involvement.
Chris Morris Public Works Lead Employee	Responsible for overall management and decision-making for water system. Primary contact for all water system emergencies.
Ret Stewart City Clerk	Responsible for administrative functions in the office, including receiving phone calls and keeping a log of events. A scripted message will be prepared by the water system staff to answer general questions.

SECTION 4
EVENTS THAT CAUSE EMERGENCIES

TYPE OF EVENT	PROBABILITY OF EVENT (HIGH-MEDIUM-LOW)	RISK OF DAMAGE FROM THE EVENT (High-Medium-Low)	ACTIONS TO BE TAKEN
Earthquake	Low	High	• Manually adjust lag/lead status of pumps if necessary • Monitor reservoir levels and determine if water main and/or intertie breaks have occurred • Check reservoirs for cracks, shifting in foundation, cracking or breaks in fittings and pipes leading to and from reservoirs • Check pipes for cracks or breaks in the line • Check the booster station equipment for damage
Floods	Low	Medium	• Manually adjust lag/lead status of pumps if necessary • Monitor reservoir levels and determine if water main and/or intertie breaks have occurred • Check pipes for areas of wash out • Check pipes for cracking or breaks • Increase monitoring for coliforms
High Winds	High	Low	• Check structures for damage

TYPE OF EVENT	PROBABILITY OF EVENT (HIGH-MEDIUM-LOW)	RISK OF DAMAGE FROM THE EVENT (High-Medium-Low)	ACTIONS TO BE TAKEN
Ice Storms	Low	Medium	• Manually adjust lag/lead status of pumps if necessary • Monitor reservoir levels and determine if water main and/or intertie breaks have occurred • Check reservoirs for cracking due to ice formation inside the tanks • Check pipe lines for breaks or frozen pipes
Droughts	High	Low	• Advise citizens to conserve water
Water Borne Illness	Low	Medium	• Manually adjust lag/lead status of pumps if necessary • Test water leaving wells to prevent illness • Check the reservoirs to ensure water is safe • Issue notices, such as boil notice, as needed • Increase monitoring for coliforms • Drain and refill reservoirs • Flush water lines • Notify DOH

TYPE OF EVENT	PROBABILITY OF EVENT (HIGH-MEDIUM-LOW)	RISK OF DAMAGE FROM THE EVENT (High-Medium-Low)	ACTIONS TO BE TAKEN
Vandalism	Low	Medium	• Check all properties on a regular basis and clean up any signs of problems • Manually adjust lag/lead status of pumps if necessary • Call police to investigate
Terrorism	Low	Medium	• Manually adjust lag/lead status of pumps if necessary • Issue notices to residents as needed • Flush lines. • Drain and refill reservoirs
System Neglect	Low	Medium	• Follow the operation and maintenance plan
Cross-Connections	Low	High	• Follow the guidelines in Appendix L • Prevent backflow problems • Follow backflow incident procedure
Construction Accidents	Medium	Medium	• Check pipe stability if damaged and repair immediately to prevent backflow problems
Electrical Outages	High	Low	• Issue curtail order if needed for extended outages

TYPE OF EVENT	PROBABILITY OF EVENT (HIGH-MEDIUM-LOW)	RISK OF DAMAGE FROM THE EVENT (HIGH-MEDIUM-LOW)	ACTIONS TO BE TAKEN
Chemical Spills	Low	Medium	• Issue a notice to all residences • Follow chemical clean up protocol set up by the EPA • Test the water system at the wells and the reservoirs • Flush pipelines in effected areas • Follow backflow incident procedures

SECTION 5
SEVERITY OF EMERGENCIES

The system personnel will determine the severity of an emergency, but the water distribution manager will make the final decision. The information for making the decision will accumulate over a period of time and results may change as more information becomes available. The following gives a break down of different severities and the approximate amount of time it will take to resolve the issue.

Level I – Normal (Routine) Emergency (Definition)

Description: The City of Mabton water system considers the following as level I emergencies:

- Distribution line breaks.
- Short power outages.
- Minor mechanical problems with the wells
- Other minor situations where it is not likely that public health will be jeopardized.

These situations commonly are resolved in 24 hours. If they cannot be resolved in the time frame the situation will be elevated to a level II due to a draw down on the storage level of the water, which could be below a safe operating level.

Level II – Minor Emergency (Alert Status) (Definition)

Description: The City of Mabton water system considers the following as level II emergencies:

- Disruption in supply such as a transmission main line break, pump failure with a potential for backflow, and loss of pressure.
- Storage is not adequate to handle disruption in supply.
- An initial positive coliform or E. coli sample.
- An initial primary chemical contaminant sample.
- A minor act of vandalism.
- Drought, with a noticeable and continuing effect on pump output.

These situations commonly are resolved in 72 hours.

Level III – Significant Emergency (Definition)

Description: The City of Mabton water system considers the following as level III or actual emergencies:

- A verified acute coliform MCL or E. coli/fecal positive sample requiring immediate consideration of a health advisory notice to customers.
- A confirmed sample of another primary contaminant requiring immediate consideration of a health advisory notice to customers.
- A loss or complete malfunction of the well facilities
- A major line break or other system failure resulting in a water shortage or requiring system shutdown.
- An act of vandalism or terrorist threat such as intrusion or damage to a primary facility.
- An immediate threat to public health of the customers and an advisory is required.

These situations commonly require more than 72 hours to resolve.

Level IV – Catastrophic Disaster/Major Emergency (Definition)

Description: The City of Mabton water system considers the following events to be level IV or major emergencies:

- Earthquake that shuts down the system or impacts sources, lines, etc.
- Act of terrorism possibly contaminating the water system with biological or chemical agents.
- Flood that infiltrates system facilities and sources.
- Chemical spill within 2000 feet of the system's sources.
- Storm that significantly damages power grid and system facilities.
- Mudslide or other earth shift that causes failure of transmission or inability to operate reservoir in system

These events often take several days or weeks to resolve before the system returns to normal operation.

SECTION 6
EMERGENCY NOTIFICATION

Person or Agency	*Phone Number*
WATER SYSTEM PERSONNEL	
Chris Morris, Public Works Lead	894-4096 City Hall
	439-4077 Cell
CITY PERSONNEL	
Ret Stewart, City Clerk	894-4096
LOCAL, STATE, AND FEDERAL AGENCIES	
Sunnyside Community Hospital	911 or 837-1500
Fire Department, Chief Luke Cussins	911 or 830-0867
Washington State Department of Health, Spokane	(877)-481-4901 (emergency)
Andres Cervantes, P.E., Regional Engineer	(509) 329-2120
Washington State Dept. of Ecology, Spokane	(509) 329-3400
Yakima County Public Works	(509) 574-2300
Yakima County Sheriff - Yakima	(509) 574-2500
Yakima County Health Department	(509) 575-4040
State Division of Emergency Management	(800) 258-5990
U.S. Environmental Protection Agency	(206) 754-0500
UTILITIES	
Pacific Power	(888) 221-7070
Telephone – CenturyLink	(800) 877-1125
One-Call Locates	(800) 424-5555
SUPPLIERS, CONTRACTORS	
H.D. Fowler	(425)-746-8400
Columbia Electric Supply Co.	(509) 837-6033
MEDIA	
Local Newspaper – Grandview Herald	(509) 882-3712
Local radio station – KARY	(509) 248-2900
CITY ENGINEER	
Gray & Osborne, Inc.	(509) 453-4833

NOTIFICATION PROCEDURES

Notifying water system customers

Who is Responsible:	Public Works Lead
Procedures:	Contact local newspaper and radio station to keep citizens updated about status of water system during emergencies. For generic information, pamphlets are distributed with bills.

Alerting local law enforcement, state drinking water officials, and local health

Who is Responsible:	Public Works Lead
Procedures:	Contact appropriate officials from Emergency Call List.

Contacting service and repair contractors

Who is Responsible:	Public Works Lead
Procedures:	Contact appropriate contractors from Emergency Call List.

Contact neighboring water systems, if necessary

Who is Responsible:	Public Works Lead
Procedures:	The City of Grandview can be contacted at (509) 882-3099

Procedures for issuing a health advisory

Who is Responsible:	Public Works Lead
Procedures:	Contact local newspaper and radio station to keep citizens updated about status of water system during emergencies.

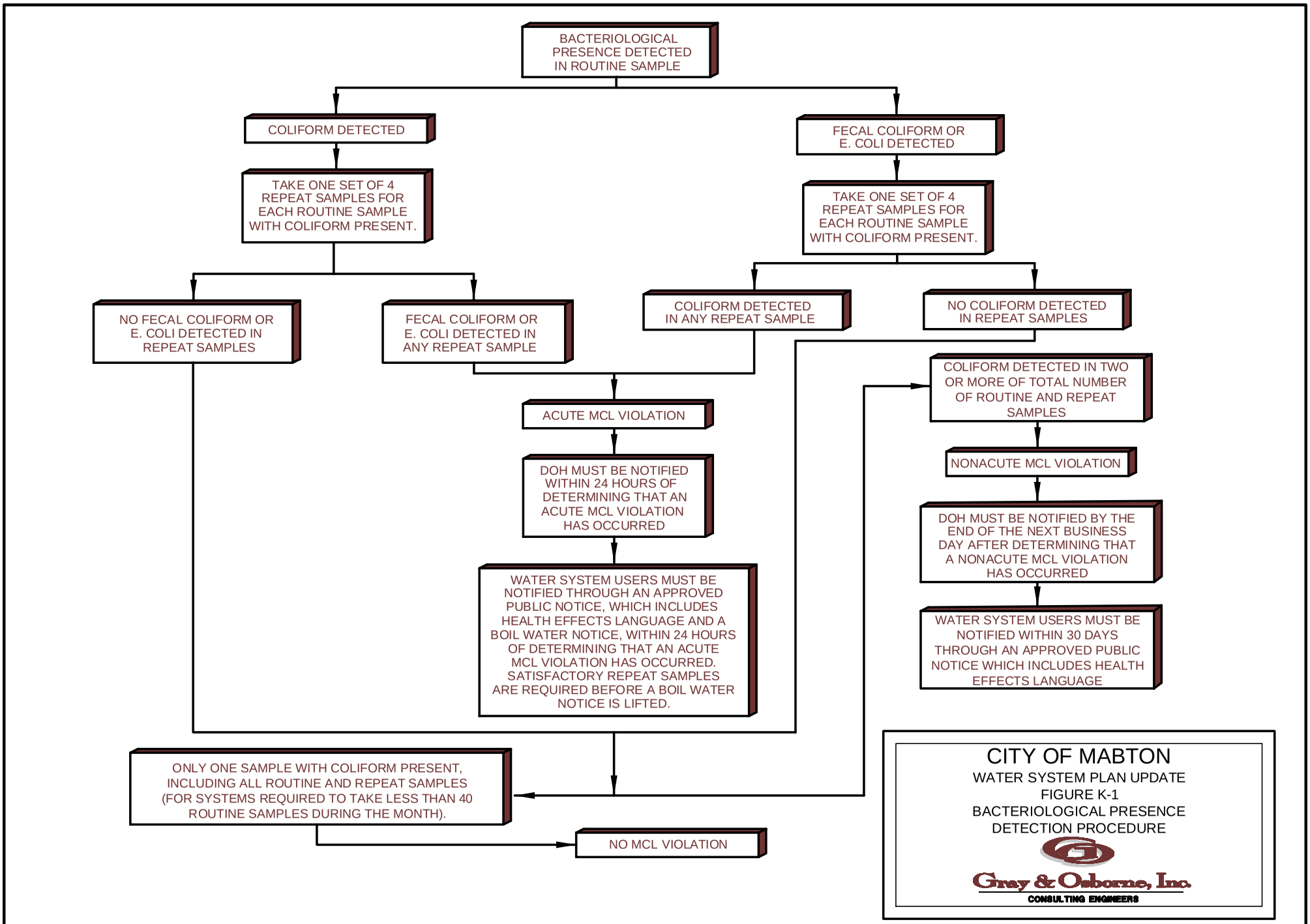
SECTION 7
WATER SAMPLING

A. BACTERIOLOGICAL DETECTION

The persistent detection of coliforms in the water supply, particularly E. coli or fecal bacteria, may require issuing a public boil water notice to ensure the health and safety of the City's water customers. In addition, emergencies such as floods, earthquakes, or other disasters can affect water quality as a result of damage to water system facilities. WAC 246-290-320 requires water utilities to follow specific procedures in the event coliform bacteria are detected in the water system. These procedures are outlined in Figure K-1. In addition to these requirements, the City's Coliform Monitoring Plan, located in Appendix F, summarizes increased sampling requirements in the month following coliform detection.

B. INORGANIC, VOC AND SOC CHEMICAL DETECTION

A procedure to comply with DOH requirements in the event of an inorganic, volatile organic, or synthetic organic chemical detection is presented in Figure K-2.



CITY OF MABTON

WATER SYSTEM PLAN UPDATE

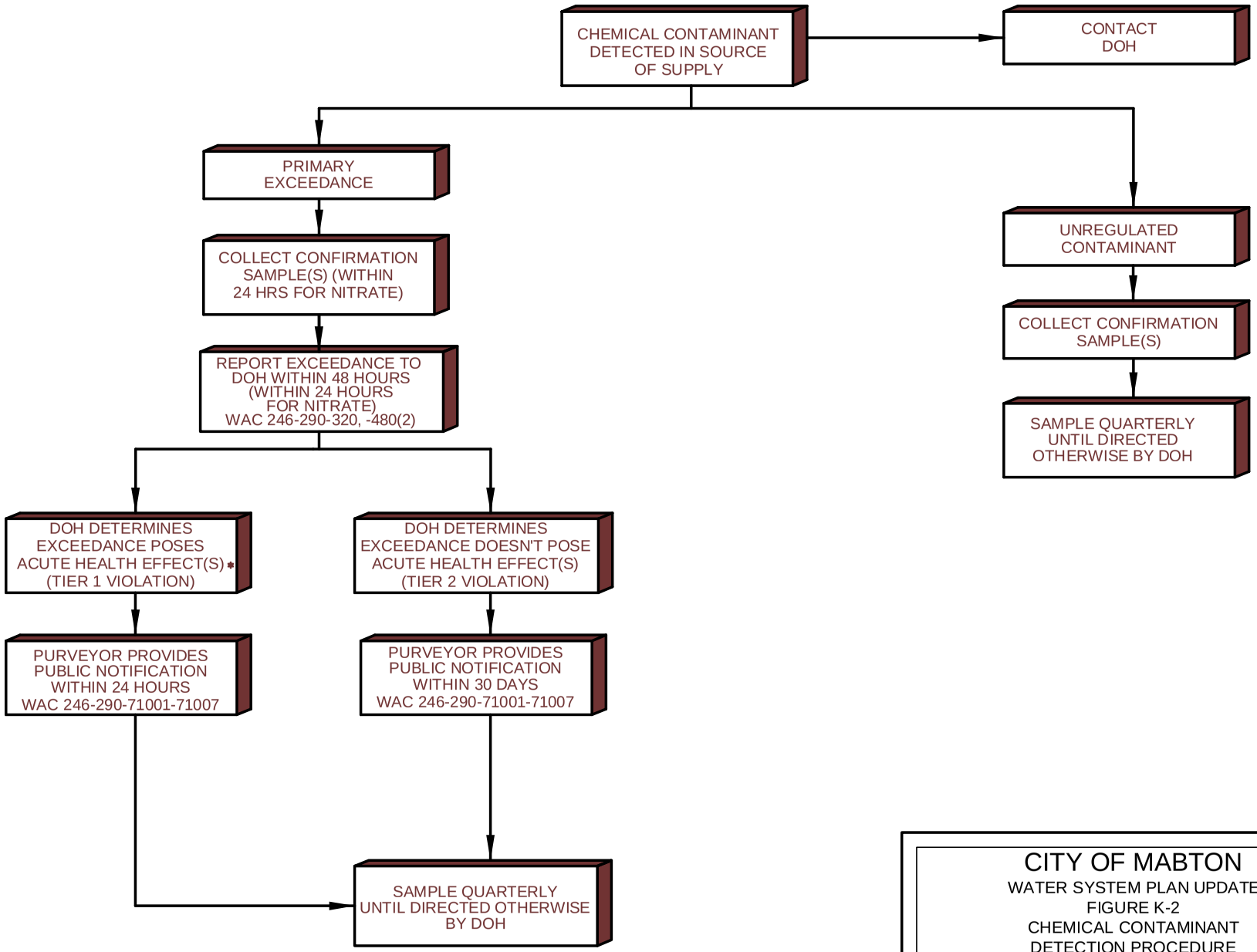
FIGURE K-1

BACTERIOLOGICAL PRESENCE DETECTION PROCEDURE

Gray & Osborne, Inc.

CONSULTING ENGINEERS

M:\MABTON\11064 WSP\FIGURES\FIG K-1



CITY OF MABTON

WATER SYSTEM PLAN UPDATE

FIGURE K-2

CHEMICAL CONTAMINANT DETECTION PROCEDURE

Gray & Osborne, Inc.

CONSULTING ENGINEERS

* AN EXCEEDANCE OF THE 10.0 MG/L NITRATE MCL CONSTITUTES AN ACUTE HEALTH EFFECT CONCERN, AS DOES ANY RESULT WHICH IS FOUR TIMES THE PRIMARY MCL FOR OTHER REGULATED CONTAMINANT.

M:\MABTON\11064 WSP\FIGURES\FIG K-2

SECTION 8
EFFECTIVE COMMUNICATION

Communication Tips:

Do:
- Be prepared.
- Designate a spokesperson.
- Provide complete, accurate, and timely information.
- Tell the truth.
- Express empathy.
- Acknowledge uncertainty and offer to get back with more information later.
- Document your communications.

Do not:
- Speculate on the cause or outcome of an incident.
- Blame or debate.
- Minimize or brush off concerns of customers.
- Treat inquiries from interested parties as an annoying distraction from the real business of emergency response.

Spokesperson	Alternate 1	Alternate 2
Mayor	Public Works Lead	City Clerk

Key messages

Develop possible messages in advance, and update them as the emergency develops:
• We are taking this incident seriously and doing everything we can to resolve it. • Our primary concern is protecting our customers' health. • Another important concern is keeping the system operational and preventing damage. • What we know right now is _____ • The information we have is incomplete. We will keep you informed as soon as we know more. • We have contacted state and local officials to help us respond effectively. • If you think you may be ill or need medical advice, contact a physician. • We are sampling the water and doing tests to determine whether or not the water is contaminated.

SECTION 9
VULNERABILITY ASSESSMENT

Not included due to security concerns.

SECTION 10
RESPONSE TO SPECIFIC EVENTS

A. Construction Accident

ASSESSMENT	Construction crews often encounter pipes unexpectedly. Pipe rupture possible.
Immediate action	If a water distribution pipe is ruptured, identify the necessary valves to isolate the line and remove all pressure to it. Identify all connections to isolated line. Perform water quality testing in system to determine if contamination has occurred.
Notifications	Notify all affected water users of the break and expected duration of water loss. If pipe supplies are needed, contact pipe suppliers listed in Call List above.
Follow-up actions	Once line break is repaired, verify that each valve used to isolate the broken section has been returned to an open position.

B. Severe Weather

ASSESSMENT	Mabton experiences freezing weather consistently throughout winter months, but these conditions don't necessarily result in emergency situations.
Immediate actions	During an extended storm situation, maintain roads necessary to reach reservoirs and sources. Should the storm result in damage to system components, the ability to access them in a timely manner is important. There is also a possibility of the reservoir level sensing being affected, in which case the well pumps may require manual operation.
Notifications	Unless major system components must be taken out of service, weather conditions shouldn't require notification of customers.
Follow-up actions	Following an extended period of freezing weather, verify that the reservoirs are operating correctly. Examine water use records in the following month to determine if distribution leakage has escalated, indicating the probability of a pipe main break.

C. Earthquake

ASSESSMENT	Historically, the likelihood for an earthquake in Mabton is low.
Immediate actions	Verify if the City's pumps and reservoirs are operating correctly. The City has three sources, so a single failing source is not a direct emergency. Perform bacterial testing to determine if earthquake damage to system has resulted in system contamination. Contact neighboring water systems and/or local grocers to determine availability of potable water in the area.
Notifications	Notify public of any boil orders or the requirement of bottled water. In the event of major system damage, Department of Health will need to be involved.
Follow-up actions	Perform necessary system repairs and disinfection, and continue testing until water is determined to be clean and safe.

D. Vandalism

ASSESSMENT	The City has not historically had problems with vandalism on water system infrastructure due to security measures.
Immediate actions	Contact police in all cases to report criminal activity. If the nature of the vandalism indicates a direct threat to water system operation or water quality, perform water testing to determine the extent of the impact. Graffiti or other aesthetic damage should be repaired, but requires no official response beyond police notification.
Notifications	Local police department should be contacted. If water quality has been impaired, contact Department of Health. Public to be notified as necessary, based upon nature and extent of water contamination.
Follow-up actions	Perform necessary system repairs and disinfection, and continue testing until water is determined to be clean and safe.

E. Power outage

ASSESSMENT	The City does not have a generator to power the wells or booster station.
Immediate action	If possible, determine if the power outage will be extended in nature.
Notifications	Notify Pacific Power of outage. Number is shown in Section 6. Notify customers of outage and request water conservation.
Follow-up actions	Once power is restored and verify proper system operation. Inspect each electrical component in the field to determine that the component is operational.

F. Microbial (coliform, E. coli) contamination

See Figure K-1 and following tables.

G. Chemical contamination

See Figure K-2 and following table.

Actions to for contamination in water system

Distribution System Contamination
• Disinfect distribution lines as dictated by the nature of the contamination
Reservoir Contamination
• Re-sample to confirm contamination
• Check distribution system for presence of contamination
• Isolate reservoir from system
• Inspect vent screens, hatches, and piping to identify source of contamination
• If reservoir water is contaminated and therefore considered unsuitable for consumption, drain and clean reservoir.
• Consider disinfecting reservoir if bacteriological standards are exceeded. Follow AWWA Standards. A 50 ppm chlorine solution in the 800,000 gallon reservoir can be obtained by adding 770 gallons of 5.25% chlorine bleach.

H. Fires

The availability of adequate water supplies and pressure is an integral part of the City's ability to fight fires within its service area. When fires occur in the City's service area, the local fire authority will contact the City so that the water system components can be managed in such a way as to maximize the flow and pressure to the affected area.

I. Nursing Homes, Elder Care Facilities, Dialysis Patients

Some water customers require immediate notification should their water service be interrupted for any reason. These customers include facilities such as nursing homes, elder care facilities, and kidney dialysis patients. The City maintains a list of all these customers so that in the event the City's water supply is to be interrupted because of an emergency situation these customers can be quickly notified.

SECTION 11
ALTERNATIVE WATER SOURCES

Intertie to adjacent water supply system

Water systems within one-quarter mile of our system	Feasibility of connecting
The closest water system is Grandview (7 miles).	It is not feasible for Mabton to intertie with Grandview for short-term emergency supply. The City does have access to a tanker truck that could be used to transport water from another system and provide basic water supply needs to Mabton residents during an extended outage.

Alternate source(s) of water

Alternative sources	Names	Phone	Availability	Is the water safe for drinking?
Bottled Water Suppliers	Blue Sky Market Safeway, (Grandview)	(509)-894-4444 (509)-882-1325	Limited Limited	Yes

SECTION 13
RETURNING TO NORMAL OPERATION

Action	Description and actions
Inspect, flush, and disinfect the system	Water Distribution Manager and support staff inspect all system facilities, ensure all water quality tests have been done and the system has been flushed and disinfected if necessary. City staff report to the Water Distribution Manager as to nature of work completed. The Water Distribution Manager will determine when necessary work is completed.
Verification of water quality	Water Distribution Manager verifies water quality sampling results.
Coordinate with DOH	Water Distribution Manager coordinates with DOH on system condition and water quality results.
Notify customers	Water Distribution Manager works with City staff to write notice to customers. This notice will then be distributed to the public.

APPENDIX L

CROSS CONNECTION CONTROL

City of Mabton
Cross Connection Initial Survey

Customer	Condition	Hazard	Recommended Protection At Meter
Yellow Rose	Green Houses	High	
Northwest Horticulture	Protected?	High	
Laundromat	Chemicals	High	
Blue Sky Market	Fountain Drink	High	
C&D Market	Fountain Drink	High	
Gotta Stop Shell	Fountain Drink	High	
Silver Dollar	Fountain Drink	High	
Ixtapa	Fountain Drink	High	
Su Mercadito	Fountain Drink	High	
Mabton Jr. Sr. High	Fire sprinkler system	High	
Arts Fox Elementary	Fire sprinkler system	High	
WWTP Mabton		High	

Date: 3/11/05

By: Cade D. Scott
Cade Scott, Cross Connection Specialist

Comments: This is a list of potential High Hazard service connections. With the exception of the Mabton WWTP, Yellow Rose Nursery, and Northwest Horticulture which are High Hazard connections.

ORDINANCE NO. 865

AN ORDINANCE OF THE CITY OF MABTON, WASHINGTON, CREATING CHAPTER 13.05 CROSS-CONNECTION CONTROL OF TITLE 13 OF THE MABTON MUNICIPAL CODE ESTABLISHING A PROGRAM TO MONITOR CROSS-CONNECTIONS WITHIN THE MABTON WATER SYSTEM

WHEREAS, the City of Mabton is a code city operating under the laws of the State of Washington; and

WHEREAS, pursuant to WAC 246-290-490, or as amended, it is the responsibility of the City of Mabton to protect its drinking water by instituting and enforcing a cross-connection control program; and

WHEREAS, the city council of the City of Mabton with the assistance of city staff have been reviewing the guidelines for the establishment of a cross-connection plan;

NOW, THEREFORE, BE IT ORDAINED by the City Council of the City of Mabton, Washington as follows:

Section 1. Chapter 13.05 Cross-Connection Control shall be created within Title 13 Public Services of the Mabton Municipal Code, which reads as follows:

CHAPTER 13.05 - CROSS- CONNECTION CONTROL

SECTIONS:

13.05.005 Authority
13.05.010 Definitions
13.05.020 Purpose
13.05.030 Cross-Connections
13.05.040 Application and Responsibilities
13.05.050 Backflow Prevention Assembly Requirements
13.05.060 Irrigation Systems
13.05.070 Fire Systems
13.05.080 Temporary Meters and Hydrant Valves
13.05.090 Mobil Units
13.05.100 Right-of-Way Encroachment
13.05.110 Plumbing Code
13.05.120 Access to Commercial Industrial Premises
13.05.130 Access to Residential
13.05.140 Testing
13.05.150 Responsibilities of Backflow Prevention Assembly
13.05.160 Maintenance of Backflow Prevention Assembly
13.05.170 Installation Requirements and Specifications
13.05.180 Thermal Expansion
13.05.190 Pressure
13.05.200 Parallel Installation
13.05.210 New Construction
13.05.220 Residential Service Connections
13.05.230 Rental
13.05.240 Retrofitting
13.05.250 Costs of Compliance
13.05.260 Recovery of Costs
13.05.270 Emergency Suspension of Service
13.05.280 Non-Emergency Suspension of Service
13.05.290 Penalties
13.05.300 Falsifying Information

13.05.005 Authority

Pursuant to WAC 246-290-490, or as amended, it is the responsibility of the City of Mabton to protect its drinking water by instituting and enforcing a cross-connection control

program. Now, therefore, the City of Mabton stipulates as follows in this chapter.

13.05.010 Definitions

Except where specifically designated herein, all words used in this document shall carry their customary meanings. Words used in the present tense include the future and plural words include the singular. The word "shall" is always mandatory, and the word "may" denotes a use of discretion in making a decision. Any definition not found in this section will take its meaning from chapter 246-290 WAC, or as amended, or in the most recent edition of the "Manual of Cross Connection Control" published by the Foundation for Cross Connection control and Hydraulic Research, University of Southern California.

A. "Air gap" means a physical separation between the free-flowing end of a potable water supply pipeline and the overflow rim of an open or nonpressure-receiving vessel. To be an "approved air gap", the separation must be at least twice the diameter of the inlet piping (supply pipe) measured vertically, and never be less than one inch.

B. "Approved backflow prevention assembly" or "backflow assembly" or "assembly" means an assembly to counteract backpressures or prevent backsiphonage. This assembly must appear on the list of approved assemblies issued by the Washington state Department of Health. The assembly must be purchased and installed as a complete unit including two shut-off valves and test cocks.

C. "Auxiliary supply" means any water source or system other than the City of Mabton's.

D. "Backflow" means the flow of water or other liquids, gases or solids from any source back into the distribution system. The flow of water in the opposite direction of its intended flow.

E. "Backflow assembly tester" means a person holding a valid BAT certificate issued in accordance with WAC 246-290-490 and Chapters 18.27, 18.106 and 70.119 RCW.

F. "Backpressure" shall mean backflow due to water pressure on the downstream side of the meter which exceeds the operating pressure of the public potable water supply.

G. "Backsiphonage" shall mean backflow due to a negative or reduced pressure within the public potable water.

H. "Building inspector" shall mean the building inspector for the City of Mabton.

I. "City" shall mean the City of Mabton.

J. "Closed system" means any water system or portion of a water system in which water is closed.

K. "Contamination" means the entry into or presence in a public water supply system of any substance which may be harmful to health and/or quality of the water.

L. "Cross-connection" means any physical arrangement where a public water system is connected, directly or indirectly (actual or potential), with any other non-drinkable water system or auxiliary system, wells, sewer, drain conduit, swimming pool, storage reservoir, plumbing fixture, swamp coolers, or any device which may be capable of imparting contamination or pollution to the public water system as a result of backflow. Bypass arrangements, jumper connections, removable sections, swivel or changeover devices, or other temporary or permanent devices through which, or because of which, backflow may occur are considered to be cross-connections.

M. "Cross-connection Specialist" or "CCS" shall mean a person holding a valid CCS certificate issued in accordance with the Washington Administrative Code.

N. "Degree of hazard" means the low or high hazard classification that shall be attached to all actual or potential cross-connections.

O. "Director" shall mean the public works director or his/her designee.

P. "DOH" means the department of health.

Q. "Double check detector assembly" or "DCDA" means an assembly which consists of two independently operating check valves which are spring-loaded or weighted. The assembly comes complete with a shut-off valve on each side of the checks, as well as test cocks to test the checks for tightness. It shall also be provided with a factory bypass arrangement wit a meter and a minimum of an approved double check assembly.

R. "Double check valve backflow prevention assembly" or "double check assembly" or "double check" or "DCVA" or "DC" means an assembly which consists of two independently operating check valves which are spring-loaded or weighted. The assembly comes complete with a shut-off valve on each side of the checks, as well as test cocks.

S. "Health hazard" means an actual or potential threat of contamination of a physical, toxic or biological nature that would be a danger to health.

T. "High hazard" means the classification assigned to an actual or potential cross-connection that potentially could allow a substance that may cause illness or death to backflow into the potable water supply.

U. "In-premises protection" means a method of protecting the health of consumers served by the customer's plumbing system (i.e., located within the property lines of the customer's premises) by the installation of an approved air gap, backflow prevention assembly or device at the point of hazard.

V. "Inspector", "surveyor" or "specialist" shall mean a person holding a valid CCS certificate issued in accordance with the Washington Administrative Code, who meets the stipulations in this chapter.

W. "Local administrative authority" means the local official, board, department or agency authorized to administer and enforce the provisions of the Uniform Plumbing Code and all other plumbing codes recognized by the state of Washington.

X. "Low hazard" means the classification assigned to an actual or potential cross-connection that could allow a substance that may be objectionable, but not hazardous to one's health, to backflow into the potable water supply.

Y. "Mobil unit" shall mean units connecting to the water system through a hydrant, hose bibb, or other appurtenance of a permanent nature that is part of the city water system or a permanent water service to a premises. Examples can include but are not limited to the following: water trucks, pesticide applicator vehicles, chemical mixing units or tanks, waste or septage hauler trucks or units, sewer cleaning equipment, carpet or steam cleaning e2quipment, rock quarry or asphalt/concrete batch plants, or any other mobile equipment or vessel. Uses that are excluded from this definition are recreational vehicles at assigned sites or parked in accordance with other city ordinances pertaining to recreational vehicles, and homeowner devices that are used by the property owner in accordance with other provisions of this, or other, City of Mabton ordinances pertaining to provision of water to premises.

Z. "Person" means a natural person (individual), corporation, company, association, partnership, firm, limited liability company, joint venture company or association, and other such entity.

13.05.050 Backflow Prevention Assembly Requirements

A CCS employed by or under contract with the city shall determine the type of backflow assembly to be installed within the area served by the city. All assemblies shall be installed at the service connection unless it is determined by the CCS to install the assembly at an alternate location for premises protection or at the point of use. The cross-connection shall be eliminated or an assembly shall be required to be installed in each of the following circumstances, but the CCS is in no way limited to the following circumstances:

A. The nature and extent of any activity on the premises, or the materials used in connection with any activity on the premises, or materials stored on the premises, could contaminate or pollute the potable water supply.
B. Premises having any one or more cross-connections or potential cross-connections as that term are defined in this chapter and the WAC.
C. When a cross-connection survey report form is required by the city to be filled out and returned and it has not been received.
D. Internal cross-connections are present that are not correctable.
E. Intricate plumbing arrangements exist or plumbing subject to frequent changes are present that make it impractical to ascertain whether or not cross-connections exist.
F. There is a repeated history of cross-connections being established or re-established.
G. There is unduly restricted entry so that inspections for cross-connections cannot be made with sufficient frequency to assure that cross-connections do not exist.
H. Materials, chemicals or any substance or apparatus is being used that if backflow occurred contamination would result.
I. Installation of an approved backflow prevention assembly is deemed to be necessary in the judgment of the CCS to accomplish the purpose of these regulations.
J. Any premises having auxiliary water supply which is not in compliance with WAC 248-54-30 and is not acceptable to the city.
K. In the event of a point-of-use assembly has not been tested or repaired as required by WA 246-290-490, or as amended, and this chapter.
L. If it is determined that additions or rearrangements have been made to the plumbing system without obtaining proper permits as required by the city code enforcement division.
M. All high health hazard premises which are defined in Table 9 of WAC 246-290-490, or as amended, are required to have premises isolation by installing a reduced pressure principle assembly in accordance with this chapter.
N. When a garden hose attachment is connected to the premises plumbing, including but not limited to fertilizer applicators, pesticide applicators and radiator flush kits
O. Where reclaimed or reused water systems are installed.
P. Premises on which any substance is handled under pressure so as to permit entry into the public water system.

13.05.060 Irrigation

All irrigation systems shall be protected in accordance with the plumbing code regulations. In the event any system is equipped with an injector system, or has submerged heads, a reduced pressure principle assembly will be required.

13.05.070 Fire

An approved double check detector backflow prevention assembly shall be the minimum protection on all new fire sprinkler systems using piping material that is not approved for potable water use, and/or that does not provide for periodic flow-through. A reduced pressure principle detector backflow prevention assembly must be installed, if any solution other than the potable water can be introduced into the sprinkler system. Retrofitting on fire sprinkler systems will be required in each of the following circumstances:

A. Where improper maintenance has occurred.
B. On all high hazard locations.
C. Where a CCS deems necessary.
D. Wherever required by the WAC.

13.05.080 Temporary Meters and Hydrant Valves

Backflow protection will be required on temporary meters and all hydrant valves. The type of assembly will be commensurate with the degree of hazard and will be determined on a case-by-case basis by the city's CCS.

13.05.090 Mobile Units

Any mobile unit or apparatus as defined in MMC 13.05.010 which uses the city's water from any premises or piping within the distribution system shall first obtain a permit from the city. The mobile unit will be inspected to assure appropriate backflow protection is installed in accordance with this chapter.

13.05.100 Right-of-Way Encroachment

A. No person shall install or maintain a backflow prevention assembly upon or within any city right-of-way except as provided in this section.
B. The city reserves the right to have an assembly installed in the right-of-way.
C. A backflow prevention assembly required by the city may be installed upon or within any city right-of-way only if the owner proves to the city that there is no other feasible location for installing the assembly, and installing it in the right-of-way will not interfere with traffic or utilities. The city retains the right to approve the location, height, depth, enclosure, and other requisites of the assembly prior to its installation.
D. All permits required by the city code to perform work in the right-of-way.
E. A property owner shall, at the request of the city and at the owner's expense, relocate a backflow prevention assembly which encroaches upon any city right-of-way, when such relocation is necessary for street or utility construction or repairs for purposes of public safety.

13.05.110 Plumbing Code

As a condition of water service, customers shall install, maintain, and operate their piping and plumbing systems in accordance with all Washington State plumbing codes.

13.05.120 Access to Commercial Industrial Premises

Authorized employees of the city, with proper identification, shall have access during the hours of 8:00am to 5:00pm to all parts of commercial and industrial premises and within the buildings to which water is supplied. If access to the premises or to the interior of a structure during these hours are denied,

a reduced pressure principle assembly shall be required to be installed at the service connection to that premises.

13.05.130 Access to Residential

Permission to perform a cross-connection inspection at a residential property must be requested by the city at least 72 hours prior to the time of inspection. If permission is denied, the property owner shall contact a CCS to perform the inspection and provide a report to the city. The report must reach the city within 21 days of the request for permission from the city. Failure to comply may result in the city installing a RP assembly at the meter incompliance with this chapter.

13.05.140 Testing

Backflow prevention assemblies shall be tested and repaired in accordance with the requirements set out in the WAC, this chapter and the most recent edition of the city's SOP manual.

13.05.150 Responsibilities of Backflow Prevention Assembly

All backflow assembly testers operating within the city shall be certified in accordance with all applicable regulations and shall comply with all stipulations in this chapter and the most recent edition of the city's SOP manual.

13.05.160 Maintenance of Backflow Prevention Assembly

Backflow prevention assemblies shall be maintained in accordance with the requirements set out in the WAC, or as amended, and the most recent edition of the city's SOP manual.

13.05.170 Installation Requirements and Specifications

Backflow Prevention assemblies shall be installed in accordance with the requirements in the WAC and the most recent edition of the city's SOP manual. In the even the CCS allows a premises isolation assembly to be installed at an alternate location, there shall be no connections between the meter and the premises isolation assembly.

13.05.180 Thermal Expansion

If a closed system has been created by the installation of a backflow prevention assembly, it is the responsibility of the property owner to eliminate the possibility of thermal expansion.

13.05.190 Pressure

Any reduction in water pressure caused by the installation of a backflow assembly is not the responsibility of the city. The city will give reasonable assistance to the owner regarding information on adequate sizing of assemblies and proper plumbing practices to provide for required pressure and flows for fire protection.

13.05.200 Parallel Installation

Premises where noninterruption of water supply is critical shall have two assemblies of the same type installed in parallel. They shall be sized in such a manner that either assembly will provide the minimum water requirements while the two together will provide the maximum water requirements.

13.05.210 New Construction

A. On all new nonresidential construction, an approved backflow assembly shall be installed at the service connection. The type of the assembly will be commensurate with the degree of hazard as determined by a CCS.

B. When a building is constructed on commercial premises, and the end use of the building is not determined or could change, a reduced pressure principle backflow prevention assembly shall be installed at the service connection to provide protection of the public water supply in the event of the most hazardous use of the building.

13.05.220 Residential Service Connections

Any residential property which has been determined to have an actual or potential cross-connection and/or has violated the plumbing code or this chapter in any way shall be required to install an approved backflow prevention assembly in accordance with this chapter.

13.05.230 Rental

The property owner is responsible for the installation, testing and repair of all backflow assemblies on their property. When the tenants change, or, if the plumbing is altered in any way, it is the responsibility of the owner to notify the city.

13.05.240 Retrofitting

Retrofitting shall be required on all service connections where an actual or potential cross-connection exists, and wherever else the city deems retrofitting necessary.

13.05.250 Costs of Compliance

All costs associated with the purchase, installation, inspections, testing, replacement, maintenance, parts, and repairs of the backflow assembly are the financial responsibility of the property owner. All costs associated with any disconnect fees associated with the enforcement of this chapter are the sole responsibility of the water user and/or property owner. On residential irrigation systems, the city may purchase, install, test, and maintain the backflow assemblies. The cost for these services will be passed on to the end user and/or property owner on their water bill and my be amortized over a period of time upon request.

13.05.260 Recovery of Costs

Any water customer violating any of the provisions of this chapter and who causes damage to or impairs the city's water system, including, but not limited to, allowing contamination, pollution, any other solution or used water to enter the city's water system, shall be liable to the city for any expense, loss or damage caused by such violation. The city shall collect from the violator for the cost incurred by the city for any cleaning, purifying, repair or replacement work or any other expenses caused by the violation. Refusal to pay the assessed costs shall constitute a violation of this chapter and shall result in the termination of service.

13.05.270 Emergency Suspension of Service

The director or his/her designee may, without prior notice, suspend water service to any premises when such suspension is necessary to stop the eminent threat of any actual or potential cross-connection as defined in this chapter and the most recent edition of the city's SOP manual.

13.05.280 Non-Emergency Suspension of Service

The director or his/her designee may, with 24 hr prior notice, suspend water service to any premises where the conditions as defined in this chapter and the most recent edition of the city's SOP manual have been violated.

13.05.290 Penalties

Any person, property owner, firm, corporation or business entity violating (a) this chapter or (b) any regulation, rule or permit of the city issued pursuant to this chapter, shall be liable to the city for civil penalty. The amount of such civil penalty shall be $2,000 per violation. Each continuing day's violation under this chapter shall constitute a separate offense. The penal provisions imposed under this chapter shall not preclude the city from filing suite to enjoin the violation. The City of Mabton retains all legal rights and remedies available to it pursuant to local, state and federal law.

13.05.300 Falsifying Information

Any person who knowingly makes any false statement, representation, record, report or other document filed or required to be maintained pursuant to this chapter, or who falsifies, tampers with, or knowingly renders inaccurate any backflow assembly, device or method required under this chapter shall (in addition to civil and/or criminal penalties provided by state law) be guilty of a misdemeanor subject to the general penalty clause of the Mabton Municipal Code.

Section II. This Ordinance shall take effect and be in force five (5) days from and after its passage, approval, and publication, as provided by law.

PASSED by the CITY COUNCIL of the CITY OF MABTON, WASHINGTON and APPROVED by the MAYOR this 10th day of May 2005.

MAYOR:

DAVID CONRADT

ATTEST:

ILDIA JACKSON
CITY ADMINISTRATOR

APPENDIX M

SANITARY SURVEY

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
EASTERN DRINKING WATER REGIONAL OPERATIONS
16201 East Indiana Avenue, Suite 1500, Spokane Valley, Washington 99216-2830
TDD Relay 1-800-833-6388

GRAY & OSBORNE INC
MAR - 7 2012

February 10, 2011

Angel Reyna, Mayor
City of Mabton
PO Box 655
Mabton, Washington 98935

Subject: Mabton, City of; PWS ID #49650R; Yakima County
Routine Sanitary Survey – January 12, 2010

Dear Mr. Reyna:

Thank you and Francisco Tijerina for your time and help with the Department of Health (DOH) Routine Sanitary Survey on January 12, 2010. I documented our discussion and observations during the survey, in this letter. Please refer to the enclosed copy of the report and photographs for more information.

Findings

We inspected wellfield S05 (consisting of S01 and S04), the Reservoir, chlorination stations and the booster station. During the survey, we observed no significant deficiencies. Making sure all water systems correct each Significant Deficiency discovered during a survey, is a high priority for the state's drinking water program.

Other Findings

During the course of the survey, we also observed some additional concerns that I listed below, followed by a brief explanation. Because these concerns can impact the quality of the water supply, please correct and provide a brief letter documenting how you had each deficiency corrected by **April 29, 2010**.

1. S04 (Well #5) – Replace the end of the screened air vent, so the vent portion turns to face the floor. Also replace the screen. The existing vent is at an angle directed outwards from the pump motor base, and the external screen had begun to deteriorate (See Photo-6). I enclosed a fact sheet describing the specifics of the vent and screen.

Sanitary Control Area

S01 (Well #4) – The Sanitary Control Area (SCA) is secured by a locking fence and used primarily for storage. In addition, the city keeps the heavy equipment and materials away from the pumphouse and the source. Please keep watch over the SCAs and avoid using the areas to dump old broken equipment or debris.

Reservoir

The reservoir hatches and vents appeared sealed and protected. Please document the gasket is in place and the screens have not corroded, during the next scheduled maintenance check.

General Water System Information

Operation

The attached system operation and analysis were part of the old water system plan approved on September 19, 2005. The analysis explains some of the questions and some of the set points observed at the S04 (Well 5), S01 (Well 4), and the booster station. The information will provide a starting point for tracking, as well as, to determine whether the water system is operating correctly. For example, the reservoir works as a large aeration tower with splash plates on top. The wells are treated with chlorine and fill the reservoir from the top about 5-feet above the splash plates. Please keep in mind the aerated inorganic compounds can increase corrosion and deterioration of screens and vents.

Total Number of Approved Connections

The total number of approved connections was established when the current water system plan was approved in 2005. DOH based the limitation on the water right and current water system usage. At the time, the city was pumping more water on an annual basis than the water right allowed. Currently, the operating permit is Blue for exceeding the total number of approved connections, and cannot be changed to Green or increase the approved number of connections, until a new water system plan is submitted for review and approval.

Survey Fee

Our office will notify you when the next sanitary survey is due. WAC 246-290-990 (3)(c), authorizes a schedule of fees to be implemented to help recover the cost of conducting a sanitary survey.. The Department of Health's (DOH) total cost to complete this sanitary survey is $1836.00. The Office of Drinking Water has used state and federal funds to pay $918.00 of this amount. An invoice showing the remaining amount due of $918.00 is enclosed.

Do not hesitate to call me at (509) 329-2120, if you require additional information or assistance.

Sincerely,

Andres R. Cervantes, PE
Regional Engineer
Office of Drinking Water
Division of Environmental Health

Enclosures: Invoice
Sanitary Survey Report and Photos

cc: **Yakima** County Health District
Danielle Finley, Survey Coordinator

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Office of Drinking Water
INVOICE
Engineering, Planning, and Sanitary Survey Review Form

TO: ANGEL REYNA, MAYOR
CITY OF MABTON
PO BOX 655
MABTON, WA 98935

Invoice Number	202973E
Invoice Date	FEBRUARY 10, 2011
Billing Period	30 DAYS

DATE	DESCRIPTION	QUANTITY	COST	AMOUNT
01/12/11	SANITARY SURVEY MABTON, CITY OF YAKIMA COUNTY DATE OF SURVEY: JANUARY 12, 2010 PWS ID #49650R	1		$1,836.00
	DOH SHARE			- 918.00
	TOTAL			$ 918.00
	Payment due within 30 days. Interest shall accrue at 1% per month after 30 days.			

Make Checks Payable to Department of Health
Return Lower Portion to:
Department of Health
PO Box 1099
Olympia, WA 98507-1099

Office of Drinking Water
Engineering, Planning, and Sanitary Survey Review Form

NAME	MABTON, CITY OF
INVOICE NUMBER	202973E
INVOICE DATE	FEBRUARY 10, 2011
AMOUNT	$918.00

Return to:
Department of Health
Revenue Section
PO Box 1099
Olympia, WA 98507-1099

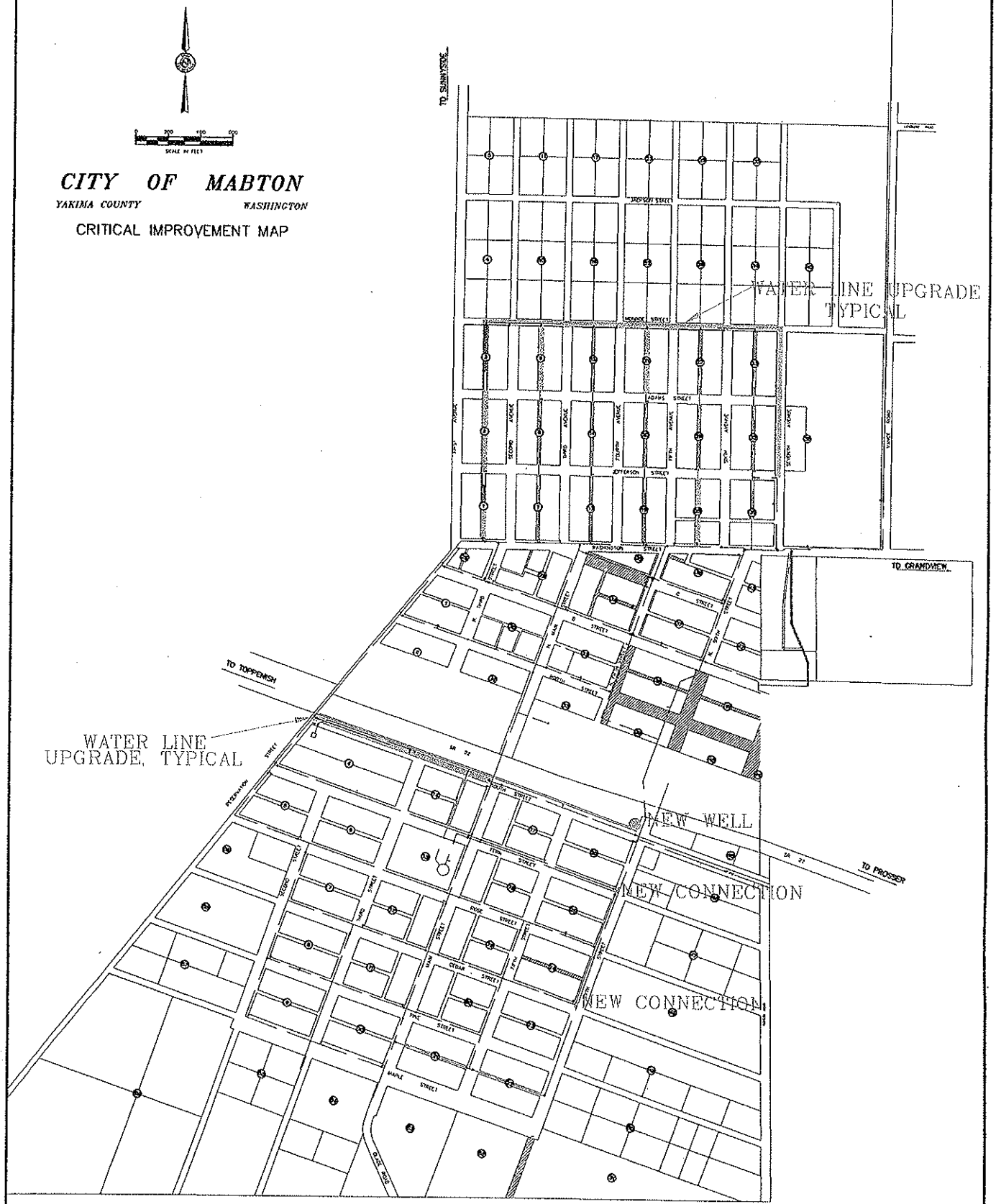
DOH Form #331-332

For persons with disabilities, this document is available on request in other formats. To submit a request, please call 1-800-525-0127 (TTY 1-800-833-6388).

CITY OF MABTON

YAKIMA COUNTY *WASHINGTON*

CRITICAL IMPROVEMENT MAP



SPINK ENGINEERING
CIVIL & MUNICIPAL ENGINEERS
RICHLAND, WASHINGTON

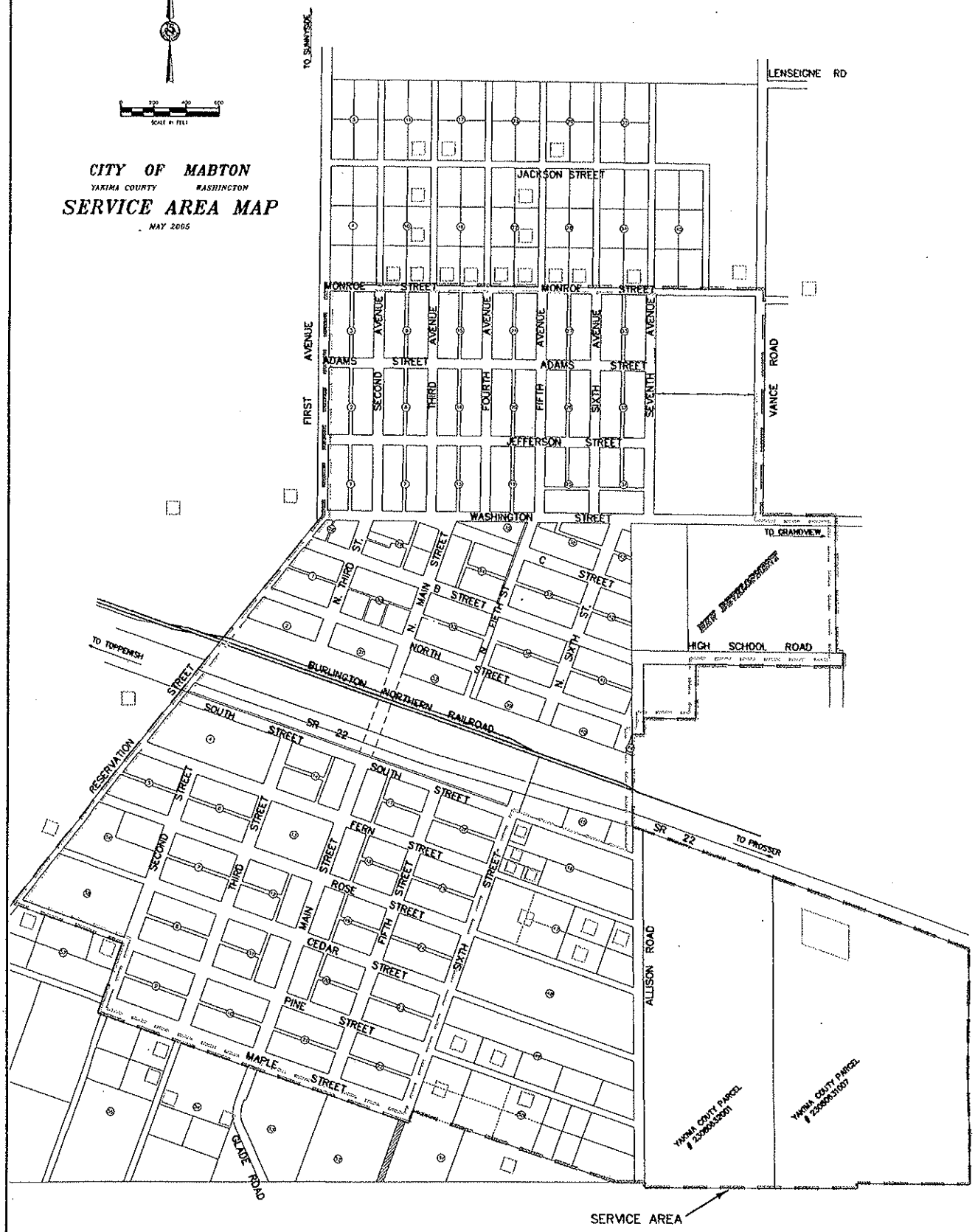
02134Improvements.dwg

CITY OF MABTON

YAKIMA COUNTY WASHINGTON

SERVICE AREA MAP

MAY 2005



LEGEND

SERVICE AREA

RETAIL SERVICE AREA

RETAIL CUSTOMER OUTSIDE RETAIL SERVICE AREA
Service will be continued to the existing residences
No new services will be granted outside the
Retail Service Area.

SPINK ENGINEERING
CIVIL & MUNICIPAL ENGINEERS
RICHLAND, WASHINGTON

Mabton2004ServiceArea.dwg
Revised: May 2005

disinfection byproducts due to the chlorination of the drinking water. The total concentration of these four compounds is less than 80 ug/l, and is not an immanent concern at this time. Bromochloromethane was found at 0.81 ug/l. Although this is not a regulated chemical, it is above the trigger level. The levels of this compound will need to be reviewed in future testing.

C. SYSTEM INVENTORY, DESCRIPTION AND ANALYSIS

1. SOURCE

Mabton's water system can draw water from three wells, Well #2, Well #3 and Well #4. Water production from Well #1 was discontinued sometime in 1956. From 1957 to 1987, Well #2 and Well #3 were used as the primary sources. Well #4, now the primary source, was drilled in 1987. The static water level (no pump running) in Well #4 was 76 feet below the ground surface. By 1999, the static water level had dropped to 114 feet below the ground surface. In 1987 the water production in Well #4 was 1,000 gpm and the current production rate is 450 gpm. Pump bowls were lowered in 2001 to prevent cavitation (pumping air) when the pump is on.

In 1987, Well #3 was taken off line due to high nitrates and Well #2 was used as a supplementary well in the summer and an emergency backup well in the winter. Water produced from Well #2 has high hydrogen sulfide (rotten egg) concentrations. In the early 1990's, water production from Well #4 was decreasing, requiring Well #2 to be used continually during the summer.

Complaints regarding the hydrogen sulfide by Mabton's residents brought about the use of Well #3 as a primary source. In 2001, the City received Department of Health approval for blending the high nitrate water in Well #3 with water from Well #4 (**Appendix 21**). The water provided to consumers is below the drinking water limits for nitrates.

Water levels in Well #3 have decreased over the years. In 1985, the static water level was 34 feet below the ground surface. In 2002, the static water level was 64 feet below the ground surface, 30 feet lower than in 1985. The pump bowls for Well #3 were lowered approximately 60 feet in 2002 to prevent cavitation when pumping water.

Over the past three years the wells have not kept up with the peak demands occurring in the summer months. On several occasions, the distribution system has been shut off in order to allow the reservoir to fill at least 1/4 of the operating height. Department of Health has informed the City that this is not a good practice because it creates a great potential for cross-connections. With the low pressure in the distribution system, a back syphon into the system can occur and potentially bring a contaminant source with it.

Well #3 construction consists of:

- 16-inch casing from ground surface to 130 feet below ground surface with perforations from 96' to 115'.
- 12-inch casing to 307 feet below ground surface with perforations from 295' to 305'.
- 12-inch open hole to 413 feet below ground surface.
- 10-inch open hole to 1,004 feet below ground surface.

Rehabilitation of well #3 is not considered the best option for increasing water production. In 1957, the well produced approximately 400 gpm. Currently the well produces 250 gpm. In 1985, Charles Jungman recommended drilling a new well instead of making improvements to well #3 (**Appendix 18**). The primary reason for this recommendation was the observation that the water level in well #3 was not affected during a pump test of well #1, which pumped water from 859 feet below ground surface and deeper. This was an indication that most of the water produced in well #3 was from the upper water bearing zones.

The City is in need of an additional water source capable of 500 gpm to augment well #3 and Well #4. Without an additional source, the City of Mabton will have to enforce stringent water conservation measures.

Table 3-5: Water Source Information

WELL #	SOURCE 3	PUMP RATE	NOTES
2	SO 2	200	Hydrogen Sulfide odor
3	SO 3	250	High nitrates, must be blended
4	SO 1	450	Main water source.

2. TREATMENT

The City of Mabton treats the groundwater as it is pumped into the storage tank. Chlorine is added near the top of the reservoir. The residual chlorine level in the water system is kept above 1.0 mg/l.

3. STORAGE

Mabton has one storage tank. A pressure gage located in the booster station is used to determine the depth of water in the tank and is set five feet (5') above the floor of the water tank. Operating pressures are 34 psi for the "pump on" level and 36 psi for the "pump off" level. The water depth in the tank for the "pump on" level is 83 feet (5' +

78') and the "pump off" level is 88 feet (5' + 83'). The total volume in the tank below the "pump off" level is 611,500 gallons.

Chapter 246-290-235 of the Washington Administrative Code requires reservoirs to be adequately sized to provide operating storage (OS), equalizing storage (ES), standby storage (SB) and fire suppression storage (FSS). The equalizing and standby storage evaluations take into account well production rates. With water production decreases over the past decade, the Mabton reservoir does not meet these recommendation for total storage. The available storage of 611,500 gallons is less than the total recommended amount of storage; 1,051,300 gallons (**Appendix 5**). This has been evident during the summer of 2003 and 2004. Water production has not kept up with prolonged peak demands.

In July of 2004, the City tried turning off the booster pumps to help decrease the water use. In four days, the water level increased 10 feet. The City then started shutting off the water to the distribution system from 11:00 p.m. to 3:00 a.m. to allow the reservoir to fill. The water level increased approximately 40 feet each night by doing this. This lasted for about three weeks. The Washington State Department of Health recommended that the City stop this procedure due to the potential for creating a cross connection. Since the middle of August 2004, Mabton has continued to operate the water system with out the booster pumps on. The fire pump is left on the automatic settings for emergency situations.

With the addition of a well producing 500 gpm, the Mabton water system will meet the current storage requirements. If the standby storage is set at the minimum recommendation of 200 gallons and a new well in constructed, the Mabton water system can provide service to 1,166 ERU's.

4. DISTRIBUTION SYSTEM HYDRAULICS

WaterCAD by Haestad Methods was used to perform the hydraulic analysis of the Mabton water system. Hazen-Williams roughness coefficients were not determined in the field due to the inability to isolate sections of the water system with a fire hydrant or other outlet at the end of the "pipe run". The roughness coefficients and other input data used in the computer model were:

4" Cast Iron Pipe	C = 90
6" Cast Iron Pipe	C = 100
PVC Pipe	C = 130
Concrete Pipe	C = 110
Normal Operation System Pressure	30 psi
Minimum Fire Flow	1,000 gpm, w/ min. system pressure of 20 psi

Roughness Coefficients (C values) were selected based on age of the pipe and potential for restriction of flow. Conservative values were selected since no field measurements were made. Elevations used in the modeling are from the contour map done by Gray and Osborne in 1953. (Surveys will be required for future upgrade projects to verify all elevations used in the computer model).

A peak hourly demand (PHD) of 1,200 gpm was used for year 2003. This was estimated from Mabton's existing circular flow charts for the booster pumps. On six different days during the summer of 2002 the flow on the recorded charts reached 1,000 gpm. Three days the duration of the peak flow was two hours and on the other three days, the duration was three hours. Due to the length of time of the higher flows, the PHD was increased to 1,200 gpm to help ensure the hydraulic analysis evaluated flows at or higher than the existing flows.

The critical situation for water systems is fire flow during PHD. In each evaluation the available fire flow was compared to the recommended fire flow requirements (Section 3.5). Changes to the model water system were evaluated to determine minimum upgrades needed for the system to meet the recommended minimum fire flow requirements, 1,000 gpm with minimum system pressure of 20 psi.

Existing fire hydrants are represented by junction nodes near the actual location of the fire hydrants. Pipes PS511 and PS521 in the southwest section of town were drawn in the model. Mabton Public Works indicated these pipes have not been constructed. Therefore, these pipes were closed during the modeling, simulating no pipe.

Locations of future demands are dependent on new housing and businesses in Mabton. As noted in 3.C "Current & Future Land Use," Mabton has approved the plat on the east side of the City for development as noted in Section 2.C. Without knowing where other growth will occur or the locations of new water lines, the future PHD was added in the areas near this plat.

MODELING RESULTS

NORMAL OPERATION ANALYSIS

The base scenario shows the system at peak hourly demand, 1,200 gpm, with the two booster pumps and fire pump in operation. The distribution system in this situation has pressures that exceed 30 psi. Without the fire pump, the system pressure drops approximately 8 psi, bu the lowest pressure of 71 psi is still significantly higher than the required 30 psi (**Appendix 6, Normal Operation**).

FIRE FLOW ANALYSIS

The existing water system was evaluated to determine if a fire flow 1,000 gpm can be provided throughout the City while maintaining a minimum pressure of 20 psi. Each

of the scenarios listed in the following sections are based on a minimum system pressure of 20 psi. Where fire flow deficiencies are noted, the fire flow listed is the flow rate available during peak hourly demands and sustaining 20 psi throughout the system. Upgrades to the system were evaluated to determine where water line replacements are needed to increase the fire flow and maintain 20 psi in the system.

The analysis shows the existing system can provide over 2,000 gpm at junctions JC-40, JC-60 and JC-6, near the high school with peak hourly demands and maintain 20 psi throughout the system. Near the middle school, the existing system can provide over 2,000 gpm at junctions JN-71 and JN-80. At junction JN-85 the available fire flow is 1,950 gpm. At 98% of the desired fire flow, this existing will provide an acceptable fire flow at the middle school.

Peak hourly demand was used for the fire flow analysis. The peak hourly demand of 1,200 was determined from the City's flow recording charts. This is greater than the maximum daily demand (MDD) and gives a greater factor of safety. The MDD is equal to twice the amount of the average daily demand (ADD). In Appendix 2, the ADD is equal to 367 gpm (70,734 cf/day). The MDD is equal to 735 gpm.

YEAR 2003, Existing System

Year 2003 simulations use a peak hourly demand of 1,200 gpm. As noted previously, the 1,200 gpm flow was inferred from existing flow data. Results from the modeling are in **Appendix 6.**

Year 2003, Base Scenario: this simulation evaluated the existing systems ability to meet the minimum recommended fire flow standards with a peak hourly demand (PHD) of 1,200 gpm. Fire flow requirements were not met at the locations shown in Table 3-6.

Table 3-6: Year 2003 Existing System Fire Flow Deficiencies

Location	Model Label	Fire Flow @ 20 psi	Recommended Requirement
Jefferson & Block 1 Alley	JN-110	719	1, 000 gpm
Jefferson & Block 13 Alley	JN-120	768	1, 000 gpm
Jefferson & Block 26 Alley	JN-155	765	1, 000 gpm
Adams & Block 8 Alley	JN-220	688	1, 000 gpm
Adams & Block 20 Alley	JN-245	723	1, 000 gpm
Monroe & 2nd	JN-315	721	1, 000 gpm
Monroe & 4th	JN-340	948	1, 000 gpm
Fern & 5th	JS-150	791	1, 000 gpm
Fern & 6th	JS-160	758	1, 000 gpm
Rose & 6th	JS-260	946	1, 000 gpm
Cedar & 6th	JS-360	800	1, 000 gpm

Year 2003, Scenario 5: the same PHD of 1,200 gpm was used with the following upgrades to the existing system:

- South Street between Main St. & Reservation Rd — new 8" PVC
- Seventh Street between Jefferson & Monroe — new 8" PVC
- Monroe Street between 7th St. and alley west of 2nd — new 8" PVC
- Alley's in Blocks 1,2,3,9,21,25 in north section — new 8" PVC

Fire flow requirements were not met at the locations shown in Table 3-7.

Table 3-7: Year 2003 Upgraded System Fire Flow Deficiencies

Location	Model Label	Fire Flow @ 20 psi	Recommended Requirement
Fern & 5th	JS-150	791	1,000 gpm
Fern & 6th	JS-160	758	1,000 gpm
Rose & 6th	JS-260	946	1,000 gpm
Cedar & 6th	JS-360	800	1,000 gpm

YEAR 2009, Scenario 5: the Mabton distribution system was evaluated with upgrades noted in Year 2003, Scenario 5, a PHD of 1,260 gpm and connections of the 8" AC and 4" CI water lines on Sixth Street at intersections with Fern Street and Cedar Street. Fire flow requirements were not met at the location shown in Table 3-8.

Table 3-8: Year 2009 Upgraded System Fire Flow Deficiencies

Location	Model Label	Fire Flow @ 20 psi	Recommended Requirement
Fern & 5th	JS-150	944	1,000 gpm

YEAR 2023, Scenario 5: the Mabton distribution system was evaluated with upgrades noted in Year 2003, Scenario 5 and a PHD of 1,500 gpm. Fire flow requirements were not met at the location shown in Table 3-9.

Table 3-9: Year 2023 Upgraded System Fire Flow Deficiencies

Location	Model Label	Fire Flow @ 20 psi	Recommended Requirement
Fern & 5th	JS-150	922	1,000 gpm

D. SUMMARY OF SYSTEM DEFICIENCIES

Mabton's water system critical deficiency is lack of water during peak demands. An additional water source is urgently needed to provide water in the summer months.

The existing wells and reservoir do not meet the required storage requirements. This is due to the decrease in production of Wells #3 and #4. An additional well that provides 500 gpm will allow Mabton to meet existing needs and allow for future growth.

The recommended fire flow cannot be met throughout the City of Mabton. The following upgrades are considered to be the minimum upgrades needed to provide a fire flow of 1,000 gpm to all areas of the City. There are other options available, but will cost significantly more money. These recommendations that will provide overall fire flow with the least amount of cost are:

1. South Street between Main St. & Reservation Rd — new 8" PVC
2. Seventh Street between Jefferson & Monroe — new 8" PVC
3. Monroe Street between 7th St. and alley west of 2nd — new 8" PVC
4. Alley's in Blocks 1,2,3,9,21,25 in north section — new 8" PVC
5. Sixth Street "Connections" at intersections — 6th & Fern, 6th &Cedar

E. ANALYSIS OF POSSIBLE IMPROVEMENTS

Possible
Hydraulics." Section 3.D "Summary of System Deficiencies" provides recommended improvements to the distribution system. These improvements will provide adequate fire protection throughout the system.

A
production capacity and reservoir volume. The existing system cannot meet the peak demands. A new well producing 500 gpm will meet the existing storage needs and allow up to 1,166 ERU's for the system.

4. CONSERVATION PROGRAM & SOURCE SUPPLY ANALYSIS

A. CONSERVATION PROGRAM

The City of Mabton Water Conservation Program is in **Appendix 7.** Mabton will not be discontinuing any water conservation measures. The City will be implementing more measures to help determine an accurate water balance. In pr residential lawn watering was alternated by one-half the town watering on even days and the other half water on odd days of the month. The City will be implementing a time period each day that lawns can be watered. The time for watering will be from 5:00
This will avoid watering in the heat of the day when more evaporation occurs a watering all night.

In March, 2005, the City Council approved the plan to install meters at all parks. The Public Works Department is working with Spink Engineering to have the installed in June, 2005.

B. WATER RIGHT ASSESSMENT

The
G4-29212C. The Water Right Self-Assessment Form
are in **Appendix 8.** Waterright G3-00381C is for a well at the wastewatertreatment plant
and

The annual volume allowed by the water rights G3-00027c and G4-29212C is 452.4 acre-feet
greater
also listed on the Water Right Self-Assessment Form. In 2009, it is estimated that the water production will be 694.7 acre-feet, or 242.3 acre-feet over the existing water right.

existing water right. Mabton needs an additional 370 to 400 acre-feet to cover the future water needs.

Mabton received a modification to water right G4-29212C. This allows a second point of withdrawal. Another well will allow Mabton to pump up to 500 gpm. This change to the water right will not increase the total annual volume of the permit. The combined instantaneous flow rate (pumping rate) from Wells #2 and #3 is 550 gpm. This is well below the 1,400 gpm allowed by water right G3-00027C. Well #4 has a pumping rate of 450 gpm, one-half of that allowed on water right G4-29212C.

PLAN FOR ADDITIONAL WATER RIGHTS

i. Reduce water consumption and production through water conservation.
ii. Acquire available water rights in vicinity of City of Mabton and transfer water rights to the existing system. Mabton is checking the "Washington Water Exchange" web page for potential water rights to purchase and transfer.
iii. Apply for additional water rights. The City is aware no water rights are being issued by Department of Ecology at this time. The City would like to establish a priority date for the review to their application in the event that Ecology begins to issue new water rights in the Yakima Valley.
iv. The Yakima River is not consider a viable source for Mabton due to the distance required to pump water to the City, and will not be pursued at this time.

C. SOURCE SUPPLY ANALYSIS & EVALUATION OF SUPPLY ALTERNATIVES

Mabton has been using wells to supply the City with water since 1908. The City's location with respect to the Yakima River does not lend itself to a feasible option to use surface water to supplement the water supply. A surface water supply would require a large intake system, a large treatment system, a large booster pumping system and new water supply lines large enough to provide adequate water to the City system.

There are no other private or public water systems adjacent to Mabton that can be considered a reliable source of water during an emergency. The closest cities are Grandview, Prosser and Sunnyside. Prosser and Sunnyside are approximately 12 miles away and Sunnyside is on the opposite side of the Yakima River. The estimated cost of an intertie with Prosser or Sunnyside is $2,800,000. An emergency intertie is not feasible with either city.

Grandview is 5.5 miles from Mabton and on the opposite side of the Yakima River. The approximate cost an emergency intertie with Grandview is $1,700,000. An emergency intertie is intended to be used occasionally when one system cannot meet minimum demands. Mabton is in need of a constant source under the City's control. Therefore, an intertie with Grandview is not feasible.

Table 4-1: Intertie Cost Estimate

Grandview Intertie Cost Estimate		
5.5 Mile Water Line	29,040 ft x $40/ft	$1,161,600
Booster Station		$300,000
River Crossing		$300,000
Total		$1,761,600
Sunnyside or Prosser Intertie		
12 Mile Water Line	63,360 ft x $40/ft	$2,534,400
Booster Station		$300,000
Total		$2,834,400

D. WATER SUPPLY RELIABILITY ANALYSIS & WATER SHORTAGE RESPONSE PLAN

RELIABILITY

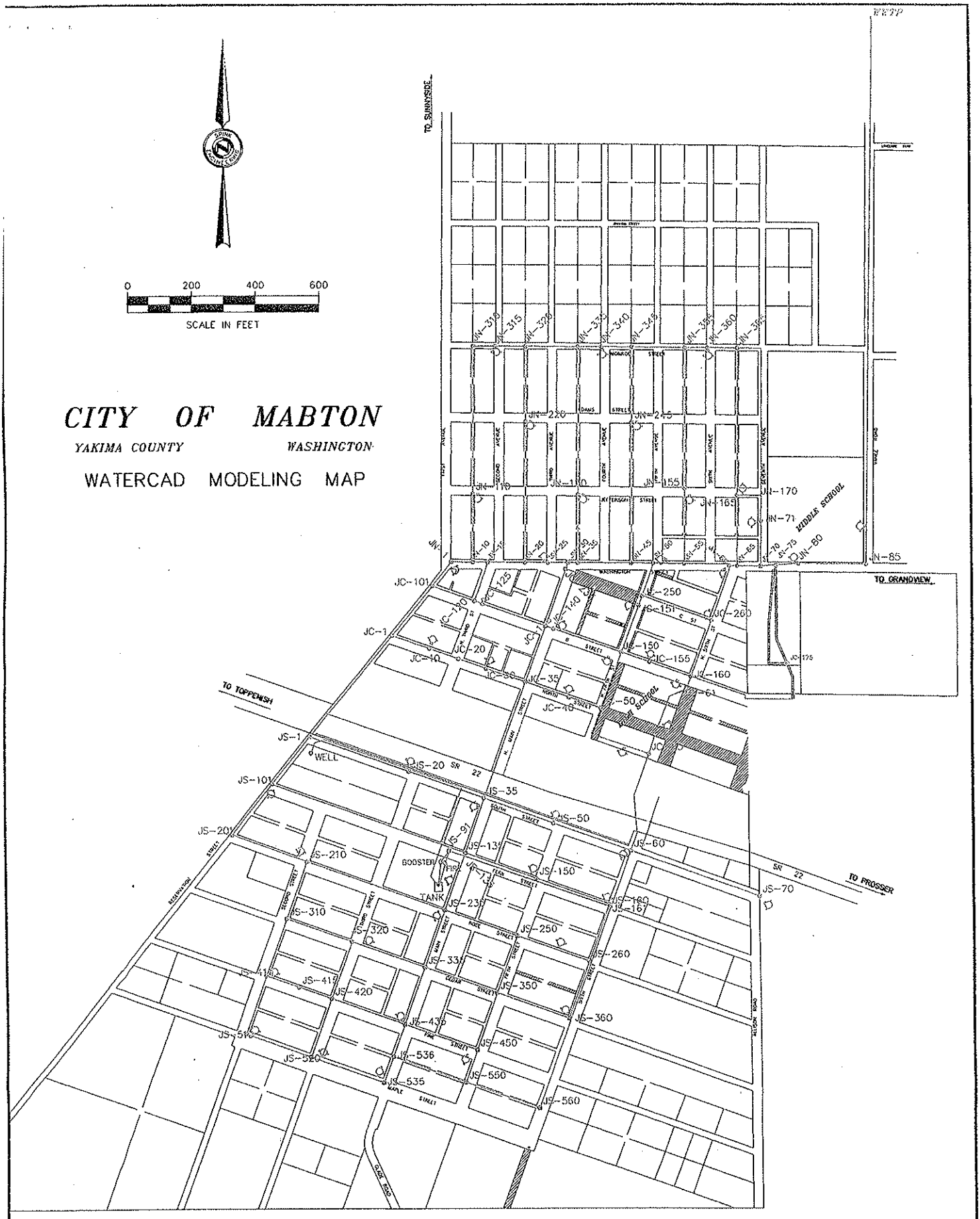
There are concerns with Mabton's water system reliability. A power outage or a well out operation could require Mabton residents to conserve water for the duration of the condition. This will depend on several factors such as the time of year, the water demand, level of water in the reservoir and which wells are out of service.

The system's water supply consists of three wells. Well #3 and Well #4 are used for normal operation. Well #2 can be used for emergency situations. Well #2 is not used on a routine basis because of the high hydrogen sulfide levels in the water. Although this presents no health hazard, the citizens have complained about the odor so much in the past, the well was removed from the system's normal operation.

Currently Well #3 and Well #4 run at the same time due to the mixing requirement for the high nitrates in Well #3. These wells are operated by pressure switches in the reservoir. Well #2 is operated manually. Additional pressure switches need to be added to the operating system to startup Well #2 when the reservoir level reaches less than 40 feet.

The existing water wells and reservoir do not meet the demands as shown in Appendix 5, Item 8: Existing Storage Requirement. The available storage is 611,500 gallons. The existing storage requirement is 1,051,300 gallons. This is a 440,800 gallon deficiency.

This deficiency was evident on one occasion in late May, 2003 and on August 11, 2003. In late July 2004, the water level in the reservoir was low. The City turned off



CITY OF MABTON
YAKIMA COUNTY
WASHINGTON
WATERCAD MODELING MAP
0
200
400
600
SCALE IN FEET
TO SUNNYSIDE
TO GRANDVIEW
TO TOPPENISH
TO PROSSER
MIDDLE SCHOOL
WELL
GOOSTER
TANK
SR 22
JN-85
JN-170
JN-71
JN-80
JC-101
JC-1
JC-10
JC-20
JC-35
JC-40
JC-150
JC-155
JC-160
JC-250
JC-260
JS-1
JS-20
JS-35
JS-50
JS-60
JS-70
JS-101
JS-201
JS-210
JS-310
JS-320
JS-330
JS-350
JS-360
JS-420
JS-450
JS-535
JS-536
JS-550
JS-560
SPINK ENGINEERING
CIVIL & MUNICIPAL ENGINEERS
RICHALND, WASHINGTON
02134MODELMAP.DWG

City of Mabton

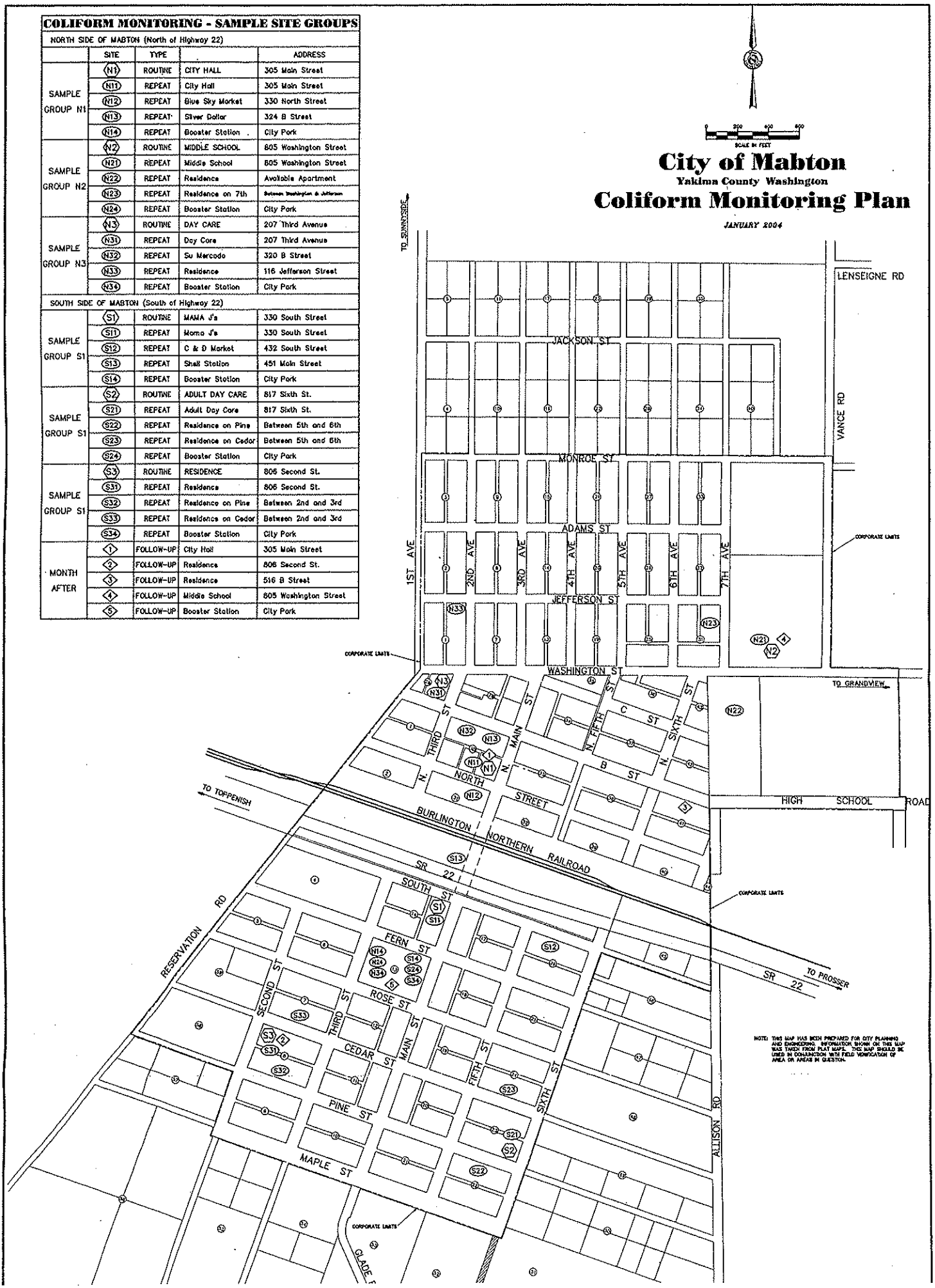
Yakima County Washington

Coliform Monitoring Plan

JANUARY 2004

COLIFORM MONITORING - SAMPLE SITE GROUPS

	SITE	TYPE		ADDRESS
NORTH SIDE OF MABTON (North of Highway 22)				
SAMPLE GROUP N1	N1	ROUTINE	CITY HALL	305 Main Street
	N11	REPEAT	City Hall	305 Main Street
	N12	REPEAT	Blue Sky Market	330 North Street
	N13	REPEAT	Silver Dollar	324 B Street
	N14	REPEAT	Booster Station	City Park
SAMPLE GROUP N2	N2	ROUTINE	MIDDLE SCHOOL	805 Washington Street
	N21	REPEAT	Middle School	805 Washington Street
	N22	REPEAT	Residence	Available Apartment
	N23	REPEAT	Residence on 7th	Between Washington & Jefferson
	N24	REPEAT	Booster Station	City Park
SAMPLE GROUP N3	N3	ROUTINE	DAY CARE	207 Third Avenue
	N31	REPEAT	Day Care	207 Third Avenue
	N32	REPEAT	Su Mercado	320 B Street
	N33	REPEAT	Residence	116 Jefferson Street
	N34	REPEAT	Booster Station	City Park
SOUTH SIDE OF MABTON (South of Highway 22)				
SAMPLE GROUP S1	S1	ROUTINE	MAMA J's	330 South Street
	S11	REPEAT	Mama J's	330 South Street
	S12	REPEAT	C & D Market	432 South Street
	S13	REPEAT	Shell Station	451 Main Street
	S14	REPEAT	Booster Station	City Park
SAMPLE GROUP S1	S2	ROUTINE	ADULT DAY CARE	817 Sixth St.
	S21	REPEAT	Adult Day Care	817 Sixth St.
	S22	REPEAT	Residence on Pine	Between 5th and 6th
	S23	REPEAT	Residence on Cedar	Between 5th and 6th
	S24	REPEAT	Booster Station	City Park
SAMPLE GROUP S1	S3	ROUTINE	RESIDENCE	806 Second St.
	S31	REPEAT	Residence	806 Second St.
	S32	REPEAT	Residence on Pine	Between 2nd and 3rd
	S33	REPEAT	Residence on Cedar	Between 2nd and 3rd
	S34	REPEAT	Booster Station	City Park
MONTH AFTER	1	FOLLOW-UP	City Hall	305 Main Street
	2	FOLLOW-UP	Residence	806 Second St.
	3	FOLLOW-UP	Residence	516 B Street
	4	FOLLOW-UP	Middle School	805 Washington Street
	5	FOLLOW-UP	Booster Station	City Park



NOTE: THIS MAP HAS BEEN PREPARED FOR CITY PLANNING AND ENGINEERING. INFORMATION SHOWN ON THIS MAP WAS TAKEN FROM PLAT MAPS. THIS MAP SHOULD BE USED IN CONJUNCTION WITH FIELD VERIFICATION OF AREA OR AREAS IN QUESTION.

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Sanitary Survey Data Report / Packet

As Of: 1/11/2011

Sentry DOH

Administrative Data

WS Id:	49650 R
WS Name:	MABTON, CITY OF
DOH Region:	Eastern
County:	YAKIMA
Group:	A
Type:	Community
Group Active Date:	01/01/1970
Delivery Address:	
Attention:	
Address:	
City:	
State:	
Zip:	

Primary Contact

Name:	Angel Reyna
Mailing Address:	
Attention:	City of Mabton
Address:	PO Box 655
City:	Mabton
State:	WA
Zip:	98935
Day / Office Phone:	(509) 894-4096
Mobile / Pager:	(509) 439-4012
Evening / Weekend:	
Fax:	(509) 894-4813
Alternate Day / Office:	
Alternate Evening / Wk:	

24 Hour / Emergency Number

Name:	
Day / Office Phone:	
Mobile / Pager:	
Evening / Weekend:	
Fax:	
Alternate Day / Office:	
Alternate Evening / Wk:	

Sanitary Survey Notes

Comment Focus	Comment Date	Author
General	*05/14/2002*	*DWAIN Conversion*

CvtDWPRO - UNSPECIFIED # OF CONNECTIONS PER JULIE D. - 5/26/93

Planning

Last Plan Date:	09/19/2005
Next Plan Due Date:	09/19/2011
Type of Plan:	Water System Plan

Operator Certification

Number of Mandatory Positions for the WS Id: 1

Operator Compliance Status: In Compliance

Mandatory	Pos. Num.	Operator Name (Last, First, MI)	Min. Cert. Req'd	Certification Held	Operator Number	Evening / Weekend Phone Number	Has CCS
Yes	1	Tijerina, Francisco	WDM 2				

Compliance

Action	Status	IssueDate	Penalty	Comply By	Completed
Directive	Completed	05/15/2006	No	06/30/2006	08/10/2006

CompActionComments: HPHR identified by Mike Wilson during a survey on 05/09/06. 07/12/2006: Reminder phone call. Reminder letter sent. 08/08/2006: Reminder call.
08/10/2006: Recd ltr confirming HPHR have been corrected.

Vio - 05/09/06 High Public Risk

Milestones: Well #3 - Seal the opening where the air tube passes through the top of the wellhead with silicone sealer or caulk.
Provide documentation from the CCCS that the water service to Mabtons wastewater treatment plan has an RPBA and that its been tested

Action	Status	IssueDate	Penalty	Comply By	Completed
Notice of Violation	Completed	07/06/2006	No	09/09/2006	07/25/2006

CompActionComments: HQ issued for LCR monitoring vio. dlgb

Milestones: collect and report lead/copper samples
notify water system users - PN

Action	Status	IssueDate	Penalty	Comply By	Completed
Violation Letter	Completed	12/12/2008	No		

Action	Status	IssueDate	Penalty	Comply By	Completed
Violation Letter	Completed	06/28/2010	No		

Action	Status	IssueDate	Penalty	Comply By	Completed
Operator Certification Temporary	Active	08/05/2010	No	08/05/2011	

CompActionComments: T2-Francisco Tijerina to achieve WDM 2. wdl

Vio - 06/14/10 Operator Certification Requirements

Milestones: Francisco Tijerina to achieve WDM 2

Action	Status	IssueDate	Penalty	Comply By	Completed
Violation Letter	Completed	10/15/2010	No		

Action	Status	IssueDate	Penalty	Comply By	Completed
Violation Letter	Completed	10/21/2010	No		

Vio - 07/01/10 Consumer Confidence Report

Source Information

Source Inventory

Src Num	Source Name	Status	Type	Use	Depth to First Open Interval	Capacity (GPM)	Source Metered	Well Tag ID
01	Well #4 - ABR606	Act	Well in Well Field	P	740	450.0	Undefined	ABR606
02	Well #2 - AFL768	Act	Well	E	1,180	200.0	Undefined	AFL768
03	Well #3 - AFL767	Act	Well	E	1,004	250.0	Yes	AFL767
04	Well #5 - ALF995	Act	Well in Well Field	P	710	500.0	Yes	ALF995
05	Wellfield / S01, S04	Act	Well Field	P	710	950.0	Yes	

Source Location

Src Num	Source Name	Qtr / Qtr	Sect	Township	Range	Lat / Long	SWTR
01	Well #4 - ABR606	SENW	01	08	22E	46.211498 / -120.002975	Does Not Apply
02	Well #2 - AFL768	SENW	01	08	22E	46.209745 / -120.000080	Does Not Apply
03	Well #3 - AFL767	SENW	01	08	22E	46.209262 / -120.000357	Does Not Apply
04	Well #5 - ALF995	SENE	01	08	22E	46.205960 / -120.004000	
05	Wellfield / S01, S04			00	00E		

Source Ratings

Src Num	Source Name	Susceptibility	IOC Vuln	VOC Vuln	SOC Vuln	Micro Vuln	RAD Vuln
01	Well #4 - ABR606	High	High	Moderate	Low	Unknown	Unknown
02	Well #2 - AFL768	Moderate			Low		
03	Well #3 - AFL767	High	Moderate	High	High	Unknown	Unknown
04	Well #5 - ALF995	High	Moderate	Moderate	Moderate	Unknown	Unknown
05	Wellfield / S01, S04	Unknown	Unknown	Unknown	Low	Unknown	Unknown

Water Treatment Plant

Source Treatment

Water Treatment Plant Id: **496500001**

Water Treatment Plant Name: Booster Station

Source Number	SrcName	SrcType	Source Status	Source Use
01	Well #4 - ABR606	Well in Well Field	Act	Permanent
03	Well #3 - AFL767	Well	Act	Emergency
04	Well #5 - ALF995	Well in Well Field	Act	Permanent

Treatment Purpose	Treatment Type	Applicable Rule	Appoval Status
DISINFECTION	CHLORINATION, GASEOUS	Total Coliform Rule	AppvCCR
ORGANICS AND COLOR REMOVAL			
TASTE/ODOR CONTROL & DECHLORINATION			

Water Quality

COLIFORM SUMMARY

	1/11	12/10	11/10	10/10	9/10	8/10	7/10	6/10	5/10	4/10	3/10	2/10
Routine Sample												
SamReq	4	3	3	3	3	3	3	3	4	4	4	4
SamTaken	0	4	4	4	4	4	0	4	4	4	4	4
TC												
EC												
FC												
Repeat Sample												
SamReq												
SamTaken												
TC												
EC												
FC												
Incidents Actual												
Acute												
Non Acute												
MajorRep												
MajorMon							1					
Min Rep												
Min Mon												

	1/10	12/09	11/09	10/09	9/09	8/09	7/09	6/09	5/09	4/09	3/09	2/09
Routine Sample												
SamReq	4	3	3	3	3	3	3	3	4	4	4	4
SamTaken	4	4	4	4	4	4	4	4	4	6	0	4
TC												
EC												
FC												
Repeat Sample												
SamReq												
SamTaken												
TC												
EC												
FC												
Incidents Actual												
Acute												
Non Acute												
MajorRep												
MajorMon											1	
Min Rep												
Min Mon												

INORGANIC CHEMICALS (IOC)

History - IOC - Analyte Group

Src Num	Source Name	Source Type	Source Status	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
01	Well #4 - ABR606	WW	Act	P	105 11192	06/25/2009	IOC	31 of 43
01	Well #4 - ABR606	WW	Act	P	149 00661	12/30/2002	IOC	29 of 43
01	Well #4 - ABR606	WW	Act	P	081 57144	09/14/1998	IOC	25 of 43
01	Well #4 - ABR606	WW	Act	P	014 22298	09/14/1998	IOC	4 of 43
01	Well #4 - ABR606	WW	Act	P	081 22972	09/13/1994	IOC	27 of 43
01	Well #4 - ABR606	WW	Act	P	109 93015	09/29/1993	ICHEM	1 of 19
02	Well #2 - AFL768	W	Act	E	014 22297	09/14/1998	IOC	4 of 43
02	Well #2 - AFL768	W	Act	E	081 57143	09/14/1998	IOC	25 of 43
02	Well #2 - AFL768	W	Act	E	081 22974	09/13/1994	IOC	27 of 43
02	Well #2 - AFL768	W	Act	E	051 12683	08/28/1990	ICHEM	18 of 19
02	Well #2 - AFL768	W	Act	E	051 10100	09/14/1987	ICHEM	18 of 19
02	Well #2 - AFL768	W	Act	E	051 07785	12/17/1984	ICHEM	18 of 19
02	Well #2 - AFL768	W	Act	E	052 10836	10/02/1984	ICHEM	1 of 19
02	Well #2 - AFL768	W	Act	E	052 10837	10/02/1984	ICHEM	1 of 19
02	Well #2 - AFL768	W	Act	E	052 10848	10/02/1984	ICHEM	1 of 19
02	Well #2 - AFL768	W	Act	E	052 09891	01/25/1984	ICHEM	1 of 19
02	Well #2 - AFL768	W	Act	E	052 09895	01/24/1984	ICHEM	1 of 19
02	Well #2 - AFL768	W	Act	E	052 09894	01/23/1984	ICHEM	1 of 19
03	Well #3 - AFL767	W	Act	E	149 00661	12/30/2002	IOC	29 of 43
03	Well #3 - AFL767	W	Act	E	081 72032	09/12/2000	IOC	24 of 43
03	Well #3 - AFL767	W	Act	E	014 35191	09/12/2000	IOC	6 of 43
03	Well #3 - AFL767	W	Act	E	051 12684	08/28/1990	ICHEM	20 of 19
03	Well #3 - AFL767	W	Act	E	051 07786	12/17/1984	ICHEM	19 of 19
04	Well #5 - ALF995	WW	Act	P	105 11193	06/25/2009	IOC	31 of 43
04	Well #5 - ALF995	WW	Act	P	105 19503	10/11/2007	IOC	31 of 43
04	Well #5 - ALF995	WW	Act	P	105 19504	10/11/2007	IOC	31 of 43

Detail - IOC

Source 01

Source Status	Source Type	Test Panel	Lab Number	Sample Number	Collect Date	Sample Location
Act	Well in Well Field	IOC	105	11192	06/25/2009	s01

Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
0004	ARSENIC	LT	mg/L	0.0030	0.0020	N	0.0103	N	0.0104
0005	BARIUM	EQ	mg/L	0.4000	0.0170	N	1.9999	N	2.0000
0006	CADMIUM	LT	mg/L	0.0020	0.0003	N	0.0049	N	0.0050
0007	CHROMIUM	LT	mg/L	0.0200	0.0047	N	0.0999	N	0.1000
0011	MERCURY	LT	mg/L	0.0004	0.0003	N	0.0019	N	0.0020
0012	SELENIUM	LT	mg/L	0.0100	0.0050	N	0.0499	N	0.0500
0110	BERYLLIUM	LT	mg/L	0.0008	0.0002	N	0.0039	N	0.0040
0111	NICKEL	LT	mg/L	0.1000	0.0100	N	0.0999	N	0.1000
0112	ANTIMONY	LT	mg/L	0.0060	0.0050	N	0.0059	N	0.0060
0113	THALLIUM	LT	mg/L	0.0020	0.0010	N	0.0019	N	0.0020
0116	CYANIDE	LT	mg/L	0.0100	0.0100	N	0.1999	N	0.2000
0019	FLUORIDE	EQ	mg/L	0.5000	1.7100	N	1.9999	N	4.0000
0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
0161	TOTAL NITRATE/NITRITE	LT	mg/L	0.5000	0.5000	N		N	
0008	IRON	EQ	mg/L	0.1000	0.0232	N		N	
0010	MANGANESE	EQ	mg/L	0.0100	0.0173	N		N	
0013	SILVER	LT	mg/L	0.1000	0.0047	N		N	
0021	CHLORIDE	EQ	mg/L	20.0000	17.3000	N		N	
0022	Sulfate	EQ	mg/L	50.0000	0.7700	N		N	
0024	ZINC	LT	mg/L	0.2000	0.0200	N		N	
0014	SODIUM	EQ	mg/L	5.0000	46.8000	N		N	
0015	HARDNESS	EQ	mg/L	10.0000	43.5000	N		N	
0016	CONDUCTIVITY	EQ	Umhos/c	70.0000	320.0000	N		N	
0017	TURBIDITY	LT	NTU	0.1000	0.2000	N		N	
0018	COLOR	LT	CU	15.0000	4.0000	N		N	
0026	TDS-TOTAL DISSOLVED SOLID	EQ	mg/L	100.0000	298.0000	N		N	
0009	LEAD	LT	mg/L	0.0010	0.0005	N	9,999.0000	N	
0023	COPPER	EQ	mg/L	0.0200	0.0042	N	9,999.0000	N	
0171	ORTHOPHOSPHATE	NA	mg/L	0.1000		N		N	
0172	SILICA	NA	mg/L	1.0000		N		N	
0402	ALUMINUM	NA	mg/L	0.0500		N		N	
0403	ALKALINITY-LAB	NA	mg/L	5.0000		N		N	
0404	MAGNESIUM	EQ	mg/L	0.1000	3.4100	N		N	
0405	CALCIUM	EQ	mg/L	0.0500	11.8000	N		N	
0406	AMMONIA	NA	mg/L	1.0000		N		N	
0407	CHLORINE DIOXIDE	NA	mg/L	0.8000		N		N	
0408	OZONE	NA	mg/L	0.2000		N		N	
0409	PH	NA	PH			N		N	
0410	CHLORAMINES	NA	mg/L			N		N	
0099	INACTIVATION RATIO	NA	None			N		N	
0100	RESIDUAL CHLORINE	NA	mg/L	0.2000		N		N	
0115	ASBESTOS	NA	MFL	1.4000		N	6.9990	N	7.0000

Result Range:
EQ - Equal To LT - Less Than GT - Greater Than NA - Not Analyzed ND -- No Detect

Source 04

Source Status	Source Type	Test Panel	Lab Number	Sample Number	Collect Date	Sample Location
Act	Well in Well Field	IOC	105	11193	06/25/2009	s04

Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
0004	ARSENIC	LT	mg/L	0.0030	0.0020	N	0.0103	N	0.0104
0005	BARIUM	EQ	mg/L	0.4000	0.0340	N	1.9999	N	2.0000
0006	CADMIUM	LT	mg/L	0.0020	0.0003	N	0.0049	N	0.0050

Source 04

Source Status	Source Type	Test Panel	Lab Number	Sample Number	Collect Date	Sample Location
Act	Well in Well Field	IOC	105	11193	06/25/2009	s04

Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
0007	CHROMIUM	LT	mg/L	0.0200	0.0047	N	0.0999	N	0.1000
0011	MERCURY	LT	mg/L	0.0004	0.0003	N	0.0019	N	0.0020
0012	SELENIUM	LT	mg/L	0.0100	0.0050	N	0.0499	N	0.0500
0110	BERYLLIUM	LT	mg/L	0.0008	0.0002	N	0.0039	N	0.0040
0111	NICKEL	LT	mg/L	0.1000	0.0100	N	0.0999	N	0.1000
0112	ANTIMONY	LT	mg/L	0.0060	0.0050	N	0.0059	N	0.0060
0113	THALLIUM	LT	mg/L	0.0020	0.0010	N	0.0019	N	0.0020
0116	CYANIDE	LT	mg/L	0.0100	0.0100	N	0.1999	N	0.2000
0019	FLUORIDE	EQ	mg/L	0.5000	0.3900	N	1.9999	N	4.0000
0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
0161	TOTAL NITRATE/NITRITE	LT	mg/L	0.5000	0.5000	N		N	
0008	IRON	EQ	mg/L	0.1000	0.0234	N		N	
0010	MANGANESE	EQ	mg/L	0.0100	0.0630	N		N	
0013	SILVER	LT	mg/L	0.1000	0.0047	N		N	
0021	CHLORIDE	EQ	mg/L	20.0000	10.2000	N		N	
0022	Sulfate	EQ	mg/L	50.0000	4.3600	N		N	
0024	ZINC	LT	mg/L	0.2000	0.0200	N		N	
0014	SODIUM	EQ	mg/L	5.0000	24.8000	N		N	
0015	HARDNESS	EQ	mg/L	10.0000	117.0000	N		N	
0016	CONDUCTIVITY	EQ	Umhos/c	70.0000	352.0000	N		N	
0017	TURBIDITY	LT	NTU	0.1000	0.2000	N		N	
0018	COLOR	LT	CU	15.0000	4.0000	N		N	
0026	TDS-TOTAL DISSOLVED SOLID	EQ	mg/L	100.0000	250.0000	N		N	
0009	LEAD	LT	mg/L	0.0010	0.0005	N	9,999.0000	N	
0023	COPPER	LT	mg/L	0.0200	0.0020	N	9,999.0000	N	
0171	ORTHOPHOSPHATE	NA	mg/L	0.1000		N		N	
0172	SILICA	NA	mg/L	1.0000		N		N	
0402	ALUMINUM	NA	mg/L	0.0500		N		N	
0403	ALKALINITY-LAB	NA	mg/L	5.0000		N		N	
0404	MAGNESIUM	EQ	mg/L	0.1000	10.5000	N		N	
0405	CALCIUM	EQ	mg/L	0.0500	29.7000	N		N	
0406	AMMONIA	NA	mg/L	1.0000		N		N	
0407	CHLORINE DIOXIDE	NA	mg/L	0.8000		N		N	
0408	OZONE	NA	mg/L	0.2000		N		N	
0409	PH	NA	PH			N		N	
0410	CHLORAMINES	NA	mg/L			N		N	
0099	INACTIVATION RATIO	NA	None			N		N	
0100	RESIDUAL CHLORINE	NA	mg/L	0.2000		N		N	
0115	ASBESTOS	NA	MFL	1.4000		N	6.9990	N	7.0000

Result Range:
EQ - Equal To LT - Less Than GT - Greater Than NA - Not Analyzed ND -- No Detect

NITRATE / NITRITE

History - IOC - Analyte Group

Src Num	Source Name	Source Type	Source Type	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
01	Well #4 - ABR606	WW	Act	P	151 18449	09/14/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 17649	09/07/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 17010	08/30/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 16155	08/17/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 11871	06/29/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 10838	06/14/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 09343	05/24/2010	NIT	3 of 3
01	Well #4 - ABR606	WW	Act	P	151 08490	05/11/2010	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 11449	07/09/2007	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 10548	06/25/2007	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 16049	09/05/2006	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 14976	08/21/2006	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 13724	08/07/2006	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 13105	08/01/2005	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	151 09712	06/13/2005	NIT	3 of 3
02	Well #2 - AFL768	W	Act	E	105 13716	08/09/2004	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 14696	08/20/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 13478	08/06/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 12477	07/23/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 11449	07/09/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 10548	06/25/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 10055	06/18/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	151 08120	05/21/2007	NIT	3 of 3
03	Well #3 - AFL767	W	Act	E	105 05755	04/13/2007	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 18450	09/14/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 17649	09/07/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 17010	08/30/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 16155	08/17/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 11871	06/29/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 10838	06/14/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 09343	05/24/2010	NIT	3 of 3
04	Well #5 - ALF995	WW	Act	P	151 08490	05/11/2010	NIT	3 of 3

Detail - NIT

Source 01 — Source Status - Act — Source Type - Well in Well Field

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
151 18449	09/14/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 18449	09/14/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 17649	09/07/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 17649	09/07/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 17010	08/30/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 17010	08/30/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 16155	08/17/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 16155	08/17/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 14696	08/20/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.9400	Y	4.9990	N	10.0000
151 14696	08/20/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 12477	07/23/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.5400	Y	4.9990	N	10.0000
151 12477	07/23/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 16049	09/05/2006	0020	NITRATE-N	EQ	mg/L	0.2000	6.5600	Y	4.9990	N	10.0000
151 16049	09/05/2006	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 14976	08/21/2006	0020	NITRATE-N	EQ	mg/L	0.2000	6.6600	Y	4.9990	N	10.0000
151 14976	08/21/2006	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000

Source 02 — Source Status - Act — Source Type - Well

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
151 11449	07/09/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.1800	Y	4.9990	N	10.0000
151 11449	07/09/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 10548	06/25/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.0400	Y	4.9990	N	10.0000
151 10548	06/25/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 16049	09/05/2006	0020	NITRATE-N	EQ	mg/L	0.2000	6.5600	Y	4.9990	N	10.0000
151 16049	09/05/2006	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 14976	08/21/2006	0020	NITRATE-N	EQ	mg/L	0.2000	6.6600	Y	4.9990	N	10.0000
151 14976	08/21/2006	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000

Source 03 — Source Status - Act — Source Type - Well

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
151 14696	08/20/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.9400	Y	4.9990	N	10.0000
151 14696	08/20/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 13478	08/06/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.1000	Y	4.9990	N	10.0000
151 13478	08/06/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 12477	07/23/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.5400	Y	4.9990	N	10.0000
151 12477	07/23/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 11449	07/09/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.1800	Y	4.9990	N	10.0000
151 11449	07/09/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 10548	06/25/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.0400	Y	4.9990	N	10.0000
151 10548	06/25/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 16049	09/05/2006	0020	NITRATE-N	EQ	mg/L	0.2000	6.5600	Y	4.9990	N	10.0000
151 16049	09/05/2006	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 14976	08/21/2006	0020	NITRATE-N	EQ	mg/L	0.2000	6.6600	Y	4.9990	N	10.0000
151 14976	08/21/2006	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000

Source 04 — Source Status - Act — Source Type - Well in Well Field

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
151 18450	09/14/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 18450	09/14/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 17649	09/07/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 17649	09/07/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 17010	08/30/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 17010	08/30/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 16155	08/17/2010	0020	NITRATE-N	LT	mg/L	0.2000	0.0500	N	4.9990	N	10.0000
151 16155	08/17/2010	0114	NITRITE-N	LT	mg/L	0.2000	0.0500	N	0.4999	N	1.0000
151 14696	08/20/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.9400	Y	4.9990	N	10.0000

Source 04 **Source Status - Act** **Source Type - Well in Well Field**

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
151 14696	08/20/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 13478	08/06/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.1000	Y	4.9990	N	10.0000
151 13478	08/06/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 11449	07/09/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.1800	Y	4.9990	N	10.0000
151 11449	07/09/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000
151 10548	06/25/2007	0020	NITRATE-N	EQ	mg/L	0.2000	7.0400	Y	4.9990	N	10.0000
151 10548	06/25/2007	0114	NITRITE-N	LT	mg/L	0.2000	0.1000	N	0.4999	N	1.0000

Result Range:
EQ - Equal To LT - Less Than GT - Greater Than NA - Not Analyzed ND -- No Detect

ARSENIC

Detail - Arsenic

Source 01 **Source Status - Act** **Source Type - Well in Well Field**

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
105 11192	06/25/2009	0004	ARSENIC	LT	mg/L	0.0030	0.0020	N	0.0103	N	0.0104
			No Samples with Arsenic being Analyzed were found.								
149 00661	12/30/2002	0004	ARSENIC	EQ	mg/L	0.0030	0.0040	N	0.0103	N	0.0104
			No Samples with Arsenic being Analyzed were found.								

Source 02 **Source Status - Act** **Source Type - Well**

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
081 57143	09/14/1998	0004	ARSENIC	LT	mg/L	0.0030	0.0100	N	0.0103	N	0.0104
			No Samples with Arsenic being Analyzed were found.								

Source 03 **Source Status - Act** **Source Type - Well**

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
149 00661	12/30/2002	0004	ARSENIC	EQ	mg/L	0.0030	0.0040	N	0.0103	N	0.0104
			No Samples with Arsenic being Analyzed were found.								

Source 04 **Source Status - Act** **Source Type - Well in Well Field**

Lab/Sample Number	Sample Collect Date	Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
105 11193	06/25/2009	0004	ARSENIC	LT	mg/L	0.0030	0.0020	N	0.0103	N	0.0104
			No Samples with Arsenic being Analyzed were found.								

Result Range:
EQ - Equal To LT - Less Than GT - Greater Than NA - Not Analyzed ND -- No Detect

VOLATILE ORGANIC CHEMICALS (VOC)

History - VOC - Analyte Group

Src Num	Source Name	Source Type	Source Status	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
01	Well #4 - ABR606	WW	Act	P	089 73688	08/23/2006	VOC1	62 of 62
01	Well #4 - ABR606	WW	Act	P	046 16437	06/21/2006	VOC1	61 of 62
01	Well #4 - ABR606	WW	Act	P	089 72401	10/11/2005	VOC1	61 of 62
01	Well #4 - ABR606	WW	Act	P	089 72017	07/20/2005	VOC1	61 of 62
01	Well #4 - ABR606	WW	Act	P	107 25704	03/19/2004	VOC1	59 of 62
01	Well #4 - ABR606	WW	Act	P	149 00662	12/30/2002	VOC1	60 of 62
01	Well #4 - ABR606	WW	Act	P	081 57700	10/13/1998	VOC1	61 of 62
01	Well #4 - ABR606	WW	Act	P	081 22973	09/12/1994	VOC2	54 of 57
01	Well #4 - ABR606	WW	Act	P	054 02799	11/13/1990	VOC1	57 of 62
01	Well #4 - ABR606	WW	Act	P	054 01587	10/31/1989	VOC1	57 of 62
02	Well #2 - AFL768	W	Act	E	081 57698	10/12/1998	VOC1	61 of 62
02	Well #2 - AFL768	W	Act	E	081 22975	09/12/1994	VOC2	54 of 57
03	Well #3 - AFL767	W	Act	E	089 74248	12/19/2006	VOC1	61 of 62
03	Well #3 - AFL767	W	Act	E	089 73688	08/23/2006	VOC1	62 of 62
03	Well #3 - AFL767	W	Act	E	089 72400	10/11/2005	VOC1	61 of 62
03	Well #3 - AFL767	W	Act	E	089 72015	07/20/2005	VOC1	61 of 62
03	Well #3 - AFL767	W	Act	E	107 25703	03/19/2004	VOC1	59 of 62
03	Well #3 - AFL767	W	Act	E	149 00662	12/30/2002	VOC1	60 of 62
03	Well #3 - AFL767	W	Act	E	054 01588	10/31/1989	VOC1	57 of 62
04	Well #5 - ALF995	WW	Act	P	089 77185	10/01/2008	VOC1	61 of 62
04	Well #5 - ALF995	WW	Act	P	089 77119	09/12/2008	VOC1	61 of 62
04	Well #5 - ALF995	WW	Act	P	089 76605	06/12/2008	VOC1	61 of 62
04	Well #5 - ALF995	WW	Act	P	089 76279	03/24/2008	VOC1	62 of 62

Detail - VOC

Source 01

Source Status	Source Type	Test Panel	Lab Number	Sample Number	Collect Date	Sample Location
Act	Well in Well Field	VOC1	089	73688	08/23/2006	bs

Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
0027	CHLOROFORM	EQ	ug/L	0.5000	0.9000	Y	9,999.0000	N	
0028	BROMODICHLOROMETHANE	EQ	ug/L	0.5000	2.2000	Y	9,999.0000	N	
0029	DIBROMOCHLOROMETHANE	EQ	ug/L	0.5000	7.8000	Y	9,999.0000	N	
0030	BROMOFORM	EQ	ug/L	0.5000	9.4000	Y	9,999.0000	N	
0031	TOTAL TRIHALOMETHANE	EQ	ug/L		20.3000	N	9,999.0000	N	80.0000

Result Range:
EQ - Equal To LT - Less Than GT - Greater Than NA - Not Analyzed ND -- No Detect

SYNTHETIC ORGANIC CHEMICALS (SOC)

History - SOC - Analyte Group

Src Num	Source Name	Source Type	Source Status	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
01	Well #4 - ABR606	WW	Act	P	046 16438	06/21/2006	HERB1	16 of 18
01	Well #4 - ABR606	WW	Act	P	046 16438	06/21/2006	INSECT1	10 of 10
01	Well #4 - ABR606	WW	Act	P	046 16438	06/21/2006	PEST1	59 of 66
01	Well #4 - ABR606	WW	Act	P	089 83855	07/20/2005	HERB1	17 of 18
01	Well #4 - ABR606	WW	Act	P	089 83855	07/20/2005	INSECT1	10 of 10
01	Well #4 - ABR606	WW	Act	P	089 83855	07/20/2005	PEST1	60 of 66
01	Well #4 - ABR606	WW	Act	P	125 58061	09/14/1998	HERB1	17 of 18
01	Well #4 - ABR606	WW	Act	P	125 58061	09/14/1998	INSECT1	10 of 10
01	Well #4 - ABR606	WW	Act	P	125 58061	09/14/1998	PEST1	60 of 66
02	Well #2 - AFL768	W	Act	E	081 57699	10/12/1998	FUMIGANT	2 of 4
02	Well #2 - AFL768	W	Act	E	125 58060	09/14/1998	HERB1	17 of 18
02	Well #2 - AFL768	W	Act	E	125 58060	09/14/1998	INSECT1	10 of 10
02	Well #2 - AFL768	W	Act	E	125 58060	09/14/1998	PEST1	60 of 66
03	Well #3 - AFL767	W	Act	E	089 85240	12/19/2006	PEST1	60 of 66
03	Well #3 - AFL767	W	Act	E	089 84849	08/23/2006	PEST1	60 of 66
03	Well #3 - AFL767	W	Act	E	089 83854	07/20/2005	HERB1	17 of 18
03	Well #3 - AFL767	W	Act	E	089 83854	07/20/2005	INSECT1	10 of 10
03	Well #3 - AFL767	W	Act	E	089 83854	07/20/2005	PEST1	60 of 66
04	Well #5 - ALF995	WW	Act	P	089 88227	06/25/2009	HERB1	14 of 18
04	Well #5 - ALF995	WW	Act	P	089 87435	10/01/2008	HERB1	16 of 18
04	Well #5 - ALF995	WW	Act	P	089 87435	10/01/2008	INSECT1	10 of 10
04	Well #5 - ALF995	WW	Act	P	089 87435	10/01/2008	PEST1	60 of 66
04	Well #5 - ALF995	WW	Act	P	089 87382	09/12/2008	HERB1	16 of 18
04	Well #5 - ALF995	WW	Act	P	089 87382	09/12/2008	INSECT1	10 of 10
04	Well #5 - ALF995	WW	Act	P	089 87382	09/12/2008	PEST1	60 of 66
04	Well #5 - ALF995	WW	Act	P	089 86959	06/12/2008	INSECT1	10 of 10
04	Well #5 - ALF995	WW	Act	P	089 86959	06/12/2008	PEST1	60 of 66
04	Well #5 - ALF995	WW	Act	P	089 86720	03/24/2008	HERB1	16 of 18
04	Well #5 - ALF995	WW	Act	P	089 86720	03/24/2008	INSECT1	10 of 10
04	Well #5 - ALF995	WW	Act	P	089 86720	03/24/2008	PEST1	60 of 66

Detail - SOC

No Analytes Detected for Testpanel "HERB1" where 10 analytes were tested.
No Analytes Detected for Testpanel "PEST1" where 55 analytes were tested.
No Analytes Detected for Testpanel "INSECT1" where 8 analytes were tested.

Halo Acetic Acids (HAA5)

History - DBP - Analyte Group

Src Num	Source Name	Source Type	Source Status	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
Dist					089 80086	09/27/2010	HAA5	7 of 8
Dist					089 84956	09/14/2006	HAA5	7 of 8

Halo Acetic Acids (HAA5)

No Analytes Detected for Testpanel "HAA5"

Total Trihalomethane (THM)

History - DBP - Analyte Group

Src Num	Source Name	Source Type	Source Status	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
Dist					089 70006	09/27/2010	THM	5 of 6
Dist					089 73831	09/14/2006	THM	5 of 6

Total Trihalomethane (THM)

No Analytes Detected for Testpanel "THM" where 1 analytes were tested.

RADIONUECLIDES (RAD)

History - RAD - Analyte Group

Src Num	Source Name	Source Type	Source Status	Source Use	Lab / Sample Num	Collect Date	Test Panel	Analytes Tested
Dist					101 03094	02/20/1990	RAD	1 of 13
Dist					101 00237	12/10/1980	RAD	1 of 13
01	Well #4 - ABR606	WW	Act	P	028 34396	04/25/2007	RAD	2 of 13
01	Well #4 - ABR606	WW	Act	P	028 32534	09/07/2006	RAD	3 of 13
01	Well #4 - ABR606	WW	Act	P	101 06035	09/14/1998	RAD	2 of 13
02	Well #2 - AFL768	W	Act	E	101 06036	09/14/1998	RAD	3 of 13
03	Well #3 - AFL767	W	Act	E	028 33323	12/19/2006	RAD	4 of 13
03	Well #3 - AFL767	W	Act	E	028 32534	09/07/2006	RAD	3 of 13
03	Well #3 - AFL767	W	Act	E	028 25159	12/12/2003	RAD	1 of 13
03	Well #3 - AFL767	W	Act	E	023 67641	09/12/2000	RAD	3 of 13
04	Well #5 - ALF995	WW	Act	P	142 44001	06/21/2006	RAD	2 of 13

Detail - RAD

Source 01

Source Status	Source Type	Test Panel	Lab Number	Sample Number	Collect Date	Sample Location
Act	Well in Well Field	RAD	028	34396	04/25/2007	well 4 s01

Analyte DOH #	Analyte Name	Result Range	Units	SRL	Result Qty	Trigger Ind	Trigger Value	MCL Ind	MCL Value
0166	RADIUM 228	EQ	pCi/L	1.0000	0.6500	N	4.9999	N	5.0000
0165	GROSS ALPHA	EQ	pCi/L	3.0000	0.4500	N	14.9999	N	

Result Range:
EQ - Equal To LT - Less Than GT - Greater Than NA - Not Analyzed ND -- No Detect

LEAD AND COPPER (LCR)

Monitoring Level	Start	End	Pb 90th	Pb Hi	Cu 90th	Cu Hi	Sam Reqt	Sam Taken	AL Pb Inc	AL Cu Inc	Mon Inc
Base3Y	01/2010	12/2012					20	0			
Base3Y	01/2007	12/2009	.0011	.0099	.0482	.0990	20	20			
Base3Y	01/2004	12/2006	.0025	.0108	.0478	.1480	20	20			
Base3Y	01/2003	12/2005					20	0			Mon
Base3Y	01/2002	12/2004					20	0			Mon
Base3Y	01/2001	12/2003					10	0			Mon
Base3Y	01/1998	12/2000	.0050	.0070	.2000	.2000	10	10			
AnnualRed	01/1997	12/1997	.0020	.0110	.1200	.1500	5	10			
Second6Mo	07/1994	12/1994					20	20			
First6Mo	01/1994	06/1994					20	20			

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
Updated: 11/08/2010
Printed: 01/11/2011
WFI Printed For: Annual
Submission Reason: Source Update

RETURN TO: Eastern Regional Office, 16201 E Indiana, Suite 1500, Spokane Valley, WA, 99216

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
49650 R	MABTON, CITY OF	YAKIMA	A	Comm

6. PRIMARY CONTACT NAME & MAILING ADDRESS

ANGEL REYNA [MAYOR]
CITY OF MABTON
PO BOX 655
MABTON, WA 98935

7. OWNER NAME & MAILING ADDRESS — **8. Owner Number** 003522

MABTON, CITY OF
ANGEL REYNA
PO BOX 655
MABTON, WA 98935
TITLE: MAYOR

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS 305 MAIN STREET
CITY MABTON STATE WA ZIP 98935

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS 305 MAIN ST
CITY MABTON STATE WA ZIP 98935

9. 24 HOUR PRIMARY CONTACT INFORMATION

Primary Contact Daytime Phone: (509) 894-4096
Primary Contact Mobile/Cell Phone: (509) 439-4012
Primary Contact Evening Phone:
Fax: (509) 894-4813 E-mail: angel.reyna@co.yakima.wa.us

10. OWNER CONTACT INFORMATION

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Owner Mobile/Cell Phone: (509) 439-4012
Owner Evening Phone:
Fax: (509) 894-4813 E-mail: angel.reyna@co.yakima.wa.us

WAC 246-290-420(9) requires that water systems provide 24-hour contact information for emergencies.

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- [X] Not applicable (Skip to #12)
- [ ] Owned and Managed — SMA NAME: _____ SMA Number: _____
- [ ] Managed Only
- [ ] Owned Only

12. WATER SYSTEM CHARACTERISTICS (mark ALL that apply)

[ ] Agricultural	[ ] Hospital/Clinic	[X] Residential
[X] Commercial / Business	[ ] Industrial	[X] School
[X] Day Care	[ ] Licensed Residential Facility	[ ] Temporary Farm Worker
[X] Food Service/Food Permit	[ ] Lodging	[X] Other (church, fire station, etc.):
[ ] 1,000 or more person event for 2 or more days per year	[ ] Recreational / RV Park	

13. WATER SYSTEM OWNERSHIP (mark only one)

[ ] Association	[ ] County	[ ] Investor	[ ] Special District
[X] City / Town	[ ] Federal	[ ] Private	[ ] State

14. STORAGE CAPACITY (gallons)

800,000

15	16 SOURCE NAME	17 INTERTIE	18 SOURCE CATEGORY								19 USE		20	21 TREATMENT					22 DEPTH	23	24 SOURCE LOCATION			
Source: Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456. IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN INTERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	Well #4 - ABR606				X								X					X				X	740	450	SE NW	01	08N	22E
S02	Well #2 - AFL768		X												X			X				1180	200	SE NW	01	08N	22E
S03	Well #3 - AFL767		X												X	Y		X			X	1004	250	SE NW	01	08N	22E
S04	Well #5 - ALF995				X								X			Y		X				425	500	SE NE	01	08N	22E
S05	Wellfield / S01, S04			X									X			Y		X				420	950			00N	00E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
49650 R	MABTON, CITY OF	YAKIMA	A	Comm

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)	0	894	632
A. Full Time Single Family Residences (Occupied 180 days or *more* per year)	547		
B. Part Time Single Family Residences (Occupied *less than* 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	89		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *more than* 180 days/year	347		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied *less than* 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	0	0	0
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	39	39	39
28. TOTAL SERVICE CONNECTIONS		933	671

29. FULL-TIME RESIDENTIAL POPULATION	
A. How many residents are served by this system 180 or *more* days per year?	2045

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?												
How many days per month is water accessible to the public?												

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
If you have schools, daycares, or businesses connected to your water system, how many students daycare children and/or employees are present each month?	1290	1285	1287	1290	1285	600	600	600	1130	1200	1200	1200
How many days per month are they present?	25	25	25	25	25	25	25	25	25	25	25	25

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	4	4	4	4	4	3	3	3	3	3	3	3

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: DATE:

PRINT NAME: TITLE:

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

WATER FACILITIES INVENTORY (WFI) FORM

ONE FORM PER SYSTEM

Quarter: 1
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PO BOX 655
MABTON, WA 98935

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CITY MABTON STATE WA ZIP 98935

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MABTON, CITY OF
ANGEL REYNA TITLE: MAYOR
PO BOX 655
MABTON, WA 98935

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- [X] Residential
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- [X] Other (church, fire station, etc.):

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S04	Well #5 - ALF995				X							X			Y		X					425	500	SE NE	01	08N	22E
S05	Wellfield / S01, S04			X								X			Y		X					420	950			00N	00E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

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How many days per month are they present?	25	25	25	25	25	25	25	25	25	25	25	25

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	4	4	4	4	4	3	3	3	3	3	3	3

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: DATE:

PRINT NAME: TITLE:

APPENDIX N

WATERLINE SPECIFICATIONS

WATERLINE SPECIFICATIONS

1 WATER PIPE

1.1 GENERAL

The work covered in this section shall include the furnishing, installation, and testing of the water piping, valves, tees, fittings, and other appurtenances and incidental work required to construct the water facility as shown on construction plans and in accordance with Washington State Standard Specifications 7-09 through 7-15, and as herein modified.

In case of discrepancies between the two different specifications, following is the order of procedure:

A. These City of Mabton Waterline Specifications.

B. Washington State Standard Specifications.

1.2 APPROVED PIPE

POLYVINYL CHLORIDE (PVC) PIPE shall conform to the requirements of AWWA designation C900 for Class 150 (DR18).

1.3 PIPE COUPLING

POLYVINYL CHLORIDE PIPE COUPLING shall be integral bell and spigot with elastomeric gasket seals, and shall be "Ring-Tite" as manufactured by Johns-Manville, or an approved equal.

1.4 INSTALLATION

Pipe shall be installed in accordance with the manufacturer's specifications for the type of approved pipe used. The Contractor shall construct the pipeline in accordance with the requirements of Standard Specifications 7-10 and 7-11 as herein modified.

1.5 TRENCH EXCAVATION AND BACKFILL

Trench excavation for water line construction shall be in accordance with Standard Specification 7-10.3(7) and shall provide a minimum of 42 inches of cover material over the top of the finished pipe grade. Trench backfill material shall be compacted by means approved by the Engineer, as required to preclude future settlement and to achieve a minimum of 95 percent maximum density when tested in accordance with Standard Specification 7-10.3(11). Hand operated jumping jacks or shoe type mechanical tampers will not be approved.

Trench excavation shall be unclassified unless rock excavation is listed as a separate pay item.

WATERLINE SPECIFICATIONS

1.6 PIPE LOCATOR RIBBON

Pipe locator ribbon is required by City of Mabton at a depth of 18 inches below ground surface.

1.7 TRACER WIRE

The Contractor shall install a tracer wire over all nonmetallic water mains. The tracer wire shall be #14 gauge copper wire with UF insulation, colored blue. The tracer wire shall be installed as shown on the detail included herein. Access points shall be provided at valve boxes, air release and blow-off installations.

1.8 DISINFECTION

The disinfection of new water lines, including all connections and appurtenances, shall be in accordance with Standard Specification 7-11.3(12) as herein modified. Water test points shall be at typical intervals of 500 to 800 feet or as approved by the Engineer. Sanitation test samples can be taken at fire hydrants and temporary blow-offs when available. When not available, a corp stop shall be installed by the Contractor at the nearest service location. The Engineer shall submit written notification to the City indicating the results of the sanitation tests to the City, including copies of the test results from a certified laboratory.

1.9 PRESSURE TESTING

The pressure testing of new water lines, including all connections and appurtenances, shall be in accordance with Standard Specification 7-11.3(11) as herein modified. The hydrostatic test pressure for all types of pipe to be tested shall be 150 psi. The Engineer shall submit written results of the pressure testing to the City. The results shall include the section of pipe tested, the length of the test and beginning and ending pressures.

1.10 TRENCH SAFETY SYSTEMS

All trench excavation which will exceed a depth of four feet shall have adequate safety systems for the trench excavation that meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW. The Contractor shall be fully responsible for providing the necessary back sloping, cribbing, trench boxes, etc., as required to meet the specified safety requirements for the trench.

1.11 MEASUREMENT AND PAYMENT

The unit contract price for each size of "Water Line," per linear foot when measured continuously along the pipe centerline, including the distances through structures, valves, and fittings, shall be full compensation for furnishing all labor, equipment, and materials, to trench, dewater, compact and backfill, lay and joint the pipe, make connections to existing stub lines, specified or required

salvage, test, disinfect, and all other incidentals required to perform the work in accordance with the plans and specifications or as directed by the Engineer.

Cost for Trench Safety Systems, if required, shall be paid for as a separate bid item.

2 ROCK EXCAVATION

2.1 GENERAL

When provided for in the bid proposal, a separate measurement and payment will be made for rock excavation. Rock excavation shall include solid rock formations requiring systematic drilling and blasting with explosives and any boulders or broken rock larger than one-half cubic yard in volume. Hardpan or cemented gravel, even though it may be advantageous to use explosives in its removal, shall not be classified as solid rock excavation. The bottom of the trench shall be brought up to grade by backfilling with selected backfill material and be compacted to the satisfaction of the Engineer.

The Contractor shall notify the Engineer at least 24 hours prior to any blasting. All blasting shall be done in accordance with local, county, and state regulations governing this class of work. Any damage to persons or property resulting from blasting operations shall be the sole responsibility of the Contractor and his surety.

2.2 MEASUREMENT

The measurement for "Rock Excavation" shall be made as follows:

2.2.A. LENGTH

Length will be the entire horizontal distance where rock is encountered measured on a linear foot basis along centerline of trench.

All water line structures; i.e., valve pits, transmission line blow-offs, pressure reducing stations, etc., will be excluded and will be measured separately. Measurement will commence at the first location where rock is encountered and continue to the point where the rock terminates.

2.2.B. WIDTH

The trench width for payment of rock excavation shall be as follows:

Size of Pipe	Pay Width of Trench

WATERLINE SPECIFICATIONS

4" - 15"	2.5 feet
18" - 36"	Outside pipe diameter plus 12"
42" & larger	Outside pipe diameter plus 24"

2.2.C. DEPTH

Measurement for depth will be the vertical distance from six inches (6") below the pipe invert to the top of the solid rock strata. Depth will be measured at intervals of 25 feet along centerline of trench, beginning at the first location that solid rock is encountered, and the average depth between measuring points will be the depth used for computing depth of rock.

2.2.D. ROCK EXCAVATION FOR STRUCTURES

Rock excavation quantities for water line structures; i.e., valve pits, transmission line blow-offs, pressure reducing stations, etc., shall be computed on a cubic yard basis from the actual profile depth as noted above, multiplied by the area within a line parallel to and one foot (1') outside of the actual dimensions of the structure base.

2.3. PAYMENT

The unit contract price for "Rock Excavation," per cubic yard, shall be paid in addition to the payment for "Water Line Pipe," per linear foot. Payment for rock excavation shall be full compensation for all work necessary to excavate and dispose of the rock material. No payment will be made for rock excavated below required grade or outside the widths mentioned above.

3 PIPE BEDDING

3.1 GENERAL

It is the intent of these specifications to use select native material from the site for backfill around the water main pipe. When unsuitable native material exists or is encountered during trench excavation, imported bedding material may be required by the Engineer, depending on the type of pipe being installed and the type of materials encountered. Where directed by the Engineer, the Contractor shall furnish and place imported pipe bedding.

3.2 NATIVE BEDDING MATERIALS

Select native material used for bedding pipes shall meet the requirements of Standard Specification 9-03.12 as herein modified. The minimum sand equivalent shall be 50. Select native material shall be free of organic materials, lumps, rocks and pavement chunks and shall meet the approval of the Engineer.

WATERLINE SPECIFICATIONS

3.3 IMPORTED BEDDING MATERIALS

Imported pipe bedding for pipes shall be in accordance with Standard Specification 9-03.12 as herein modified. The minimum sand equivalent shall be 50.

3.4 COMPACTION

The bedding material shall be placed and compacted in lifts not to exceed six inches (6"). The pipe bedding shall be compacted to not less than 95 percent of maximum density. Compaction shall be done in such a manner as to preclude future settlement.

3.5 MEASUREMENT

Measurement for payment shall be by the linear foot for imported bedding material incorporated in the project.

3.6 PAYMENT

The unit contract price for "Imported Pipe Bedding," per linear foot, shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to the installation of bedding material in accordance with the plans and specifications or as directed by the Engineer.

Select native materials, which are acceptable as bedding and utilized as bedding, shall be considered as incidental to the pipe installation and no additional payment will be made for its use as imported pipe bedding.

WATERLINE SPECIFICATIONS

4 FIRE HYDRANT ASSEMBLIES

4.1 GENERAL

Installation of fire hydrants shall conform to the requirements of the detail included herein and Standard Specification 7-14 as herein modified. Hydrants shall be three (3) port fire hydrants, as described in Section 4.2 of these specifications.

4.2 MATERIALS

Fire hydrants shall meet AWWA C502 and be dry top, break-away type. The hydrants shall allow for three (3) feet of cover over the inlet pipe and be traffic yellow in color. The main valve opening shall be five and one-quarter (5-1/4) inches. The shoe inlet shall be six (6) inches, MJ connection. Hydrants shall be equipped with two (2) two and one-half (2-1/2) inch hose nozzles and one (1) four and one-half (4-1/2) inch pumper nozzle with threads conforming to national standard thread. The operating nut shall be one and one-half (1-1/2) inch pentagon nut that opens left. Hydrants shall be equipped with bronze upper valve plate, bronze seat ring, and bronze drain ring. They shall have a self lubricating oil reservoir, sealed by dual "O" rings and equipped with an anti-friction washer and weather cap. Nozzle caps shall be attached to upper barrel with individual non-kinking chains. Bonnet and lower barrel flanges shall be concealed. The breakaway safety stem shall be recessed within hydrant barrel. The hydrants shall be Mueller Centurion A-423 or an approved equal. Any vertical adjustment shall be manufactured specifically for the hydrant used. When not protected by a curb, hydrants shall be protected by guard posts.

Fire hydrants shall be painted OSHA Safety Yellow above ground line. The hydrant waste orifice at the base of the hydrant shall be bronze and connected to the hydrant by means of a bronze on bronze fitting to prevent rust and normal soil corrosion from plugging or interfering with its operation. Hydrants shall be of standard manufacture and of a pattern approved by the Owner. The name or mark of the manufacture, size of the valve opening, and year made shall be plainly cast in raised letters and so placed on the hydrant barrel as to be visible after the hydrant has been installed.

The vertical adjustment assemblies shall be complete, including the flanged riser, stem and all required components to provide a complete adjustment kit.

All associated valves, valve boxes, fittings and thrust blocks installed under the "Fire Hydrant Assembly" shall be in conformance with Section 7 of these specifications.

4.3 INSTALLATION

Fire hydrants shall be installed according to Standard Specification 7-14 as herein modified, and the detail included herein. Fire hydrants shall be located as shown on the plans. Where conflicts

or conditions require deeper than standard bury, the Contractor shall provide an extra deep hydrant or add an adjustment to the standard hydrant. The following requirements shall prevail for the installation of the fire hydrant:

4.3.A The bottom of the lowest port shall be a minimum of eighteen inches (18") above the top of the finished surface of existing or future sidewalk.

4.3.B Hydrants are to be free of vegetation and barriers for a three foot (3') radius circle measured from the operating nut.

4.3.C Fire hydrants are to be hooded until operable and accepted.

4.3.D Valves on mains to hydrants shall be bolted directly to the tee serving the hydrant.

4.3.E Valves servicing fire hydrants on any fire line shall be installed as per fire hydrant installation detail included herein.

4.3.F Guard post shall be installed if the hydrant is not protected by a curb.

4.3.G Salvage shall be completed per these specifications, Section 19.

4.4 MEASUREMENT

Measurement for fire hydrant assembly shall be per each assembly. An assembly includes: the main line tee with flanged coupling adapters (when required), blocking for tee and hydrant, six inch (6") gate valve and valve box, six inch (6") connecting pipe, shackles, tie rods, pier blocks, coarse gravel, painting, and any other items that are required for the complete installation of the hydrant as specified. Measurement for a 6-inch or 12-inch hydrant vertical adjustment assembly installed when directed by the Engineer, shall be per each assembly complete in place, or in lieu of, the Contractor may at his option, provide an extra depth bury hydrant as the location requires. Measurement will be made for the hydrant bury greater than the standard 4'-0" bury, only when made necessary by conflicting utilities or by the grade of the ground at the hydrant location. Measurement will be made per each for "Fire Hydrant Guard Post" when required.

4.5 PAYMENT

The unit contract price for 6-inch or 12-inch hydrant vertical adjustment assembly, "Fire Hydrant Guard Post," "Fire Hydrant Assembly," per each, shall be full compensation for all necessary labor, materials, tools, and equipment to install the adjustment or the fire hydrant assembly in place, complete, including adjusting of the valve box to the finished grade in accordance with the plans and specifications or as directed by the Engineer.

WATERLINE SPECIFICATIONS

5 BLOW-OFF ASSEMBLY

5.1 GENERAL

This specification covers the construction and installation of a two inch (2") blow-off assembly to allow for the controlled flushing of water from the water distribution system.

5.2 MATERIALS AND CONSTRUCTION

With the exception of temporary installations, all materials used shall be new and assembled in accordance to the requirements of the detail included herein and the following requirements:

5.2.A Pipe shall be galvanized steel, Schedule 40, threaded by couple ends, and shall meet the requirements of ASTM designation A 120.

5.2.B Fittings shall be standard dimension, galvanized, malleable iron, manufactured in accordance with the requirements of ASTM 197, and capable of withstanding a working pressure at 150 psi.

5.2.C Gate valve shall be flanged with a nonrising two-inch square operating nut, counter-clockwise opening, similar or equal to the M&H Style 67-02.

5.2.D Valve boxes shall be as specified in Section 7.2.D of these specifications.

5.2.E Tapping saddle shall be a double strap saddle similar and equal to the Rockwell Model 313.

5.3 MEASUREMENT AND PAYMENT

The unit contract price for "Two-Inch Blow-Off Assembly," or "Temporary Two-Inch Blow-Off Assembly," per each, shall be full compensation for furnishing all labor, materials, equipment, trenching and backfill, valves, fittings, thrust blocks, adjusting the valve boxes to finished grade, all other incidentals required to install the complete blow-off assembly in place, including tapping into the water main and removal of the temporary installations.

6 AIR AND VACUUM RELEASE ASSEMBLY

6.1 GENERAL

This specification covers the construction and installation of an air and vacuum release assembly to allow for the automatic venting of air into and out of a water line during times when the line is being emptied or filled with water.

WATERLINE SPECIFICATIONS

6.2 MATERIALS AND CONSTRUCTION

All materials used shall be new and assembled in accordance to the requirements of the detail included herein and the following requirements:

6.2.A Pipe shall be galvanized steel, Schedule 40, threaded by couple ends, and shall meet the requirements of ASTM designation A120.

6.2.B Street elbows shall be standard dimension, galvanized, malleable iron, manufactured in accordance with the requirements of ASTM 197, and capable of withstanding a working pressure of 150 psi.

6.2.C Tapping saddle shall be a stainless steel, double strap saddle similar and equal to the Smith Blair 331.

6.2.D Gate valve shall be flanged with nonrising two-inch (2") square operating nut, counter-clockwise opening similar and equal to the M&H Style 67-02.

6.2.E Pipe coupling device shall be similar and equal to the Dresser Style 38.

6.2.F Air and vacuum valve shall have a cast iron body, cover and baffle with a stainless steel float and a Buna N seat. All internal parts such as float guides, bushings, and baffle retaining screws shall be either stainless steel or bronze. The valve shall be similar and equal to APCO No. 144, and shall be capable of handling operating pressures of 150 psi.

6.3 MEASUREMENT AND PAYMENT

The unit contract price for "Air and Vacuum Release Assembly," per each, shall be full compensation for furnishing all labor, materials, equipment, trenching and backfill, valves, fittings, valve chamber, and all other incidentals required to install the complete air and vacuum assembly in place, including tapping into the water main.

7 VALVES, VALVE BOXES AND FITTINGS

7.1 GENERAL

This specification covers all valves, valve boxes, and water line fittings (tees, elbows, crosses, blocks, etc.) necessary as indicated on constuction plans. All valves shall be bolted to tees and fittings unless otherwise specified.

7.2 MATERIALS

WATERLINE SPECIFICATIONS

7.2.A BUTTERFLY VALVES: Valves larger than twelve inches (12") shall be butterfly valves.

All butterfly valves shall conform to the AWWA Standard for "Rubber Seated Butterfly Valves," (AWWA C504), and shall meet the following requirements:

7.2.A.1 Valves shall be Class 150-B and shall open counter-clockwise with a standard two inch (2") square nonrising operator nut.

7.2.A.2 Flanged valves shall be furnished with flanges faced and drilled to 150 pound American Standard dimensions and, unless otherwise specified or shown on the drawings, may be either short-bodied or long-bodied.

7.2.A.3 Shaft seals shall be designed for use with standard split V type packing.

7.2.A.4 Valve discs shall be manufactured from material listed in 7.2 of the above referenced AWWA Standard.

Prior to the installation of all rubber seated valves, the Contractor shall lubricate the seat with Molykote Valve Seal, Catalog No. 98750-56, as manufactured by Dow-Corning, or approved equal.

7.2.B RESILIENT SEATED GATE VALVES

All valves twelve inches (12") and smaller shall be resilient seated gate valves.

The resilient seated gate valves shall conform to the requirements of AWWA C509. The valve shall open counter-clockwise with a two-inch (2") square nonrising operator nut. The ductile iron gate valve wedge or gate member shall be fully encapsulated in synthetic rubber. All seating surfaces within the valve body shall be inclined to the vertical, the valve stem shall be sealed by a minimum of two (2) O-rings and all stem seals shall be replaceable with the valve wide open and subjected to full rated pressure.

The valve body and bonnet shall be epoxy coated inside and out. The waterway shall be smooth and shall have no depressions or cavities in the gate seating area.

Resilient seated gate valves shall meet the above specifications and shall be Clow R/W, Waterous Series 500, Kennedy Ken-Seal, Mueller, Dresser M&H Style 3067, unless otherwise specified in the contract Special Provisions.

7.2.C TAPPING VALVES

The Contractor shall be required to install resilient seated gate valves when making 4-

inch to 12-inch live taps on mains. The resilient seated gate valves shall be in accordance with the requirements of Section 7.2.B of these specifications and shall be installed in a manner meeting the Engineer's approval.

7.2.D VALVE BOXES

Cast iron sliding type adjustable valve boxes with covers shall be provided for all buried valves. Valve boxes shall consist of top and bottom section with slide type extensions and large bottom base where specified. Drop type cover shall be marked "WATER." In unpaved areas, valve boxes shall be provided with a six-inch (6") thick concrete collar, 30 inches square at the ground surface. Valve boxes and covers shall be "Tyler No. 6855" series, or a foreign-made clone equal in all dimensions and weight. The cover shall have a skirt length of 1-1/2 inches minimum, a total lid depth of 3-1/2 inches minimum, and a lid weight of minimum 13 pounds. Valve boxes shall be installed as shown on the detail included herein.

7.2.E FITTINGS

Fittings for ductile iron and PVC pipe shall be cast or ductile iron. Cast iron fittings shall conform to the quality and wall thickness specified in the American Standard for "Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch for Water and Other Liquid" (AWWA C110), for "Fluid-Tite" joints specified in Section 1. All cast iron fittings, twelve inches (12") in diameter or larger, shall be lined with cement mortar in accordance with the requirements of the American Standard for "Cement Mortar Lining for Cast Iron and ductile Iron Pipe and Fittings for Water" (AWWA C104).

Ductile iron fittings shall be compact or standard bell and spigot, mechanical joint, or flanged as required on the plans. Standard fittings shall be in accordance with AWWA C110, "Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch for Water and Other Liquids." Ductile iron compact fittings may be used in sizes through 12-inches. The fittings shall conform to all requirements of AWWA Standard C153 for ductile iron compact fittings 3-inch through 12-inch. The bell and spigot joints shall be rubber gasket sealed joints in accordance with AWWA C111. Ductile iron fittings, twelve inches (12") inside diameter or greater, shall be mortar lined in accordance with AWWA C104.

Cut-in tees and live tap tapping sleeves shall be as directed by the Engineer.

7.2.F THRUST BLOCKING

Concrete blocking shall be installed in accordance with the detail included herein and shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints of pipe or fitting. An 8 mil polyethylene sheet, or two layers of 4 mil, shall be placed between the fitting and the

thrust block.

7.3 INSTALLATION

Installation of valves, boxes, and fittings shall be in accordance with Standard Specifications 7-11 and 7-12 as herein modified.

7.3.A All valves are to be bolted directly to the tees or crosses as indicated in the plan. The flanges on valves and tees (or crosses) shall be plain faced. Flanges shall be faced and drilled to 150 pound American Standard dimensions.

7.3.B All other connections between pipe and fittings, or pipe and valve shall be flexible coupling, "Ring-Tite," "Fluid Tite," or approved equal, except as noted otherwise for installation of a cut-in tee where flanged coupling adaptors shall be used to connect the tee to the existing main.

7.4 MEASUREMENT

Valves and associated valve boxes, including their adjustment to finished grade, shall be considered as one item and shall be measured per each according to size of valve. All fittings shall be measured per each according to size and type. All valves, thrust blocks and fittings which are included in the unit items for "Fire Hydrant Assembly," "Blow-off Assembly," etc., shall be measured and paid as incidental to those unit items and no additional payment will be made for them.

7.5 PAYMENT

The unit contract price for each size of "Valve," per each, and each type and size of "Fitting," per each, shall be full compensation for furnishing all necessary labor, equipment, and materials, concrete thrust blocks, and all other incidentals required to install all valves and fittings in place in accordance with construction plans and these specifications or as directed by the Engineer.

When constructed in conjunction with a paving project, a separate measurement and payment will be made for adjusting to grade, after completion of paving, as per Section 8 of these specifications.

WATERLINE SPECIFICATIONS

8 ADJUST EXISTING AND NEW CASTING TO GRADE

8.1 GENERAL

When constructed in conjunction with a street construction project or pavement overlay, existing and new water valve boxes, air release and blow-off assembly castings, which are required to be adjusted to finished grade, shall be adjusted in accordance with the local street authority.

Where the new water valve boxes fall outside of the pavement restoration limits, in unpaved areas, the box shall be adjusted to conform to the adjoining grade and set in a 30" X 30" X 8" - thick concrete collar.

8.2 MEASUREMENT AND PAYMENT

All costs for the specified adjustments shall be considered incidental to the water line installation pay items provided in the bid proposal.

9 SALVAGE

9.1 GENERAL

All existing tees, valves, boxes, fire hydrants and miscellaneous fittings to be abandoned during construction, shall be removed by the Contractor for City salvage.

9.2 MEASUREMENT AND PAYMENT

Salvage of existing water line appurtenances shall be considered incidental to the unit contract price for "Water Line" and no additional compensation shall be allowed.

10 SCHEDULED WATER LINE SHUT DOWN

10.1 GENERAL

The Contractor shall give the City a 72-hour notice of required water line shut down. The Contractor shall verify that all required fittings necessary for connection are secured and in hand prior to scheduling shut downs. The Contractor shall be billed for cancelled shut downs, unless circumstances beyond the Contractor's control (as determined by the Engineer), have caused the Contractor to cancel the shutdown.

11 VALVE OPEN/CLOSE POLICY

WATERLINE SPECIFICATIONS

11.1 GENERAL

The City shall open/close all existing water line valves and new valves connected to existing water line at the Contractor's request. When a water line valve connected to the existing system is open, the Contractor shall, at all times, keep at least one downstream flow open to prevent back draw. Prior to the Contractor shutting down all of the downstream flows, the water line valve connected to the existing system must be closed. The Contractor shall provide reasonable notice to the Owner of the water system of the need for opening and closing valves.

12 TIE-IN TO EXISTING WATER LINES

12.1 GENERAL

Tie-in to the existing water lines and the installation of the required fittings and water line shall be under the direct observation of the Owner and the Engineer. Work shall not be started until all the materials, equipment, an labor necessary to properly complete the work are assembled on site. Extreme care shall be taken by the Contractor to keep the existing water lines and new fittings and water line clean and free from contaminates. The inside surfaces of the valve, pipe and fittings shall be thoroughly swabbed with, or filled with, a 75-parts per million chlorine solution 24 hours prior to the installation of all fittings. The fittings and water line shall be kept in a clean environment and delivered to the site within a protective covering. The fittings and waterline shall be swabbed again with the 75-parts per million chlorine solution just prior to their installation.

12.2 MEASUREMENT AND PAYMENT

All necessary labor, tools, dewatering, chlorine swabbing and incidentals as required to cut into existing water mains or remove existing fittings and valves as called for on the plans, shall be considered incidental to the unit contract price for water line, per linear foot, or fittings as allowed in the bid proposal.

13 COUPLINGS AND FLANGE COUPLING ADAPTERS

13.1 GENERAL

Couplings and flange coupling adapters shall be manufactured from cast iron and rated at a minimum of 150 psi. The minimum overall length shall be nine (9) inches and the minimum middle ring length shall be five (5) inches. Bolts shall be galvanized steel or cast-iron protected.

14 DIG AND VERIFY

WATERLINE SPECIFICATIONS

14.1 GENERAL

At the connection with existing water lines where shown and directed on the plans and as otherwise directed by the Engineer, the contractor shall expose and verify the exact pipe location, type, size and fittings required prior to ordering the fittings. After digging and verifying, the Contractor shall backfill, compact and cold patch the surfacing. Contractor shall provide the necessary traffic control and safety measures.

14.2 MEASUREMENT AND PAYMENT

The unit contract price for "Digging and Verifying," per each, shall be full compensation for all labor, materials, equipment and incidentals necessary to dig, verify, backfill, compact, provide traffic control and cold patch in accordance with construction plans and these specifications or as directed by the Engineer.

15 ADDITIONAL/ALTERNATE FITTINGS

15.1 GENERAL

Where a standard or specified fitting cannot be obtained or is not readily available, and the Contractor is required to add an MJ adapter to the fitting, the MJ adapter shall be separately paid for under the bid items for "Flange Adapter."

Elbows where noted on the plan sheet are indicated to the degree of bend that appears to fit best. The Contractor shall have the same diameter elbows of various degrees available for installation. If actual field conditions dictate that a degree of bend other than the one noted should be installed, the Contractor shall install the required fitting. Measurement and payment for "**-inch Elbow," per each, shall be full compensation for the actual degree of elbow installed as specified.

If fittings specified for an installation are not readily available, and involve revisions other than the addition of an MJ adapter, the Contractor may, when approved by the Engineer, install alternate fittings that complete the installation in the same manner. Alternate fittings, if used, will be measured and paid for by the unit bid price for the fittings that were specified for the installation.

WATERLINE SPECIFICATIONS

16 PRESSURE CAPS

16.1 GENERAL

Where specified on the construction plans or where directed by the Engineer as required by construction, the Contractor shall pressure cap and thrust block existing water lines. All work and materials shall be in accordance with these specifications.

16.2 MEASUREMENT AND PAYMENT

The unit contract price for "1-Inch to 4-Inch Pressure Cap," or "6-Inch to 8-Inch Pressure Cap," or "10-Inch to 16-Inch Pressure Cap," per each, shall be full compensation for all labor, equipment, materials and incidentals necessary to complete the pressure cap in accordance with construction plans and these specifications or as directed by the Engineer.

17 SIDE SEWER REPAIR

17.1 GENERAL

Although every effort has been made to show potential conflict with sewer services, the exact depth and location of sewer services are not known. The Contractor shall make every effort to prevent damage to sewer services. When sewer services are inadvertently broken or damaged, the Contractor shall repair the side sewer by installing a section of Schedule 40 ABS sewer pipe. The repair section of pipe shall be placed a minimum one foot into the trench walls to provide a solid foundation for the crossing of the new trench. The pipe ends shall be connected using repair clamps. Repair clamps shall be a flexible coupling with stainless steel clamps and shall be Fernco flexible couplings or approved equal. The area under the side service connection shall be bedded with compacted 5/8-inch minus top course rock. When directed by the Engineer or where rocky soils, unstable soils, or other conditions exist, where it may be difficult to detect a damaged side service, water shall be run from the home toilet or other source, to insure that all of the side services are undamaged, prior to beginning backfill operations.

17.2 MEASUREMENT AND PAYMENT

The unit contract price for "Sewer Service Repair," per each, shall be full compensation for all necessary labor, tools, equipment, excavation, backfill and incidentals necessary to make and complete the sewer service repair.

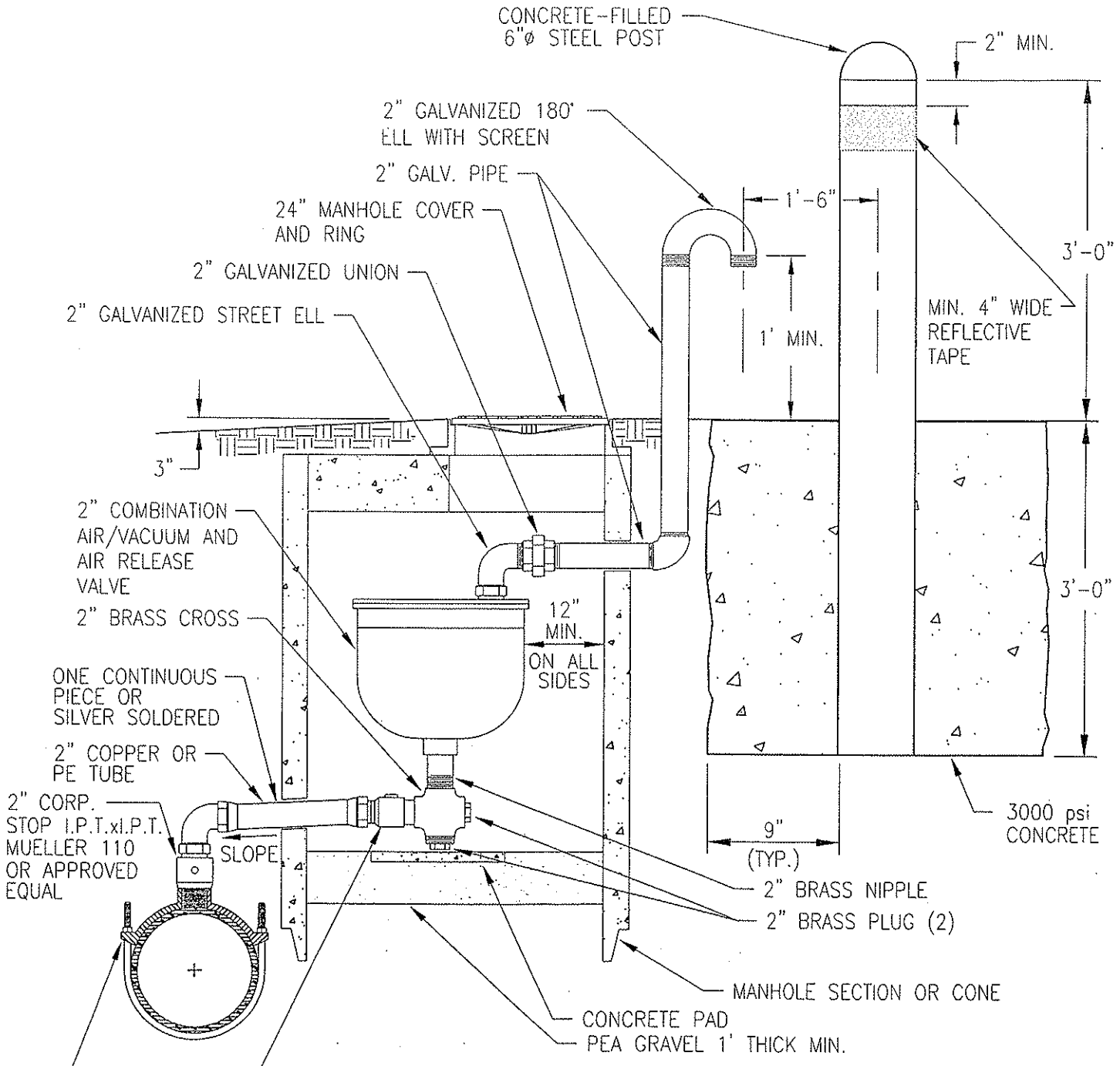
WATERLINE SPECIFICATIONS

18 ABANDONED CONDUITS

All pipes, conduits and other openings determined to be abandoned, which are cut or opened during the water line installation, shall be capped or concrete plugged prior to backfilling of the trench. Measurement and payment for required pipe cuts, labor, equipment, work and materials required to complete the specified plug shall be incidental to the pipe installation pay items.

19 ABANDONED FIRE HYDRANT REMOVAL

All fire hydrants connected to water mains scheduled for abandonment shall be removed by the Contractor and delivered to the City's storage yard for City salvage. Fire hydrants shall be removed intact, including the shoe. A separate measurement and payment will not be made for fire hydrant removal and all costs for removal and delivery shall be incidental to other bid items provided in the bid proposal.



ELEVATION

NOTES:

1. VALVE SIZE AND TYPE TO BE SPECIFIED BY THE DESIGN ENGINEER AND APPROVED BY THE CITY ENGINEER.
2. RISER SHALL BE PROTECTED FROM VEHICULAR OR PEDESTRIAN TRAFFIC AS APPROVED BY THE CITY ENGINEER.
3. PAINT GUARD POST(S) SAFETY YELLOW.
4. EXACT LOCATION OF GUARD POST(S) TO BE DETERMINED IN FIELD BY THE CITY ENGINEER.

SPINK ENGINEERING DWG FILE: 02134ARV.DWG

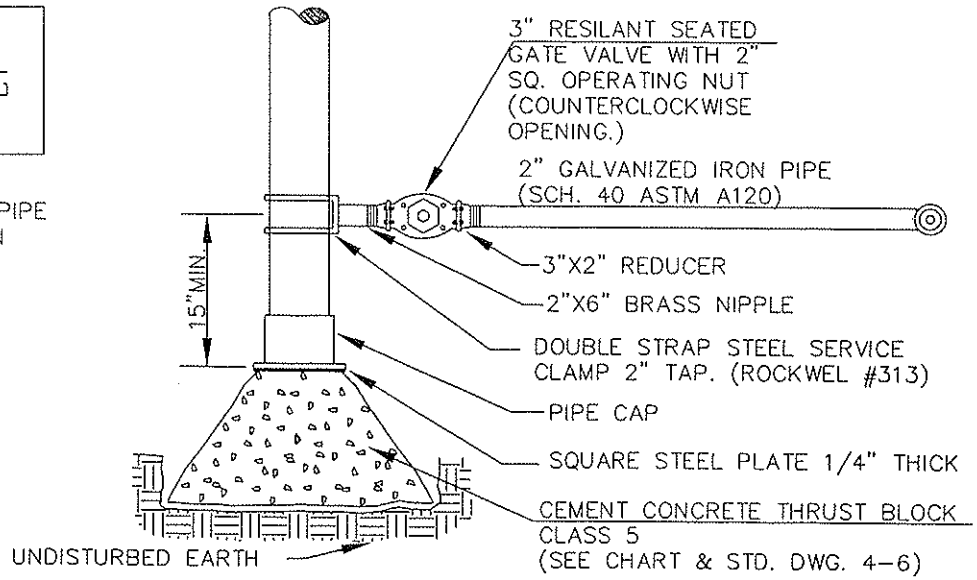
CITY OF MABTON

WATERLINE SPECIFICATIONS
AUGUST 2004

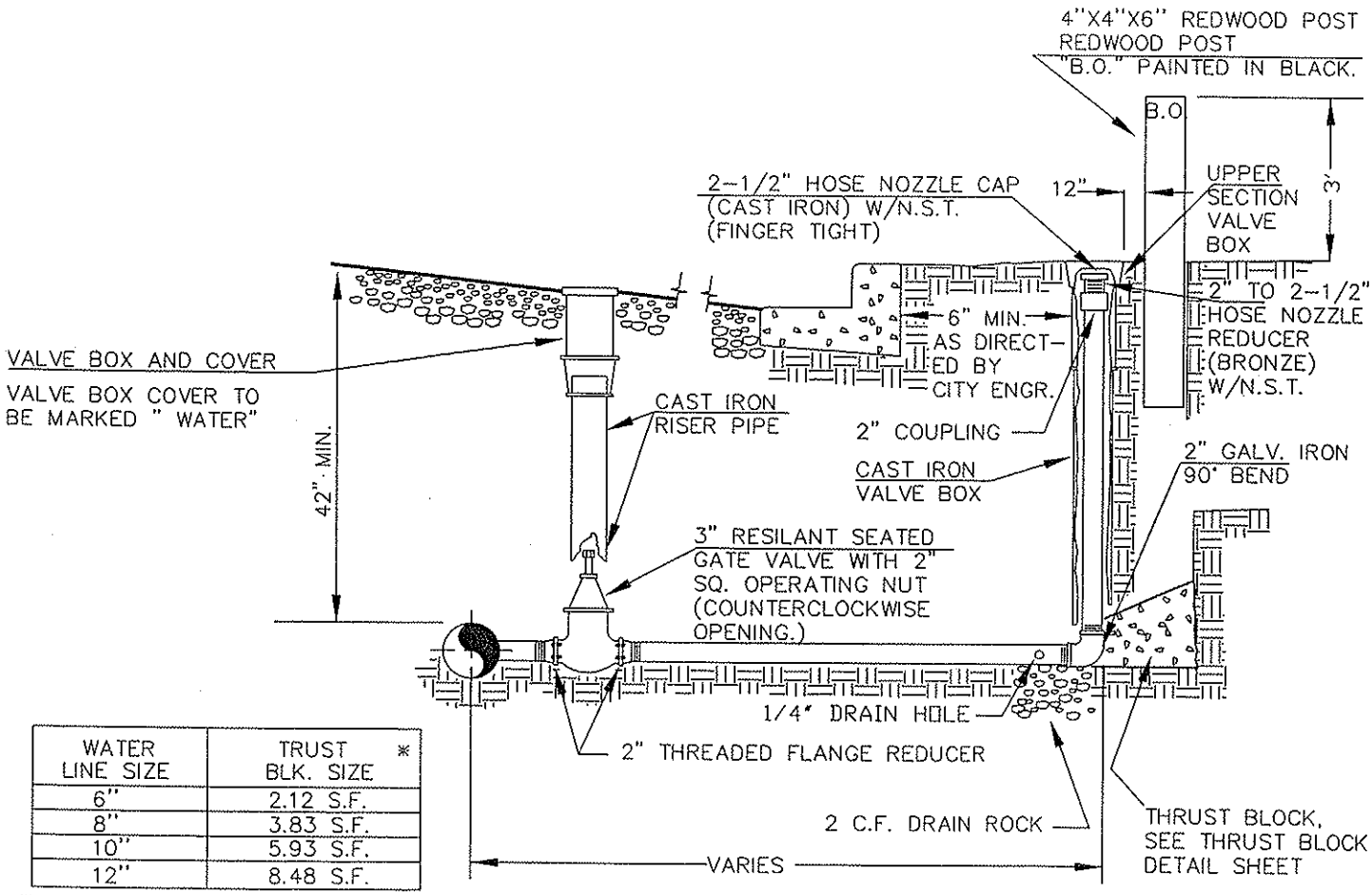
AIR RELEASE VALVE

CALL 48 HOURS
BEFORE YOU DIG
1-800-424-5555

NOTE:
TAP MAY BE OFF END OF PIPE FOR 4" AND SMALLER MAIN (SEE STD. DWG. # 4-1)



PLAN VIEW



WATER LINE SIZE	TRUST BLK. SIZE *
6"	2.12 S.F.
8"	3.83 S.F.
10"	5.93 S.F.
12"	8.48 S.F.

* BEARING AREA AGAINST TRENCH WALL.

ELEVATION

SPINK ENGINEERING DWG FILE: 0213415BO.DWG

CITY OF MABTON

WATERLINE SPECIFICATIONS
JULY 2003

BLOW-OFF DETAIL

CITY OF MABTON

WATERLINE SPECIFICATIONS
JULY 2003

FIRE HYDRANT DETAIL

CALL 48 HOURS
BEFORE YOU DIG
1-800-424-5555

NOTES:

1) HYDRANTS SHALL BE 3 PORTS.
2) HYDRANTS SHALL BE PER SECTION 4 OF THESE SPECIFICATIONS.
3) 2 EA. 3/4" SHACKLE RODS MAY BE REQUIRED IN SPECIAL CIRCUMSTANCES AS DIRECTED BY THE ENGINEER.
4) HUB & FLANGE CASTING. (SEE NOTE 2)
5) HYDRANTS SHALL BE HOODED UNTIL OPERATIONAL.

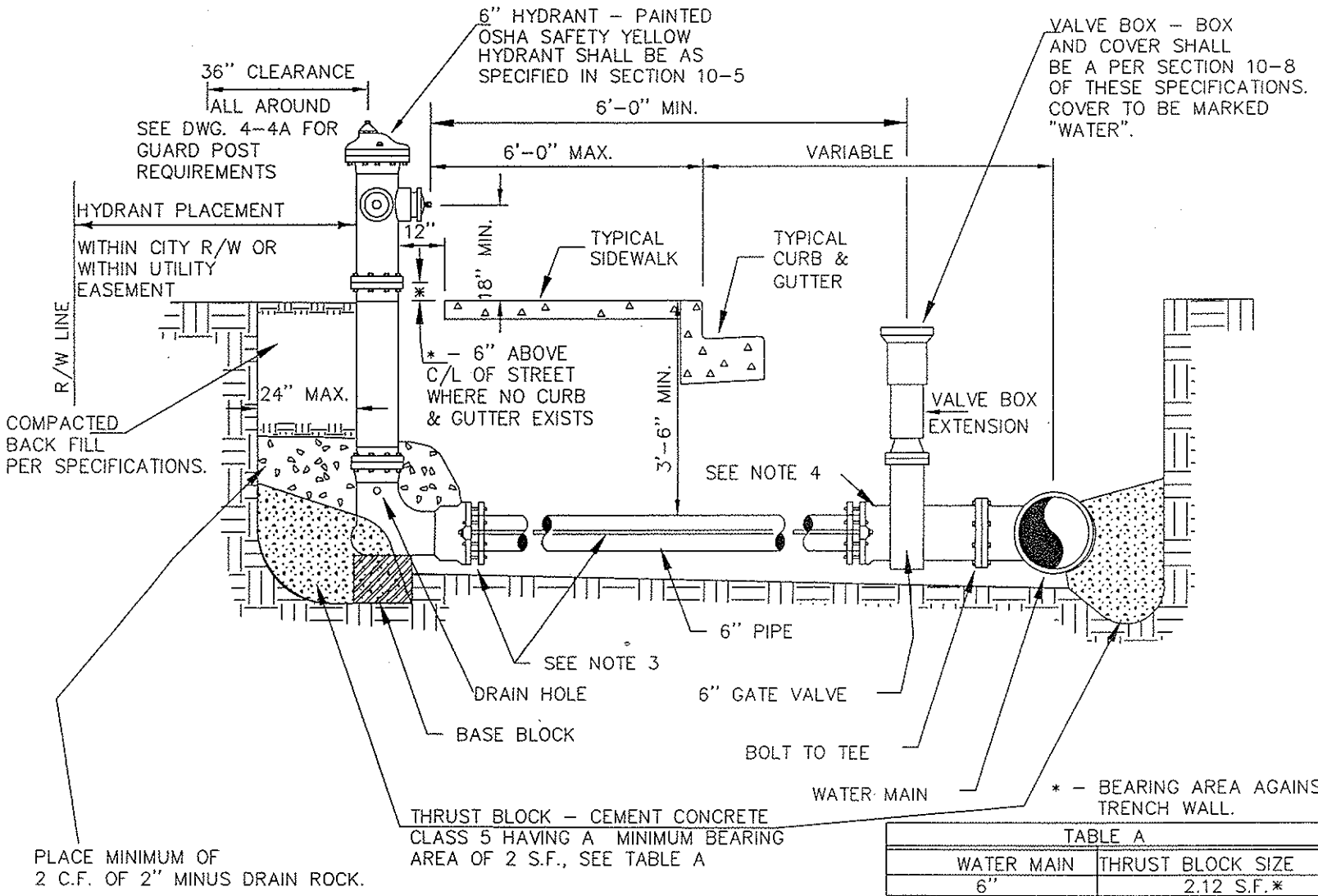
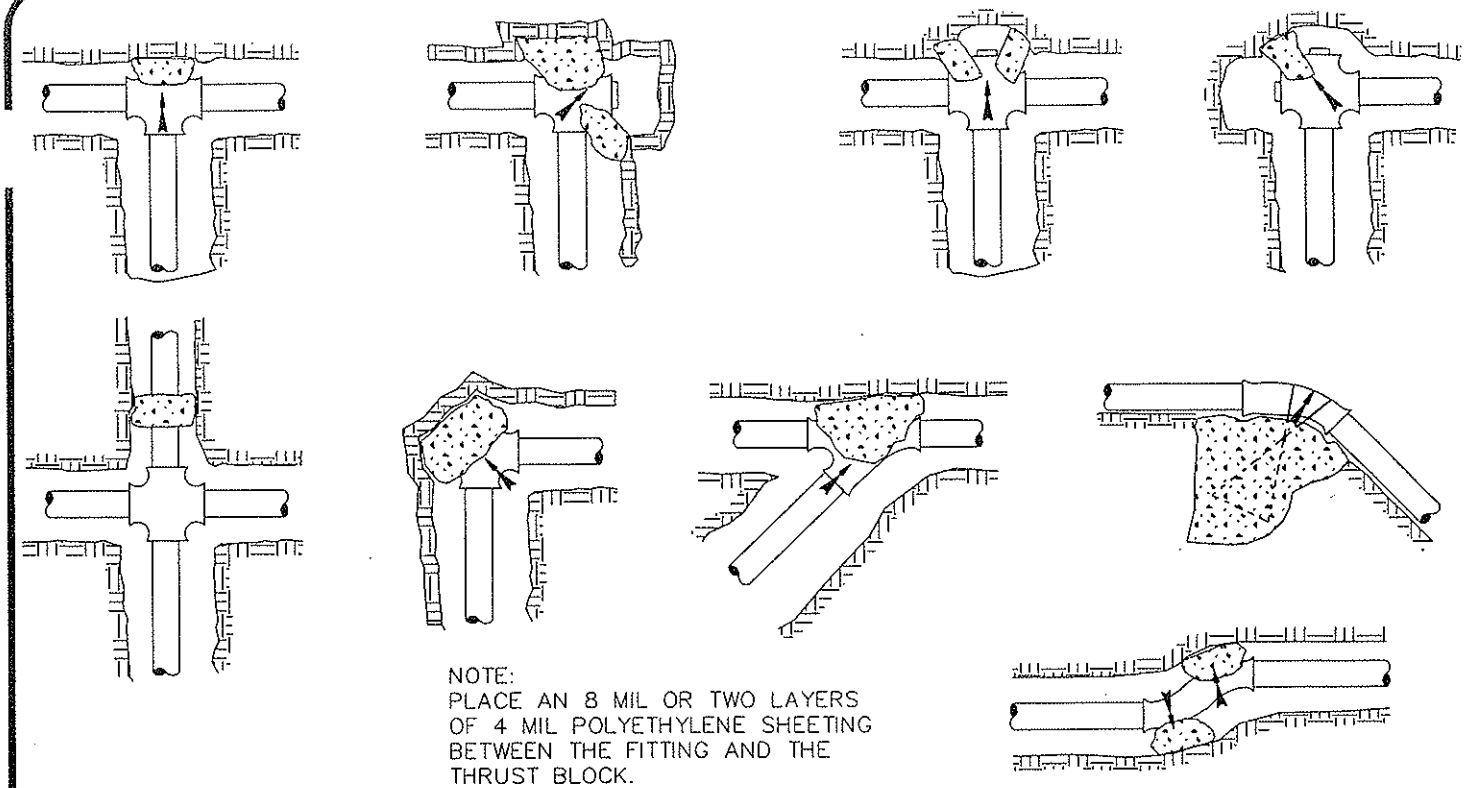


TABLE A	
WATER MAIN	THRUST BLOCK SIZE
6"	2.12 S.F.*
8"	3.83 S.F.*
10"	5.93 S.F.*
12"	8.48 S.F.*

SPINK ENGINEERING DWG FILE: 02134FH.DWG



NOTE:
PLACE AN 8 MIL OR TWO LAYERS OF 4 MIL POLYETHYLENE SHEETING BETWEEN THE FITTING AND THE THRUST BLOCK.

PVC & DUCTILE IRON PIPE
150 PSI TEST PRESSURE

TABLE FOR BEARING AREAS OF THRUST BLOCKS IN SQUARE FEET
HANGING THRUST BLOCKS ARE IN CUBIC YARDS OF CONCRETE

PIPE SIZE	TEES AND DEAD ENDS	90 DEGREE BEND	45 DEGREE BEND	11 1/4 DEGREE 22 1/2 DEGREE BEND
4" & LESS	0.94	1.33	0.76	0.38
	HANGING THRUST BLOCK		0.38 CY	0.19 CY
6"	2.12	3.01	1.71	0.86
	HANGING THRUST BLOCK		0.84 CY	0.42 CY
8"	3.83	5.40	3.08	1.54
	HANGING THRUST BLOCK		1.52 CY	0.76 CY
10"	5.93	8.40	4.73	2.39
	HANGING THRUST BLOCK		2.34 CY	1.18 CY
12"	8.48	12.00	6.83	3.46
	HANGING THRUST BLOCK		3.37 CY	1.70 CY
14"	11.55	16.40	9.30	4.68
	HANGING THRUST BLOCK		4.59 CY	2.31 CY
16"	15.08	21.41	12.14	6.10
	HANGING THRUST BLOCK		6.00 CY	3.00 CY

NOTES:
1. CONCRETE THRUST BLOCKING SHALL BE POURED AGAINST UNDISTURBED EARTH AND SHALL BE CLASS 5 CONCRETE.
2. KEEP CONCRETE CLEAR OF JOINT AND ACCESSORIES.
3. BEARING LOAD IS CALCULATED AT 2,000 LB. PER SQ. FT.
4. FOR 200 PSI PRESSURE TEST FOR FIRE LINES MULTIPLY BY 1.34.

SPINK ENGINEERING DWG FILE: 02134TR.DWG

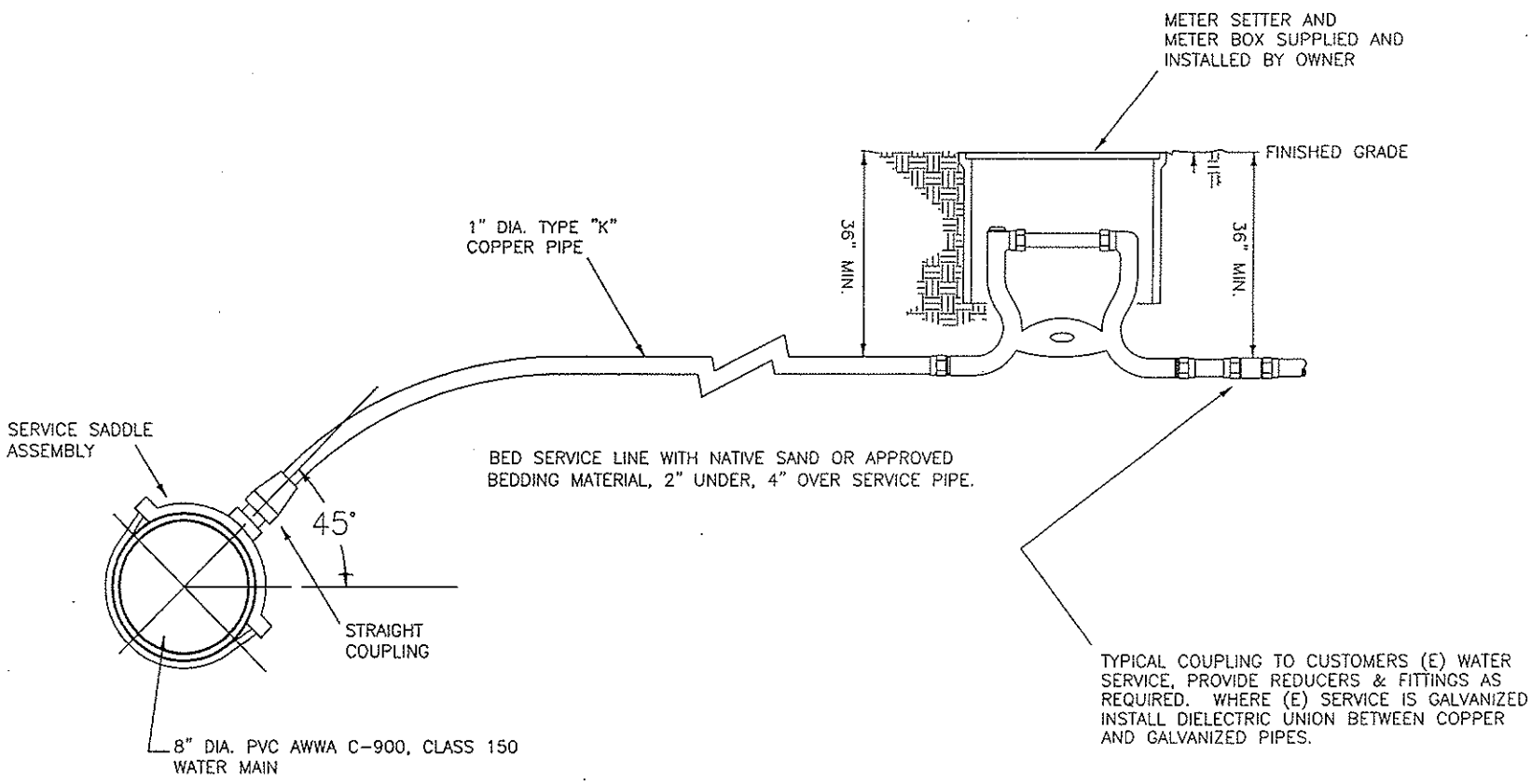
CITY OF MABTON
WATERLINE SPECIFICATIONS
JULY 2003

THRUST BLOCK DETAIL

CITY OF MABTON

WATERLINE SPECIFICATIONS
JULY 2003

WATER SERVICE DETAIL



WATER SERVICE DETAIL

SPINK ENGINEERING DWG FILE: 02134WS.DWG

APPENDIX O

PLANNING LEVEL COST ESTIMATES

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

REPAIR OF WELL NO. 4

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$5,000	$5,000
2	Well Cleaning, Video, Testing	1	LS	$24,000	$24,000
3	New Pump (Installed)[1]	1	LS	$50,000	$50,000
4	New Water Meter	1	LS	$8,000	$8,000
				Subtotal:	$87,000
				Washington State Sales Tax (7.9%):	$6,873
				Total Construction Cost (rounded):	$94,000
				Contingency (25%):	$23,500
				Total Estimated Construction Cost:	**$117,500**
				Admin. Fiscal, Legal and Engineering (5%):	$5,875
				Total Estimated Project Cost (rounded):	**$130,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WELL NO. 6 Plus Well Improvements

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$80,000	$80,000
2	Surface Seal	1	LS	$20,000	$20,000
3	Drilling for 20-in Surface Seal	100	FT	$200	$20,000
4	Drilling for 16-in Surface Seal	700	FT	$150	$105,000
5	Casing	1	LS	$70,000	$70,000
6	Alignment, Pump Test, Video, Grouting etc.	1	LS	$50,000	$50,000
7	Sitework	1	LS	$150,000	$150,000
8	Wellhouse	1	LS	$200,000	$200,000
9	Pump and Motor	1	LS	$120,000	$120,000
10	Flow Meter and Level Sensors[1]	2	LS	$10,000	$20,000
11	Generator	1	LS	$60,000	$60,000
12	Piping, Valves and Appurtenances	1	LS	$60,000	$60,000
13	Electrical	1	LS	$140,000	$140,000
				Subtotal:	$1,095,000
				Washington State Sales Tax (7.9%):	$86,505
				Total Construction Cost (rounded):	$1,182,000
				Contingency (25%):	$295,500
				Total Estimated Construction Cost:	**$1,477,500**
				Admin. Fiscal, Legal and Engineering (25%):	$369,375
				Total Estimated Project Cost (rounded):	**$1,850,000**

(1) An additional flow meter for Well No. 4, and level sensors for Well No. 4 and Well No. 5 are included.

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

1 Mgal. Reservoir

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	1 Mgal. Welded Steel Reservoir[1]	1	LS	$750,000	$750,000
				Subtotal:	$750,000
				Washington State Sales Tax (7.9%):	$59,250
				Total Construction Cost (rounded):	$809,000
				Contingency (25%):	$202,250
				Total Estimated Construction Cost:	**$1,011,250**
				Admin. Fiscal, Legal and Engineering (25%):	$252,813
				Total Estimated Project Cost (rounded):	**$1,300,000**

(1) This work will also include the investigation of the feasibility of extending the height of the existing standpipe reservoir in lieu of the new reservoir. If it is determined that the existing reservoir can be modified to meet the City's needs, the City may elect to modify the existing tank instead of constructing the new reservoir. This rework would include increasing the height of the reservoir and bringing the reservoir up to current seismic standards. These modifications to the existing steel tank are likely to be less costly than constructing a new reservoir.

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER RIGHTS - 150 AC-FT.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Water Rights	150	LS	$4,000	$600,000
				Subtotal:	$600,000
				Washington State Sales Tax (7.9%):	$47,400
				Total Estimated Construction Cost:	**$647,400**
				Admin. Fiscal, Legal and Engineering (5%):	$32,370
				Total Estimated Project Cost (rounded):	**$700,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", SOUTH STREET, RESERVATION ST. TO ALLEY 170 FT. WEST OF MAIN ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$13,000	$13,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	140	CY	$25	$3,500
4	PVC Pipe for Water Main, 8-In. Dia.	1,050	LF	$42	$44,100
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	5	EA	$150	$750
8	Water Main Fittings	1	LS	$9,000	$9,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	8	EA	$400	$3,200
11	Asphalt Concrete Pavement Repair, Class B	700	SY	$50	$35,000
12	Gravel Repair	40	SY	$15	$600
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$6,000	$6,000
				Subtotal:	$137,750
				Washington State Sales Tax (7.9%):	$10,882
				Total Construction Cost (rounded):	$149,000
				Contingency (25%):	$37,250
				Total Estimated Construction Cost:	**$186,250**
				Admin. Fiscal, Legal and Engineering (25%):	$46,563
				Total Estimated Project Cost (rounded):	**$240,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", MONROE STREET, FROM SEVENTH AVE TO ALLEY EAST OF FIRST AVE.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$21,000	$21,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	240	CY	$25	$6,000
4	PVC Pipe for Water Main, 8-In. Dia.	1,850	LF	$42	$77,700
5	8-Inch Gate Valve and Valve Box	4	EA	$1,200	$4,800
6	Hydrant Assembly	4	EA	$4,000	$16,000
7	Concrete Encasement	9	EA	$150	$1,350
8	Water Main Fittings	1	LS	$16,000	$16,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	20	EA	$400	$8,000
11	Asphalt Concrete Pavement Repair, Class B	1,240	SY	$50	$62,000
12	Gravel Repair	40	SY	$15	$600
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$10,000	$10,000
				Subtotal:	$230,450
				Washington State Sales Tax (7.9%):	$18,206
				Total Construction Cost (rounded):	$249,000
				Contingency (25%):	$62,250
				Total Estimated Construction Cost:	**$311,250**
				Admin. Fiscal, Legal and Engineering (25%):	$77,813
				Total Estimated Project Cost (rounded):	**$390,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", ALLEY EAST OF 1st AVE., FROM WASHINGTON ST. TO MONROE ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$15,000	$15,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	36	EA	$400	$14,400
11	Asphalt Concrete Pavement Repair, Class B	40	SY	$50	$2,000
12	Gravel Repair	1,250	SY	$15	$18,750
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$156,350
				Washington State Sales Tax (7.9%):	$12,352
				Total Construction Cost (rounded):	$169,000
				Contingency (25%):	$42,250
				Total Estimated Construction Cost:	**$211,250**
				Admin. Fiscal, Legal and Engineering (25%):	$52,813
				Total Estimated Project Cost (rounded):	**$270,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", IN ALLEY EAST OF 3RD AVE. FROM WASHINGTON ST. TO MONROE ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$14,000	$14,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	36	EA	$400	$14,400
11	Asphalt Concrete Pavement Repair, Class B	70	SY	$50	$3,500
12	Gravel Repair	870	SY	$15	$13,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$151,150
				Washington State Sales Tax (7.9%):	$11,941
				Total Construction Cost (rounded):	$163,000
				Contingency (25%):	$40,750
				Total Estimated Construction Cost:	**$203,750**
				Admin. Fiscal, Legal and Engineering (25%):	$50,938
				Total Estimated Project Cost (rounded):	**$260,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", IN ALLEY EAST OF 5TH AVE. FROM WASHINGTON ST. TO MONROE ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$14,000	$14,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	36	EA	$400	$14,400
11	Asphalt Concrete Pavement Repair, Class B	70	SY	$50	$3,500
12	Gravel Repair	870	SY	$15	$13,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$151,150
				Washington State Sales Tax (7.9%):	$11,941
				Total Construction Cost (rounded):	$163,000
				Contingency (25%):	$40,750
				Total Estimated Construction Cost:	**$203,750**
				Admin. Fiscal, Legal and Engineering (25%):	$50,938
				Total Estimated Project Cost (rounded):	**$260,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", MONROE ST. FROM 7TH AVE. TO VANCE RD.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$9,000	$9,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	100	CY	$25	$2,500
4	PVC Pipe for Water Main, 8-In. Dia.	700	LF	$42	$29,400
5	8-Inch Gate Valve and Valve Box	2	EA	$1,200	$2,400
6	Hydrant Assembly	2	EA	$4,000	$8,000
7	Concrete Encasement	4	EA	$150	$600
8	Water Main Fittings	1	LS	$6,000	$6,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	2	EA	$400	$800
11	Asphalt Concrete Pavement Repair, Class B	470	SY	$50	$23,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$4,000	$4,000
				Subtotal:	$94,250
				Washington State Sales Tax (7.9%):	$7,446
				Total Construction Cost (rounded):	$102,000
				Contingency (25%):	$25,500
				Total Estimated Construction Cost:	**$127,500**
				Admin. Fiscal, Legal and Engineering (25%):	$31,875
				Total Estimated Project Cost (rounded):	**$160,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", N. 6TH ST. FROM B ST. TO WASHINGTON ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$10,000	$10,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	110	CY	$25	$2,750
4	PVC Pipe for Water Main, 8-In. Dia.	800	LF	$42	$33,600
5	8-Inch Gate Valve and Valve Box	2	EA	$1,200	$2,400
6	Hydrant Assembly	2	EA	$4,000	$8,000
7	Concrete Encasement	4	EA	$150	$600
8	Water Main Fittings	1	LS	$7,000	$7,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	8	EA	$400	$3,200
11	Asphalt Concrete Pavement Repair, Class B	530	SY	$50	$26,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$5,000	$5,000
				Subtotal:	$107,100
				Washington State Sales Tax (7.9%):	$8,461
				Total Construction Cost (rounded):	$116,000
				Contingency (25%):	$29,000
				Total Estimated Construction Cost:	**$145,000**
				Admin. Fiscal, Legal and Engineering (25%):	$36,250
				Total Estimated Project Cost (rounded):	**$190,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", IN ALLEY NORTH OF MAPLE ST. FROM 6TH ST. TO MAIN ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$12,000	$12,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	160	CY	$25	$4,000
4	PVC Pipe for Water Main, 8-In. Dia.	1,200	LF	$42	$50,400
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	6	EA	$150	$900
8	Water Main Fittings	1	LS	$10,000	$10,000
9	Connection to Existing System	3	EA	$2,500	$7,500
10	Reconnect Existing Side Services	16	EA	$400	$6,400
11	Asphalt Concrete Pavement Repair, Class B	70	SY	$50	$3,500
12	Gravel Repair	740	SY	$15	$11,100
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$6,000	$6,000
				Subtotal:	$129,400
				Washington State Sales Tax (7.9%):	$10,223
				Total Construction Cost (rounded):	$140,000
				Contingency (25%):	$35,000
				Total Estimated Construction Cost:	**$175,000**
				Admin. Fiscal, Legal and Engineering (25%):	$43,750
				Total Estimated Project Cost (rounded):	**$220,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", PINE ST. FROM MAIN ST. TO 2ND ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$17,000	$17,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	3	EA	$2,500	$7,500
10	Reconnect Existing Side Services	26	EA	$400	$10,400
11	Asphalt Concrete Pavement Repair, Class B	930	SY	$50	$46,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$8,000	$8,000
				Subtotal:	$184,650
				Washington State Sales Tax (7.9%):	$14,587
				Total Construction Cost (rounded):	$199,000
				Contingency (25%):	$49,750
				Total Estimated Construction Cost:	**$248,750**
				Admin. Fiscal, Legal and Engineering (25%):	$62,188
				Total Estimated Project Cost (rounded):	**$320,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", IN ALLEY EAST OF 2ND AVE. FROM WASHINGTON ST. TO MONROE ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$14,000	$14,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	36	EA	$400	$14,400
11	Asphalt Concrete Pavement Repair, Class B	70	SY	$50	$3,500
12	Gravel Repair	870	SY	$15	$13,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$151,150
				Washington State Sales Tax (7.9%):	$11,941
				Total Construction Cost (rounded):	$163,000
				Contingency (25%):	$40,750
				Total Estimated Construction Cost:	**$203,750**
				Admin. Fiscal, Legal and Engineering (25%):	$50,938
				Total Estimated Project Cost (rounded):	**$260,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", IN ALLEY EAST OF 4TH AVE. FROM WASHINGTON ST. TO MONROE ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$14,000	$14,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	36	EA	$400	$14,400
11	Asphalt Concrete Pavement Repair, Class B	70	SY	$50	$3,500
12	Gravel Repair	870	SY	$15	$13,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$151,150
				Washington State Sales Tax (7.9%):	$11,941
				Total Construction Cost (rounded):	$163,000
				Contingency (25%):	$40,750
				Total Estimated Construction Cost:	**$203,750**
				Admin. Fiscal, Legal and Engineering (25%):	$50,938
				Total Estimated Project Cost (rounded):	**$260,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", IN ALLEY EAST OF 6TH AVE. FROM WASHINGTON ST. TO MONROE ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$14,000	$14,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	190	CY	$25	$4,750
4	PVC Pipe for Water Main, 8-In. Dia.	1,400	LF	$42	$58,800
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$12,000	$12,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	36	EA	$400	$14,400
11	Asphalt Concrete Pavement Repair, Class B	70	SY	$50	$3,500
12	Gravel Repair	870	SY	$15	$13,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$151,150
				Washington State Sales Tax (7.9%):	$11,941
				Total Construction Cost (rounded):	$163,000
				Contingency (25%):	$40,750
				Total Estimated Construction Cost:	**$203,750**
				Admin. Fiscal, Legal and Engineering (25%):	$50,938
				Total Estimated Project Cost (rounded):	**$260,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", C ST. FROM 6TH AVE. TO MAIN ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$12,000	$12,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	130	CY	$25	$3,250
4	PVC Pipe for Water Main, 8-In. Dia.	1,000	LF	$42	$42,000
5	8-Inch Gate Valve and Valve Box	2	EA	$1,200	$2,400
6	Hydrant Assembly	2	EA	$4,000	$8,000
7	Concrete Encasement	5	EA	$150	$750
8	Water Main Fittings	1	LS	$8,000	$8,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	10	EA	$400	$4,000
11	Asphalt Concrete Pavement Repair, Class B	670	SY	$50	$33,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$5,000	$5,000
				Subtotal:	$126,950
				Washington State Sales Tax (7.9%):	$10,029
				Total Construction Cost (rounded):	$137,000
				Contingency (25%):	$34,250
				Total Estimated Construction Cost:	**$171,250**
				Admin. Fiscal, Legal and Engineering (25%):	$42,813
				Total Estimated Project Cost (rounded):	**$220,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", B ST. FROM ALLISON ST. TO BOUNDARY RD.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$24,000	$24,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	280	CY	$25	$7,000
4	PVC Pipe for Water Main, 8-In. Dia.	2,100	LF	$42	$88,200
5	8-Inch Gate Valve and Valve Box	5	EA	$1,200	$6,000
6	Hydrant Assembly	5	EA	$4,000	$20,000
7	Concrete Encasement	11	EA	$150	$1,650
8	Water Main Fittings	1	LS	$18,000	$18,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	22	EA	$400	$8,800
11	Asphalt Concrete Pavement Repair, Class B	1,400	SY	$50	$70,000
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$11,000	$11,000
				Subtotal:	$262,700
				Washington State Sales Tax (7.9%):	$20,753
				Total Construction Cost (rounded):	$283,000
				Contingency (25%):	$70,750
				Total Estimated Construction Cost:	**$353,750**
				Admin. Fiscal, Legal and Engineering (25%):	$88,438
				Total Estimated Project Cost (rounded):	**$450,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", NORTH ST. FROM 6th AVE. TO BOUNDARY RD.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$20,000	$20,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	240	CY	$25	$6,000
4	PVC Pipe for Water Main, 8-In. Dia.	1,800	LF	$42	$75,600
5	8-Inch Gate Valve and Valve Box	4	EA	$1,200	$4,800
6	Hydrant Assembly	4	EA	$4,000	$16,000
7	Concrete Encasement	9	EA	$150	$1,350
8	Water Main Fittings	1	LS	$15,000	$15,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	12	EA	$400	$4,800
11	Asphalt Concrete Pavement Repair, Class B	1,000	SY	$50	$50,000
12	Gravel Repair	200	SY	$15	$3,000
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$9,000	$9,000
				Subtotal:	$212,550
				Washington State Sales Tax (7.9%):	$16,791
				Total Construction Cost (rounded):	$229,000
				Contingency (25%):	$57,250
				Total Estimated Construction Cost:	**$286,250**
				Admin. Fiscal, Legal and Engineering (25%):	$71,563
				Total Estimated Project Cost (rounded):	**$360,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", FERN ST. FROM MAIN ST. TO BOUNDARY RD.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$16,000	$16,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	170	CY	$25	$4,250
4	PVC Pipe for Water Main, 8-In. Dia.	1,300	LF	$42	$54,600
5	8-Inch Gate Valve and Valve Box	3	EA	$1,200	$3,600
6	Hydrant Assembly	3	EA	$4,000	$12,000
7	Concrete Encasement	7	EA	$150	$1,050
8	Water Main Fittings	1	LS	$11,000	$11,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	24	EA	$400	$9,600
11	Asphalt Concrete Pavement Repair, Class B	870	SY	$50	$43,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$7,000	$7,000
				Subtotal:	$170,650
				Washington State Sales Tax (7.9%):	$13,481
				Total Construction Cost (rounded):	$184,000
				Contingency (25%):	$46,000
				Total Estimated Construction Cost:	**$230,000**
				Admin. Fiscal, Legal and Engineering (25%):	$57,500
				Total Estimated Project Cost (rounded):	**$290,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", ROSE ST. FROM 6TH AVE. TO MAIN ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$12,000	$12,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	130	CY	$25	$3,250
4	PVC Pipe for Water Main, 8-In. Dia.	1,000	LF	$42	$42,000
5	8-Inch Gate Valve and Valve Box	2	EA	$1,200	$2,400
6	Hydrant Assembly	2	EA	$4,000	$8,000
7	Concrete Encasement	5	EA	$150	$750
8	Water Main Fittings	1	LS	$8,000	$8,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	18	EA	$400	$7,200
11	Asphalt Concrete Pavement Repair, Class B	670	SY	$50	$33,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$6,000	$6,000
				Subtotal:	$131,150
				Washington State Sales Tax (7.9%):	$10,361
				Total Construction Cost (rounded):	$142,000
				Contingency (25%):	$35,500
				Total Estimated Construction Cost:	**$177,500**
				Admin. Fiscal, Legal and Engineering (25%):	$44,375
				Total Estimated Project Cost (rounded):	**$230,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", CEDAR ST. FROM 6TH AVE. TO 2ND ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$23,000	$23,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	250	CY	$25	$6,250
4	PVC Pipe for Water Main, 8-In. Dia.	1,900	LF	$42	$79,800
5	8-Inch Gate Valve and Valve Box	4	EA	$1,200	$4,800
6	Hydrant Assembly	4	EA	$4,000	$16,000
7	Concrete Encasement	10	EA	$150	$1,500
8	Water Main Fittings	1	LS	$16,000	$16,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	40	EA	$400	$16,000
11	Asphalt Concrete Pavement Repair, Class B	1,270	SY	$50	$63,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$11,000	$11,000
				Subtotal:	$245,900
				Washington State Sales Tax (7.9%):	$19,426
				Total Construction Cost (rounded):	$265,000
				Contingency (25%):	$66,250
				Total Estimated Construction Cost:	**$331,250**
				Admin. Fiscal, Legal and Engineering (25%):	$82,813
				Total Estimated Project Cost (rounded):	**$420,000**

CITY OF MABTON
ENGINEER'S ESTIMATE
(ENR NATIONAL CONSTRUCTION COST INDEX: 9437, JANUARY 2013)

WATER MAIN, 8", 5TH ST. FROM MAPLE ST. TO CEDAR ST.

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization & Demobilization	1	LS	$9,000	$9,000
2	Trench Excavation Safety Systems	1	LS	$1,000	$1,000
3	Bank Run Gravel for Trench Backfill	100	CY	$25	$2,500
4	PVC Pipe for Water Main, 8-In. Dia.	700	LF	$42	$29,400
5	8-Inch Gate Valve and Valve Box	2	EA	$1,200	$2,400
6	Hydrant Assembly	2	EA	$4,000	$8,000
7	Concrete Encasement	4	EA	$150	$600
8	Water Main Fittings	1	LS	$6,000	$6,000
9	Connection to Existing System	2	EA	$2,500	$5,000
10	Reconnect Existing Side Services	8	EA	$400	$3,200
11	Asphalt Concrete Pavement Repair, Class B	470	SY	$50	$23,500
12	Gravel Repair	70	SY	$15	$1,050
13	Temporary Water Pollution/Erosion Control	1	LS	$1,000	$1,000
14	Project Temporary Traffic Control	1	LS	$4,000	$4,000
				Subtotal:	$96,650
				Washington State Sales Tax (7.9%):	$7,635
				Total Construction Cost (rounded):	$104,000
				Contingency (25%):	$26,000
				Total Estimated Construction Cost:	**$130,000**
				Admin. Fiscal, Legal and Engineering (25%):	$32,500
				Total Estimated Project Cost (rounded):	**$170,000**

APPENDIX P

WATER AND SEWER CODE

Title 13

PUBLIC SERVICES*

Chapters:

13.04 Water and Sewers
13.05 Cross-Connection Control

Chapter 13.04

WATER AND SEWERS

Sections:

I. GENERAL PROVISIONS

13.04.010 Definitions.
13.04.020 Administration.
13.04.030 Application for water and sewer service.

II. WATER SERVICE

13.04.040 Installation--Required.
13.04.050 Installation--Pipes.
13.04.060 Installation--Depth of connections.
13.04.070 Installation--Freezing precautions.
13.04.080 Installation--Valves.
13.04.090 Water meter--Access.
13.04.100 Water meter--Failure charge.
13.04.110 Service--Commencement.
13.04.120 Service--Changes.
13.04.130 Ownership of equipment.
13.04.140 Responsibility for leaks.
13.04.150 Shutoff.
13.04.160 Disconnection and reconnection.
13.04.170 Use limitation.
13.04.180 Wastage.

III. SEWER SERVICE

13.04.190 Connection required.
13.04.200 Permit--Required.

* Editor's Note: Current water and sewer charges are on file in the clerk-treasurer's office.

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13.04.210 Permit--Classes--Application--Fee.
13.04.220 Separate connection required when.
13.04.230 Excavations.
13.04.240 Use of old sewers.
13.04.250 Construction specifications.
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13.04.270 Connection--Restrictions.
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13.04.320 Discharges--Prohibited to sanitary sewer when.
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13.04.520 Sewer--Service charge--Commercial users.
13.04.530 Sewer--Service charge--Applicability.
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13.04.550 Delinquency.

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13.04.590 Interference with system--Notice required.

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13.04.600 Interference with system--Prohibited when.
13.04.610 Right of entry for inspection.
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13.04.690 Accounts--Billing.
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I. GENERAL PROVISIONS

13.04.010 Definitions.

As used in this chapter, the following definitions shall apply:

"Commercial sewer user" means any user of the city sewer system which is not a residential unit or vegetation nursery.

"Consumer" means the person or business concern using the service.

"Property owner" means the person owning the real property according to the records of the county treasurer and/or having responsibility for payment of taxes thereon.

"Sewer service" means the activities described in this chapter incident to the removal and disposal of sewage and waste fluids from buildings on real property and that constitute the sanitary sewerage system of the city.

"Water service" means the activities described in this chapter incident to the supplying of domestic water to the consumers and/or real property. (Ord. 891 § 1, 2008; Ord. 507 § 1, 1978; Ord. 489 § 1, 1977: Ord. 475-4B § 1, 1976)

13.04.020 Administration.

The mayor shall appoint some competent person who shall act as water and sewer superintendent for the city and shall supervise the operation of said utilities. (Ord. 475-B § 42, 1976)

13.04.030 Application for water and sewer service.

A. All property within the city limits of the city shall be required to apply for and use the domestic water and/or sewer provided for in this chapter.

B. All applications for water and/or sewer service shall be made to the city clerk by the property owner or his agent on forms supplied by the clerk. (Ord. 475-B § 2, 1976)

II. WATER SERVICE

13.04.040 Installation - - Required. A. A separate meter and service connection shall be installed to serve each single-family dwelling unit supplied with water service; provided, multiple dwellings (including duplexes and apartment houses), mobile home parks, co-ops, condomiums and similar dwelling unit complexes, under single or common ownership or management, may be served by either a single meter and service connection or multiple meters and service connections at the option of the owner or manager thereof, regardless of whether the dwelling units therein are individual consumers for the purpose of computing water service charges as provided in this chapter.

B. In the event of the sale of other transfer of title of any one-family dwelling unit constituting a portion of a multiple dwelling, mobile home park, co-op, condominium, or other similar dwelling unit complex so that such sold or otherwise transferred dwelling unit is separately owned, a separate meter and service connection shall be installed to serve each such separately owned dwelling unit.

C. In the event a separate meter and service connection is required by this section, the town may discontinue water service to the meter that supplies water to the premises required to be separately served. Said discontinuance of service shall continue until such time as a separate meter and service connection is installed pursuant to this chapter. (Ord. 475-B Sec. 3, 1976).

13.04.050 Installation - - Pipes. The installation of water service pipes extending from the main to the water meter box line, together with the necessary labor and materials for such construction, shall be made by the water department. (Ord. 475-B Sec. 24, 1976).

13.04.060 Installation - - Depth of connections. All pipes leading to or from the town water meter shall be laid not less than thirty-six inches below ground level. (Ord. 475-B Sec. 7, 1976).

13.04.070 Installation - - Freezing precautions. All service and household installations shall be placed at such a depth as to avoid all probability of freezing. The water department shall not be responsible for any services frozen between the water meter and the premises to be served and the owner shall pay the cost of thawing wherever the same is necessary. (Ord. 475-B Sec. 32, 1976).

13.04.080 Installation - - Valves. The water department shall have the right to order the installation of check valves, pressure relief valves and/or other approved backflow prevention devices, on services where this is deemed necessary to protect the city's water from the water, or in cases where contaminated or stagnant water may back into the city's water mains. The number, location and type of check valves or pressure relief valve, or both, to be used shall be fixed and approved by the water department. The water department shall discontinue water service to the premises if the installation of such valve or backflow prevention device has not been completed within ten days after written notice has been served. (Ord. 475-B, Sec. 27, 1976).

similar dwelling unit complexes, under single or common ownership or management, may be served by either a single meter and service connection or multiple meters and service connections at the option of the owner or manager thereof, regardless of whether the dwelling units therein are individual consumers for the purpose of computing water service charges as provided in this chapter.

B. In the event of the sale of other transfer of title of any one-family dwelling unit constituting a portion of a multiple dwelling, mobile home park, co-op, condominium, or other similar dwelling unit complex so that such sold or otherwise transferred dwelling unit is separately owned, a separate meter and service connection shall be installed to serve each such separately owned dwelling unit.

C. In the event a separate meter and service connection is required by this section, the town may discontinue water service to the meter that supplies water to the premises required to be separately served. Said discontinuance of service shall continue until such time as a separate meter and service connection is installed pursuant to this chapter. (Ord. 475-B §3, 1976).

13.04.050 Installation--Pipes. The installation of water service pipes extending from the main to the water meter box line, together with the necessary labor and materials for such construction, shall be made by the water department. (Ord. 475-B §24, 1976).

13.04.060 Installation--Depth of connections. All pipes leading to or from the town water meter shall be laid not less than thirty-six inches below ground level. (Ord. 475-B §7, 1976).

13.04.070 Installation--Freezing precautions. All service and household installations shall be placed at such a depth as to avoid all probability of freezing. The water department shall not be responsible for any services frozen between the water meter and the premises to be served and the owner shall pay the cost of thawing wherever the same is necessary. (Ord. 475-B §32, 1976).

13.04.080 Installation--Valves. The water department shall have the right to order the installation of check valves, pressure relief valves and/or other approved back-flow prevention devices, on services where this is deemed necessary to protect the city's water from the water, or in cases where contaminated or stagnant water may back into the city's water mains. The number, location and type of check valves or pressure relief valve, or both, to be used shall be fixed and approved by the water department. The water department shall discontinue water service to the

premises if the installation of such valve or backflow prevention device has not been completed within ten days after written notice has been served. (Ord. 475-B §27, 1976).

13.04.090 Water meter--Access. Authorized town employees shall have free access to stopcocks and water meters and no other person shall alter, operate or remove meters or stopcocks. Any person violating the provisions of this section shall be subject to a minimum fine of fifty dollars, which shall not be suspended. (Ord. 475-B §9, 1976).*

13.04.100 Water meter--Failure. In the event of meter failure, the consumer or property owner shall be charged the minimum charge until the meter is repaired. (Ord. 475-B §11, 1976).

13.04.110 Service--Commencement. After the applicant has complied with all the prescribed requirements relating to the application for service connection and has paid all charges, the water department shall cause the property described to be connected with the municipal water system. Where practicable the service connection shall be made in the street in front of the property to be served. Each service shall consist of a tap and connection to the main pipe, a length of service pipe extending to the property line and a curb cock and water meter installed, together with the necessary fittings and meter box for same. The water department shall have the right to install a single service pipe from the main to the property line of sufficient size to supply two separate properties, connecting two branches leading to the right and left with individual curb cocks for the separate properties. (Ord. 475-B §25, 1976).

13.04.120 Service--Changes. Any change made in a water or sewer service installation at the request of the property owner or water user, after such installation has been made, shall be made solely at the expense of the applicant who shall pay the entire cost thereof. (Ord. 475-B §26, 1976).

13.04.130 Ownership of equipment. The ownership of all main extensions, service pipes and appurtenant equipment maintained by the water and sewer departments shall be vested in the town, and in no case shall the owner of any premises have the right to claim or reclaim any part thereof. (Ord. 475-B §29, 1976).

*Editor's Note: There are two sections numbered 9 in Ordinance 475-B.

13.04.140 Responsibility for leaks. Owners of services are responsible for all leaks or damage on account of leaks from the service pipes leading from the city's water meter to the premises served. (Ord. 475-B §28, 1976).

13.04.150 Shutoff. The water may, at any time, be shut off from the mains without notice for repairs, extensions or other necessary purposes. Persons having boilers supplied by direct pressure from the mains are cautioned against danger of explosion or collapse and where meters are in use on such service, a safety valve shall be placed between the boiler and the meter at the property owner's expense and the property owner shall be responsible for all damage caused to the meter by hot water. The town shall not be responsible for the failure to supply water. The town shall make a reasonable effort to notify the consumer or property owner when the water is to be shut off for repair. (Ord. 475-B §9, 1976).*

13.04.160 Disconnection and reconnection. At the request of the property owner, water service may be disconnected at a charge of five dollars. (Ord. 475-B §19, 1976).

13.04.170 Use limitation. The town may through its administrative officials regulate the use of water and may limit the use of water in the event of shortage. The town shall not be responsible for any damages caused to property, property owners or consumers by reason of decreased water supply. (Ord. 475-B §10, 1976).

13.04.180 Wastage. It is unlawful for any person to waste water or allow it to be wasted by imperfect or leaking stops, valves, pipes, closets, faucets or other fixtures, or to use water closets without self-closing valves, or to use it in violation of the town's ordinances regulating said use of water. The wilful wasting of water shall be a misdemeanor, punishable under the provisions of Section 13.04-.650. If such waste of water continues after notice from the water department to make repairs and to desist from the waste of water, the water department shall shut off the supply of water from such premises until the necessary repairs have been made and a five dollar fee for shutting off and turning on the service shall be made, said fees to be paid prior to resumption of service. (Ord. 475-B §31, 1976).

III. SEWER SERVICE

13.04.190 Connection required. The owner of a lot or parcel of real property within two hundred feet of the

*Editor's Note: There are two sections numbered 9 in Ordinance 475-B.

sanitary sewerage system of the town, as it now exists and as it may be improved and extended in the future, upon which there shall be situated any building for human occupation, or for use for any other purpose which shall require sewer service, shall cause a connection to be made between each of said buildings or structures and said sewerage system; provided, that where more than one such building is located on a lot and all such buildings may be served by one sewer connection, only one connection for such building need be made. (Ord. 489 §4(part), 1977: Ord. 475-B §37(A), 1976).

13.04.200 Permit--Required. No unauthorized person shall uncover, make any connection with or opening into, use, alter or disturb any public sewer or appurtenance thereof without first obtaining a written permit from the water and sewer superintendent. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.210 Permit--Classes--Application--Fee. There shall be two classes of building sewer permits:

A. For residential and commercial service; and

B. For service to establishments producing industrial wastes.

In either case, the owner or his agent shall make application on a special form furnished by the town. The permit application shall be supplemented by any plans, specifications or other information considered pertinent in the judgment of the water and sewer superintendent. A permit and inspection fee of twenty-five dollars for a residential or commercial building sewer permit and twenty-five dollars for an industrial building sewer permit shall be paid to the town at the time the application is filed. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.220 Separate connection required when. A separate and independent building sewer shall be provided for every building; except, where one building stands at the rear of another on an interior lot and no private sewer is available or can be constructed to the rear building through an adjoining alley, court, yard or driveway, the building sewer from the front building may be extended to the rear building and the whole considered as one building sewer. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.230 Excavations. All excavations for building sewer installation shall be adequately guarded with barricades and lights so as to protect the public from hazard. Streets, sidewalks, parkways, and other public property disturbed in the course of the work shall be restored in a manner satisfactory to the town. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.240 Use of old sewers. Old building sewers may be used in connection with new buildings only when they are found, on examination and test by the water and sewer superintendent, to meet all requirements of this chapter. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.250 Construction specifications. The size, slope, alignment, materials of construction of a building sewer, and the methods to be used in excavating, placing of the pipe, jointing, testing and backfilling the trench, shall all conform to the requirements of the building and plumbing code or other applicable rules and regulations of the town. In the absence of code provisions or in amplification thereof, the materials and procedures set forth in appropriate specifications of the A.S.T.M. and the W.P.C.F. Manual of Practice No. 9 shall apply. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.260 Elevation. Whenever possible, the building sewer shall be brought to the building at an elevation below the basement floor. In all buildings in which any building drain is too low to permit gravity flow to the public sewer, sanitary sewage carried by such building drain shall be lifted by an approved means and discharged to the building sewer. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.270 Connection--Restrictions. No person shall make connection of roof downspouts, exterior foundation drains, areaway drains, or other sources of surface runoff or groundwater to a building sewer or building drain which in turn is connected directly to a public sanitary sewer. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.280 Connection--Specifications. The connection of the building sewer into the public sewer shall conform to the requirements of the building and plumbing code or other applicable rules and regulations of the town, or the procedures set forth in appropriate specifications of the A.S.T.M. and the W.P.C.F. Manual of Practice No. 9. All such connections shall be made gastight and watertight. Any deviation from the prescribed procedures and materials must be approved by the water and sewer superintendent or his representative. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.290 Connection--Compliance with Uniform Plumbing Code. All connections shall be made to said sewerage system in a permanent and sanitary manner, in accordance with the specifications as set by the Unifrom Plumbing Code as now written or as hereafter amended. All connections shall be

made before any use or occupation of any building not now used or occupied shall be made. (Ord. 489 §§3, 4(part), 1977: Ord. 475-B §37(B), 1976).

13.04.300 Connection--Completion by town. If any such connection is not made within the time provided, the water and sewer superintendent of the town, or such other employee of the town as the council may hereafter designate, is authorized to direct to cause the same to be made and to file a statement of the cost thereof with the town clerk-treasurer, and whereupon such amount together with a penalty of twenty percent thereof plus interest at the rate of eight percent per year upon the total amount of such cost and penalty, shall be assessed against the property upon which said building or structure is situated, and shall become a lien thereon as provided in this chapter. (Ord. 489 §4(part), 1977: Ord. 475-B §37(C), 1976).

13.04.310 Costs--Indemnification. All costs and expenses incident to the installation and connection of the building sewer shall be borne by the owner. The owner shall indemnify the town from any loss or damage that may directly or indirectly be occasioned by the installation of the building sewer. (Ord. 489 §4(part), 1977: Ord. 475-B §37 (D)(part), 1976).

13.04.320 Discharges--Prohibited to sanitary sewer when. No person shall discharge or cause to be discharged any stormwater, surface water, groundwater, roof runoff, subsurface drainage, uncontaminated cooling water, or unpolluted industrial process waters to any sanitary sewer. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.330 Discharges--Unpolluted drainage. Stormwater and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as combined sewers or storm sewers, or to a natural outlet approved by the water and sewer superintendent. Industrial cooling water or unpolluted process waters may be discharged, on approval of the water and sewer superintendent, to a storm sewer, combined sewer or natural outlet. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.340 Discharges--Prohibited. No person shall discharge or cause to be discharged any of the following described waters or wastes to any public sewers:

A. Any gasoline, benzene, naphtha, fuel oil, or other flammable or explosive liquid, solid or gas;

B. Any waters or wastes containing toxic or poisonous solids, liquids or gases in sufficient quantity, either singly or by interaction with other wastes to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, create a public nuisance, or create any hazard in the receiving waters of the sewage treatment plant, including but not limited to cyanides in excess of two mg/l as CN in the wastes as discharged to the public sewer;

C. Any waters or wastes having a pH lower than 5.5, or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works;

D. Solid or viscous substances in quantities or of such size capable of causing obstruction to the flow in sewers, or other interference with the proper operation of the sewage works such as, but not limited to, ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, unground garbage, whole blood, paunch manure, hair and fleshings, entrails and paper dishes, cups, milk containers, etc., either whole or ground by garbage grinders. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.350 Discharges--Designated as harmful. No person shall discharge or cause to be discharged the following described substances, materials, waters or wastes if it appears likely in the opinion of the water and sewer superintendent that such wastes can harm either the sewers, sewage treatment process, or equipment, have an adverse effect on the receiving stream or can otherwise endanger life, limb, public property, or constitute a nuisance. In forming his opinion as to the acceptability of these wastes, the water and sewer superintendent will give consideration to such factors as to quantities of subject wastes in relation to flows and velocities in the sewers, materials of construction of the sewers, nature of the sewage treatment process, capacity of the sewage treatment plant, degree of treatability of wastes in the sewage treatment plant, and other pertinent factors. The substances prohibited are:

A. Any liquid or vapor having a temperature higher than one hundred fifty degrees Fahrenheit (sixty-five degrees Celsius);

B. Any water or waste containing fats, gas, grease or oils, whether emulsified or not, in excess of one hundred mg/l or containing substances which may solidify or become viscous at temperatures between thirty-two and one hundred fifty degrees Fahrenheit (zero and sixty-five degrees Celsius);

C. Any garbage that has not been properly shredded. The installation and operation of any garbage grinder equipped with a motor of three-fourths horsepower (0.76 hp metric) or greater shall be subject to the review and approval of the water and sewer superintendent;

D. Any waters or wastes containing strong acid iron pickling wastes, or concentrated plating solutions whether neutralized or not;

E. Any waters or wastes containing iron, chromium, copper, zinc and similar objectionable or toxic substances; or wastes exerting an excessive chlorine requirement, to such degree that any such material received in the composite sewage at the sewage treatment works exceeds the limits established by the water and sewer superintendent for such materials;

F. Any waters or wastes containing phenols or other taste-producing or odor-producing substances, in such concentrations exceeding limits which may be established by the water and sewer superintendent as necessary, after treatment of the composite sewage, to meet the requirements of the state, federal, or other public agencies of jurisdiction for such discharge to the receiving waters;

G. Any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by the water and sewer superintendent in compliance with applicable state or federal regulations;

H. Any waters or wastes having a pH in excess of 9.5;

I. Materials which exert or cause:

1. Unusual concentration of inert suspended solids (such as, but not limited to, fuller's earth, lime slurries, and lime residues) or of dissolved solids (such as, but not limited to, sodium chloride and sodium sulfate),

2. Excessive discoloration (such as, but not limited to, dye wastes and vegetable tanning solutions),

3. Unusual BOD, chemical oxygen demand, or chlorine requirements in such quantities as to constitute a significant load on the sewage treatment works,

4. Unusual volume of flow or concentration of wastes constituting "slugs" as defined in this chapter;

J. Waters or wastes containing substances which are not amenable to treatment or reduction by the sewage treatment processes employed, or are amenable to treatment only to such a degree that the sewage treatment plant effluent cannot meet the requirements of other agencies having jurisdiction over discharge to the receiving waters. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.360 Discharges--Superintendent's powers. If any waters or wastes are discharges, or are proposed to be discharged to the public sewers, which waters contain the substances or possess the characteristics enumerated in this article, and which in the judgment of the water and sewer

superintendent may have a deleterious effect upon the sewage works, processes, equipment or receiving waters, or which otherwise create a hazard to life or constitute a public nuisance, the water and sewer superintendent may:

A. Reject the wastes;

B. Require a pretreatment to an acceptable condition for discharge to the public sewers;

C. Require control over the quantities and rates of discharge; and/or

D. Require payment to cover the added cost of handling and treating the wastes not covered by existing taxes or sewer charges under the provisions of this chapter. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.370 Discharges--Special agreements. No statement contained in this article shall be construed as preventing any special agreement or arrangement between the town and any industrial concern whereby an industrial waste of unusual strength or character may be accepted by the town for treatment, subject to payment therefor, by the industrial concern. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.380 Grease, oil and sand interceptors. Grease, oil and sand interceptors shall be provided when, in the opinion of the water and sewer superintendent, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, or any flammable wastes, sand, or other harmful ingredients; except, that such interceptors shall not be required for private living quarters or dwelling units. All interceptors shall be of a type and capacity approved by the water and sewer superintendent, and shall be located as to be readily and easily accessible for cleaning and inspection. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.390 Pretreatment facilities--Installation. If the water and sewer superintendent permits the pretreatment or equalization of waste flows, the design and installation of the plants and equipment shall be subject to the review and approval of the water and sewer superintendent, and subject to the requirements of all applicable codes, ordinances and laws. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.400 Pretreatment facilities--Maintenance. Where preliminary treatment or flow-equalizing facilities are provided for any waters or wastes, they shall be maintained continuously in satisfactory and effective operation by the owner at his expense. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976).

13.04.410 Control manhole. When required by the water and sewer superintendent, the owner of any property serviced by a building sewer carrying industrial wastes shall install a suitable control manhole together with such necessary meters and other appurtenances in the building sewer to facilitate observation, sampling and measurement of the wastes. Such manhole, when required, shall be accessibly and safely located, and shall be constructed in accordance with plans approved by the water and sewer superintendent. The manhole shall be installed by the owner at his expense, and shall be maintained by him so as to be safe and accessible at all times. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976)

13.04.420 Measurements, tests and analyses. All measurements, tests and analyses of the characteristics of waters and wastes to which reference is made in this chapter shall be determined in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater," published by the American Public Health Association, and shall be determined at the control manhole provided, or upon suitable samples taken at said control manhole. In the event that no special manhole has been required, the control manhole shall be considered to be nearest downstream manhole in the public sewer to the point at which the building sewer is connected. Sampling shall be carried out by customarily accepted methods to reflect the effect of constituents upon the sewage works and to determine the existence of hazards to life, limb and property. The particular analyses involved will determine whether a twenty-four-hour composite of all outfalls of a premises is appropriate or whether a grab sample or samples should be taken. Normally, but not always, BOD and suspended solids analyses are obtained from twenty-four-hour composites of all outfalls whereas pH is determined from periodic grab samples. (Ord. 489 §4(part), 1977: Ord. 475-B §37(D)(part), 1976)

IV. RATES AND CHARGES

13.04.430 Water--Connection and meter installation. A. Water meters shall be owned by the city. Prior to the installation of the initial water meter the clerk shall collect an installation charge as set forth below. Subsequent repairs or replacements of water meters due to failure or wear shall be the responsibility of the city.

Size of Meter	Water Service Installation Charge
3/4 inch meter	
1 inch meter	

1 1/4 inch meter	Cost of labor and material plus ten percent
1 1/2 inch meter	
2 inch meter	

B. Installation of meters larger than specified shall be upon the payment of costs and materials and labor for installation as determined by the clerk-treasurer.

C. The property owner shall bear all expense for construction of water service from water mains to building outlets.

D. Commencing with the billing year January, 1999, a water system connection fee of two hundred dollars shall be added to the basic cost of labor and material plus ten percent. Commencing with the bill year January, 2000, this fee shall increase to three hundred dollars. (Ord. 807 §1, 1998: Ord. 475-B §12, 1976)

13.04.440 Water--More than one premises supplied through one meter.

Where more than one individual consumer is supplied with water through one meter, the bill shall be computed as though there were a separate metered service for each individual consumer and each used an equal quantity of water consumed. There shall be no deductions for vacant premises unless service for that premises has been previously disconnected pursuant to Section 13.04.480. For purposes of this section, each one-family dwelling unit and each dwelling unit in a two-family dwelling or in a multiple dwelling shall constitute one individual consumer. Further, for purposes of this section, each separate mobile home site within a mobile home court, park, or other mobile home complex shall constitute one individual consumer; provided, an automobile trailer court, rather than each separate trailer site therein, shall constitute an individual consumer for purposes of this section. For purposes of this section, each dwelling unit existing on a labor camp shall constitute one individual consumer and shall be charged no less than the minimum charge for each unit. (Ord. 475-B §4, 1976)

13.04.450 Water--Service rates.

A. Water rates within the corporate city limits of Mabton shall be as follows:

Meter Size	Consumption	Minimum	Overage per 134 c.f.
3/4" or smaller	First 536 c.f.	$23.35/$15.35 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
1"	First 536 c.f.	$24.59/$16.59 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
1 1/4" to 1 1/2"	First 536 c.f.	$31.11/$23.11 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
2"	First 938 c.f.	$33.21/$25.21 Senior Rate	
	Next 4,020 c.f.		$.98
	Over 4,958 c.f.		$1.08
3"	First 938 c.f.	$56.29/$48.29 Senior Rate	
	Next 4,020 c.f.		$.98
	Over 4,958 c.f.		$1.08
4"	First 938 c.f.	$96.26/$88.26 Senior Rate	
	Next 4,020 c.f.		$.98
	Over 4,958 c.f.		$1.08

Meter Size	Consumption	Minimum	Overage per 134 c.f.
6"	First 938 c.f.	$189.51/ $181.51 Senior Rate	
	Next 4,020 c.f.		$.98
	Over 4,958 c.f.		$1.08

B. Outside the corporate limits: one hundred fifty percent of the rate within corporate limits;

C. Bulk water consumers shall be served at the convenience of the city and shall pay the sum of two dollars and fifty cents per one thousand gallon units with no proration for fractions thereof;

D. Commencing with the billing year January, 2009, a water system connection fee of five hundred dollars shall be charged for a water connection. This fee may be amended by resolution of the city council from time to time, and, upon passage, shall be on file at the office of the city clerk. (Ord. 870 §2, 2005; Ord. 849 §2, 2002; Ord. 840 §2, 2001; Ord. 835 §2, 2000; Ord. 809 §1, 1998; Ord. 704 §2, 1990; Ord. 686 §2, 1988; Ord. 669 §2, 1986; Ord. 654 §2, 1986; Ord. 642 §2, 1984; Ord. 475-B §23, 1976)
(Ord. No. 895, § 1, 12-30-2008; Ord. NO. 942, §§ 1, 2, 9-28-2010; Ord. No. 945, §§ 1, 2, 11-23-2010)

13.04.460 Water--Charges for public customers.

The city or Yakima County Fire Protection District No. 5 shall pay to the water department from its current expense fund the following amounts:

A. For all fire hydrants connected to the water mains, one hundred dollars per year;

B. For street sprinkling and flushing, per one hundred to one thousand gallon tank, two dollars;

C. For one thousand to two thousand five hundred gallon tank, four dollars;

D. For all water used in public buildings and parks, an amount figured at regular rates for each service installed. (Ord. 475-B §34, 1976)

13.04.470 Water--Building construction charge.

During the construction of a building or buildings following application for water use, the minimum charge shall be charged to the property owner for periods prior to occupancy. "Occupancy" shall include any use or occupancy of the property or building during any metered month. (Ord. 475-B §21, 1976)

13.04.480 Water--Unoccupied building or unit.

Even though property served may be unoccupied for more than one metered month, a minimum charge shall be owing unless a request from the property owner or consumer for disconnection together with the fee therefor has been received prior to the first month. (Ord. 475-B §20, 1976)

13.04.490 Water--Occupied property not receiving water service.

Any occupied property or building shall pay the minimum charge for water service whether or not connected to the municipal water supply where the service is available. (Ord. 475-B §22, 1976)

13.04.500 Sewer--Connection charge.

A. Commencing with the utility billing period January, 2009, the charge for each tap or connection to the sewer system shall be the sum of five hundred dollars. This charge is for tapping only and property owner shall bear all expense for construction of the sewer service from the main sewer line to the building outlet. This fee may be amended from time to time by resolution of the city council and, upon passage, said resolution shall be on file at the office of the city clerk.

B. All property owners within two hundred feet of public sewer line will be required to make connection for sewage disposal.

C. Where feasible, and where involving a multiple-unit dwelling only, several owners may combine and construct one main connection to reduce cost; however, the regular monthly service fee will be charged for each unit so connected.

D. All house service sewers shall be a minimum of six inches in diameter and constructed in accordance with city sewer specifications. No sewer shall be backfilled until

inspected and approved by the water and sewer superintendent. (Ord. 808 § 1, 1998; Ord. 475-B § 38, 1976)
(Ord. No. 897, § 1, 12-30-2008)

13.04.510 Sewer--Service charge--Single-family dwelling unit.

For the utility billing period commencing on May 2011, there is hereby charged to each single-family dwelling unit serviced with city water service and for each dwelling unit that is connected to the city sewer system a monthly sewer service charge in the amount of thirty-seven dollars and six cents. Senior citizens will be charged a monthly sewer service charge in the amount of thirty-two dollars and six cents. (Ord. 868 § 1, 2005: Ord. 848 § 1, 2002: Ord. 841 § 1, 2001: Ord. 810 § 1, 1998: Ord. 763 § 1, 1994: Ord. 704 § 1, 1990: Ord. 686 § 1, 1988: Ord. 669 § 1, 1986: Ord. 654 § 1, 1986; Ord. 642 § 1, 1984; Ord. No. 939, § 1, 9-28-2010; Ord. No. 957, § 1, 4-26-2011)

13.04.520 Sewer--Service charge--Commercial users.

For the utility billing period commencing on May 2011, and thereafter, the commercial users shall be charged a flat rate for sewer service of thirty-seven dollars and six cents per month, or four dollars and twenty-eight cents per one thousand gallons of water used by said user per month, whichever is higher, vegetation nurseries shall be charged as residential consumer. (Ord. 875 § 1, 2006: Ord. 869 § 1, 2005: Ord. 842 § 1, 2001: Ord. 811 § 1, 1998: Ord. 797 § 1, 1997: Ord. 766 § 1, 1995: Ord. 705 § 1, 1990: Ord. 687 § 1, 1988: Ord. 670 § 1, 1986: Ord. 655 § 1, 1986; Ord. 643 § 1, 1984)
(Ord. No. 940, § 1, 9-28-2010; Ord. No. 941, § 1, 9-28-2010; Ord. No. 958, § 1, 4-26-2011; Ord. No. 959, § 1, 5-26-2011)

13.04.530 Sewer--Service charge--Applicability.

The sewer service charges provided in this article shall be applicable to all premises served regardless of whether or not the sewer is actually used for the benefit or facilities located thereon. (Ord. 475-B §13(F), 1976)

13.04.540 Accounts--Billing.

All accounts for water shall be kept in the name of the property owner who shall be responsible for payment of

all charges set forth in this chapter. At the request of the property owner, the clerk-treasurer may bill the consumer or consumers, but the charge shall ultimately be the responsibility of the property and property owner. (Ord. 475-B §5, 1976)

13.04.550 Delinquency--Notice--Shut-off as method of enforcement.

A. 1. All charges for water and sewer service shall be due and payable to the city clerk/treasurer on or before the fifteenth day of the month succeeding the date the bill was rendered. Water bills shall be filled monthly for water services delivered in the metered month prior to the bill. A late payment charge of ten dollars shall be imposed on all delinquent accounts for each month they are delinquent. The due date shall be close of business at city hall on the fifteenth day of each month (or the next succeeding business day). Unpaid accounts become delinquent thereafter. If payment is not received on or before close of business on the fifteenth day of such month, the late payment shall be charged on the unpaid balance of each delinquent account until the total of such charges and penalty have been paid in full. Payment for water service shall not be accepted unless the payment of the sewer service charge is made at the same time.

2. If any charges remain unpaid by the fifteenth day of the next succeeding month, the clerk/treasurer shall notify the property owner or consumer in the next billing of the delinquency and the intent to disconnect service. Said notice shall inform the customer that he has the right to request a hearing before the city council, to contest the validity of the bill the nonpayment of which has resulted in the pending suspension, by submitting a written request to city hall. The written request must be received by city hall no later than ten calendar days after the date of the delinquency notice. In the event of failure to pay the delinquent payment together with the service charges appearing on the bill and no hearing is requested prior to the due date, the water service shall be disconnected. In the event the customer has requested a hearing, the clerk/treasurer has authority to prorate the bill based upon prior usage, pending the outcome of the hearing before the city council.

B. In the event of disconnection of water service for delinquencies, the property owner or consumer shall be charged ten dollars for the service of disconnecting the water service. The property owner or consumer shall also be charged ten dollars for the service of reconnecting the water service. Service to any property disconnected for delinquencies shall not be reinstated until all delinquencies, disconnection charges and reconnection charges have been paid to the clerk.

C. Delinquent charges, including connection charges, shall bear interest at the rate of eight percent per year from the date of delinquency until paid. Any delinquent water, sewer or connection charges provided for in this chapter shall immediately become a lien upon the premises. Such liens shall be superior to all other liens and encumbrances except general taxes and local and special assessments.
(Ord. 764, 1994; Ord. 629 §1(A), 1984: Ord. 475-B §§13(A), (B), (C), 1976)
(Ord. No. 914, 12-22-2009; Ord. No. 929, 3-9-2010; Ord. No. 930, 3-23-2010)

V. ADDITIONAL PROVISIONS

13.04.560 Extensions of mains.

A. All extensions of water and sewer mains outside the city limits shall be made either by the water and sewer departments at the expense of the owners of the property to be served thereby, or by the owners of said property under the supervision of the water and sewer departments and in accordance with the plans and specifications therefor prepared by the water and sewer departments, in which latter case the property owners shall pay the water and sewer departments in advance an amount equal to seventy-five percent of the estimated cost of such extension to cover the cost of plans, specifications, supervision and overhead expense.

B. All extensions shall be and remain the property of the city after said extensions have been tested and accepted by said departments. Said extensions shall be maintained by the city and operated by the water and sewer departments as part of the distribution system. The water and sewer departments shall exercise complete control over said extensions and the persons, or person, responsible for the construction of the extension shall relinquish all right to

or interest in the ownership of such extension. (Ord. 475-B §40, 1976)

13.04.580 Fire hydrants and flush tanks.

The water department shall install, maintain and keep in repair all city fire hydrants and the water connections to all sewer flush tanks and shall regulate the amount of water to be used by each such flush tank. No person other than an employee of the water department shall change or interfere in any manner with the adjustment of valves or other water regulations attached to any sewer flush tank. (Ord. 475-B §35, 1976)

13.04.590 Interference with system--Notice required.

All persons, contractors, corporations or any city department handling street work, such as grading, regrading, filling, trenching or paving, etc., shall give the water and sewer department three days' notice in writing in case it becomes necessary during the work to remove, displace or change any water or sewer mains, pipes, fittings, gates, or other water or sewer works appurtenances that may interfere

with the prosecution of such work, and the failure to furnish said notice shall make the contractor, corporation or person, or other city department liable to the water and sewer departments in case damages should result from such failure. (Ord. 475-B §41, 1976).

13.04.600 Interference with system--Prohibited when. No person other than an employee of the water department or the fire department, or any employee of the street department who is engaged in sprinkling or washing the public streets, shall open or interfere in any way with any fire hydrant, stand pipe or hose connection connected with the city water system without first obtaining authority to do so from the water department. (Ord. 475-B §36, 1976).

13.04.610 Right of entry for inspection. Employees of the water and sewer departments, properly identified, shall have free access at proper hours of the day to all parts of the buildings to which water and sewerage service may be delivered from the city mains, for the purpose of inspecting the conditions of the pipes and fixtures and the manner in which the water is used. (Ord. 475-B §33, 1976).

13.04.620 Plumbers--Penalty for unsatisfactory work. Plumbers or other persons failing to perform their work according to established rules and regulations or executing it unskillfully, or to the damage of the water and sewer departments, may be debarred temporarily or permanently from making connections or doing any work on fixtures or pipes leading from the city's mains. (Ord. 475-B §30, 1976).

13.04.630 Sale or gift of water prohibited. It is unlawful for any property owner or consumer to sell or give away water furnished by the town. (Ord. 475-B §6, 1976).

13.04.640 Unauthorized water connection prohibited. Any person or business concern making any connection with or any alteration to any pipe allowing water to be withdrawn without first applying for water shall be subject to the penalties of this chapter. (Ord. 475-B §8, 1976).

13.04.650 Violation--Penalty. Persons violating the provisions of this chapter shall be subject to a fine not to exceed five hundred dollars, or confinement in jail not to exceed six months. (Ord. 475-B §45, 1976).

13.04.660 Water/sewer hookups outside city limits--Prohibited. No water or sewer hookups will be allowed for property lying outside the corporate limits of the city of Mabton, on or after the effective date of the ordinance codified in this section January 12th, 1982. (Ord. 575 §1, 1982)

VI. CONSUMER DEPOSITS

13.04.670 Refund. All deposits held by the city shall be refunded after any application thereof toward unpaid charges for water, sewer and/or garbage. No interest shall be paid on any such refunded deposits. Any funds remaining after such refunds which cannot be identified or whose owner cannot be located shall be disposed of in accordance with the laws of the state of Washington dealing the unclaimed funds. (Ord. 649 §2, 1985; Ord. 548, 1980)

VII. PAYMENT PLAN OPTIONS

13.04.680 Eligibility. City utility service for residential customers shall provide for the option of a budget billing or equal payment plan. (Ord. 733 §1, 1993)

13.04.690 Accounts--Billing. A. All accounts shall be kept in the name of the property owner who shall be responsible for payment of all utility charges set forth in this title. At the request of the property owner, the clerk-treasurer may bill the customer or customers, but the charge shall ultimately be the responsibility of the property owner.

B. The property owner and the customer, if applicable, must agree to a payment plan and further agree to maintain the payment plan. The plan will be designed both to pay any past due bills (not to exceed the limitations imposed in Section 13.04.550), as well as to pay for continued utility service. If any delinquencies occur during the life of the budget plan, the residential utility customer or property owner shall not be eligible for the protections under the plan until all delinquencies are paid.

C. Quarterly adjustments are to be calculated into the plan to account for rate changes or changes in average monthly consumptions for the quarter. The outstanding balance of service charges are due upon transfer of ownership or the last billing for a customer or consumer. (Ord. 733 §2, 1993)

13.04.700 Equal payment plan. The clerk-treasurer may compute a twelve-month schedule of payments based upon the consumption for the residential unit for the previous twelve months. Utility service charges for residents of the city in newly constructed housing units shall be based upon an estimate of an average service charge for a similar residential unit to be determined by the clerk-treasurer. (Ord. 733 §3, 1993)

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Chapter 13.05

CROSS-CONNECTION CONTROL

Sections:

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13.05.010 Definitions.
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13.05.030 Cross-connections.
13.05.040 Application and responsibilities.
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13.05.060 Irrigation.
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13.05.005 Authority.

Pursuant to WAC 246-290-490, or as amended, it is the responsibility of the city of Mabton to protect its drinking water by instituting and enforcing a cross-connection control program. Now, therefore, the city of Mabton stipulates as follows in this chapter. (Ord. 865 §1(part), 2005)

13.05.010 Definitions.

Except where specifically designated herein, all words used in this document shall carry their customary meanings. Words used in the present tense include the future and plural words include the singular. The word "shall" is always mandatory, and the word "may" denotes a use of discretion in making a decision. Any definition not found in this section will take its meaning from Chapter 246-290 WAC, or as amended, or in the most recent edition of the "Manual of Cross-Connection Control" published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California.

"Air gap" means a physical separation between the free-flowing end of a potable water supply pipeline and the overflow rim of an open or nonpressure-receiving vessel. To be an "approved air gap," the separation must be at least twice the diameter of the inlet piping (supply pipe) measured vertically, and never be less than one inch.

"Approved backflow prevention assembly" or "backflow assembly" or "assembly" means an assembly to counteract backpressures or prevent backsiphonage. This assembly must appear on the list of approved assemblies issued by the Washington State Department of Health. The assembly must be purchased and installed as a complete unit including two shut-off valves and test cocks.

"Auxiliary supply" means any water source or system other than the city of Mabton's.

"Backflow" means the flow of water or other liquids, gases or solids from any source back into the distribution system. The flow of water in the opposite direction of its intended flow.

"Backflow assembly tester" means a person holding a valid BAT certificate issued in accordance with WAC 246-290-490 and Chapters 18.27, 18.106 and 70.119 RCW.

"Backpressure" means backflow due to water pressure on the downstream side of the meter which exceeds the operating pressure of the public potable water supply.

"Backsiphonage" means backflow due to a negative or reduced pressure within the public potable water.

"Building inspector" means the building inspector for the city of Mabton.

"City" means the city of Mabton.

"Closed system" means any water system or portion of a water system in which water is closed.

"Contamination" means the entry into or presence in a public water supply system of any substance which may be harmful to health and/or quality of the water.

"Cross-connection" means any physical arrangement where a public water system is connected, directly or indirectly (actual or potential), with any other non-drinkable water system or auxiliary system, wells, sewer, drain conduit, swimming pool, storage reservoir, plumbing fixture, swamp coolers, or any device which may be capable of imparting contamination or pollution to the public water system as a result of backflow. Bypass arrangements, jumper connections, removable sections, swivel or change-over devices, or other temporary or permanent devices through which, or because of which, backflow may occur are considered to be cross-connections.

"Cross-connection specialist" or "CCS" means a person holding a valid CCS certificate issued in accordance with the Washington Administrative Code.

"Degree of hazard" means the low or high hazard classification that shall be attached to all actual or potential cross-connections.

"Director" means the public works director or his/her designee.

"DOH" means the department of health.

"Double check detector assembly" or "DCDA" means an assembly which consists of two independently operating check valves which are spring-loaded or weighted. The assembly comes complete with a shut-off valve on each side of the checks, as well as test cocks to test the checks for tightness. It shall also be provided with a factory bypass arrangement with a meter and a minimum of an approved double check assembly.

"Double check valve backflow prevention assembly" or "double check assembly" or "double check" or "DCVA" or

"DC" means an assembly which consists of two independently operating check valves which are spring-loaded or weighted. The assembly comes complete with a shut-off valve on each side of the checks, as well as test cocks.

"Health hazard" means an actual or potential threat of contamination of a physical, toxic or biological nature that would be a danger to health.

"High hazard" means the classification assigned to an actual or potential cross-connection that potentially could allow a substance that may cause illness or death to backflow into the potable water supply.

"In-premises protection" means a method of protecting the health of consumers served by the customer's plumbing system (i.e., located within the property lines of the customer's premises) by the installation of an approved air gap, backflow prevention assembly or device at the point of hazard.

"Inspector," "surveyor" or "specialist" means a person holding a valid CCS certificate issued in accordance with the Washington Administrative Code, who meets the stipulations in this chapter.

"Local administrative authority" means the local official, board, department or agency authorized to administer and enforce the provisions of the Uniform Plumbing Code and all other plumbing codes recognized by the state of Washington.

"Low hazard" means the classification assigned to an actual or potential cross-connection that could allow a substance that may be objectionable, but not hazardous to one's health, to backflow into the potable water supply.

"Mobile unit" means units connecting to the water system through a hydrant, hose bibb, or other appurtenance of a permanent nature that is part of the city water system or a permanent water service to a premises. Examples can include, but are not limited to, the following: water trucks, pesticide applicator vehicles, chemical mixing units or tanks, waste or septage hauler trucks or units, sewer cleaning equipment, carpet or steam cleaning equipment, rock quarry or asphalt/concrete batch plants, or any other mobile equipment or vessel. Uses that are excluded from this definition are recreational vehicles at assigned sites or parked in accordance with other city ordinances pertaining to recreational vehicles, and homeowner devices that are used by the property owner in accordance with

other provisions of this, or other, city of Mabton ordinances pertaining to provision of water to premises.

"Person" means a natural person (individual), corporation, company, association, partnership, firm, limited liability company, joint venture company or association, and other such entity.

"Potable water supply" means any system of water supply intended or used for human consumption or other domestic use and meets all requirements established by the Safe Drinking Water Act and the DOH regulations.

"Premises" means any piece of property to which water is provided including, but not limited to, all improvements, mobile structures and structures located on it.

"Premises isolation" means a method of protecting a public water system by installation of an approved air gap or approved backflow prevention assembly at the point of service (end of purveyor's service pipe) to separate the customer's plumbing system from the purveyor's distribution system.

"Reduced pressure detector assembly" or "RPDA" means an approved assembly consisting of two approved reduced pressure backflow assemblies, set in parallel, equipped with a meter on the bypass line to detect small amounts of water leakage or use.

"Reduced pressure principle backflow prevention assembly" or "reduced pressure principle assembly" or "RP assembly" means an assembly containing two independently acting approved check valves together with a hydraulically operated, mechanically independent pressure differential relief valve located between the check valves. The assembly shall include properly located test cocks and tightly closing shut-off valves at each end of the assembly.

"SOP" means the most recent edition of the city of Mabton's standard operating procedures.

"Thermal expansion" means the pressure created by the expansion of heated water.

"Used water" means any water supplied by the city to a customer's property after it has passed through the service connection and is no longer under the control of the city.

"WAC" means the most recent edition of the Washington Administrative Code. (Ord. 865 §1(part), 2005)

13.05.020 Purpose.

The purpose of this chapter is to protect the water system of the city of Mabton from contamination or pollution due to any existing or potential cross-connections as defined in WAC 246-290-010, or as amended, and this chapter. (Ord. 865 §1(part), 2005)

13.05.030 Cross-connections.

A. No cross-connections shall be created, installed, used or maintained within the territory served by the city, except in accordance with this chapter.

B. The CCS for the city shall carry out or cause inspections to be carried out to determine if any actual or potential cross-connections exist. If found necessary, an assembly commensurate with the degree of hazard will be required to be installed at the service connection.

C. The owner, occupant or person in control of the property is responsible for all cross-connection control within the premises. (Ord. 865 §1(part), 2005)

13.05.040 Application and responsibilities.

This chapter applies throughout the city and to every premises and property served by the city water system. It applies to any premises, public or private, regardless of date of connection to the city water. Every owner, occupant and/or person in control of any concerned premises is responsible for compliance with the terms and provisions contained herein. (Ord. 865 §1(part), 2005)

13.05.050 Backflow prevention assembly requirements.

A CCS employed by or under contract with the city shall determine the type of backflow assembly to be installed within the area served by the city. All assemblies shall be installed at the service connection unless it is determined by the CCS to install the assembly at an alternate location for premises protection or at the point of use. The cross-connection shall be eliminated or an assembly shall be required to be installed in each of the following circumstances, but the CCS is in no way limited to the following circumstances:

A. The nature and extent of any activity on the premises, or the materials used in connection with any activity on the premises, or materials stored on the premises, could contaminate or pollute the potable water supply;

B. Premises having any one or more cross-connections or potential cross-connections as that term are defined in this chapter and the WAC;

C. When a cross-connection survey report form is required by the city to be filled out and returned and it has not been received;

D. Internal cross-connections are present that are not correctable;

E. Intricate plumbing arrangements exist or plumbing subject to frequent changes are present that make it impractical to ascertain whether or not cross-connections exist;

F. There is a repeated history of cross-connections being established or re-established;

G. There is unduly restricted entry so that inspections for cross-connections cannot be made with sufficient frequency to assure that cross-connections do not exist;

H. Materials, chemicals or any substance or apparatus is being used that if backflow occurred contamination would result;

I. Installation of an approved backflow prevention assembly is deemed to be necessary in the judgment of the CCS to accomplish the purpose of these regulations;

J. Any premises having auxiliary water supply which is not in compliance with WAC 248-54-30 and is not acceptable to the city;

K. In the event of a point-of-use assembly has not been tested or repaired as required by WAC 246-290-490, or as amended, and this chapter;

L. If it is determined that additions or rearrangements have been made to the plumbing system without obtaining proper permits as required by the city code enforcement division;

M. All high health hazard premises which are defined in Table 9 of WAC 246-290-490, or as amended, are required to have premises isolation by installing a reduced pressure principle assembly in accordance with this chapter;

N. When a garden hose attachment is connected to the premises plumbing, including, but not limited to, fertilizer applicators, pesticide applicators and radiator flush kits;

O. Where reclaimed or reused water systems are installed;

P. Premises on which any substance is handled under pressure so as to permit entry into the public water system. (Ord. 865 §1(part), 2005)

13.05.060 Irrigation.

All irrigation systems shall be protected in accordance with the plumbing code regulations. In the event any system is equipped with an injector system, or has submerged heads, a reduced pressure principle assembly will be required. (Ord. 865 §1(part), 2005)

13.05.070 Fire sprinkler systems.

An approved double check detector backflow prevention assembly shall be the minimum protection on all new fire sprinkler systems using piping material that is not approved for potable water use, and/or that does not provide for periodic flow-through. A reduced pressure principle detector backflow prevention assembly must be installed, if any solution other than the potable water can be introduced into the sprinkler system. Retrofitting on fire sprinkler systems will be required in each of the following circumstances:

A. Where improper maintenance has occurred;

B. On all high hazard locations;

C. Where a CCS deems necessary;

D. Wherever required by the WAC.

(Ord. 865 §1(part), 2005)

13.05.080 Temporary meters and hydrant valves.

Backflow protection will be required on temporary meters and all hydrant valves. The type of assembly will be commensurate with the degree of hazard and will be determined on a case-by-case basis by the city's CCS. (Ord. 865 §1(part), 2005)

13.05.090 Mobile units.

Any mobile unit or apparatus as defined in Section 13.05.010 of this chapter which uses the city's water from any premises or piping within the distribution system shall first obtain a permit from the city. The mobile unit will be inspected to assure appropriate backflow protection is installed in accordance with this chapter. (Ord. 865 §1(part), 2005)

13.05.100 Right-of-way encroachment.

A. No person shall install or maintain a backflow prevention assembly upon or within any city right-of-way except as provided in this section.

B. The city reserves the right to have an assembly installed in the right-of-way.

C. A backflow prevention assembly required by the city may be installed upon or within any city right-of-way only if the owner proves to the city that there is no other feasible location for installing the assembly, and installing it in the right-of-way will not interfere with traffic or utilities. The city retains the right to approve the location, height, depth, enclosure, and other requisites of the assembly prior to its installation.

D. All permits required by the city code to perform work in the right-of-way.

E. A property owner shall, at the request of the city and at the owner's expense, relocate a backflow prevention assembly which encroaches upon any city right-of-way, when such relocation is necessary for street or utility construction or repairs for purposes of public safety. (Ord. 865 §1(part), 2005)

13.05.110 Plumbing code.

As a condition of water service, customers shall install, maintain, and operate their piping and plumbing systems in accordance with all Washington State plumbing codes. (Ord. 865 §1(part), 2005)

13.05.120 Access to commercial and industrial premises.

Authorized employees of the city, with proper identification, shall have access during the hours of eight a.m. to five p.m. to all parts of commercial and industrial premises and within the buildings to which water is supplied. If access to the premises or to the interior of a structure during these hours are denied, a reduced pressure principle assembly shall be required to be installed at the service connection to that premises. (Ord. 865 §1(part), 2005)

13.05.130 Access to residential property.

Permission to perform a cross-connection inspection at a residential property must be requested by the city at least seventy-two hours prior to the time of inspection.

If permission is denied, the property owner shall contact a CCS to perform the inspection and provide a report to the city. The report must reach the city within twenty-one days of the request for permission from the city. Failure to comply may result in the city installing an RP assembly at the meter in compliance with this chapter. (Ord. 865 §1(part), 2005)

13.05.140 Testing.

Backflow prevention assemblies shall be tested and repaired in accordance with the requirements set out in the WAC, this chapter and the most recent edition of the city's SOP manual. (Ord. 865 §1(part), 2005)

13.05.150 Certification of backflow prevention assembly.

All backflow assembly testers operating within the city shall be certified in accordance with all applicable regulations and shall comply with all stipulations in this chapter and the most recent edition of the city's SOP manual. (Ord. 865 §1(part), 2005)

13.05.160 Maintenance of backflow prevention assembly.

Backflow prevention assemblies shall be maintained in accordance with the requirements set out in the WAC, or as amended, and the most recent edition of the city's SOP manual. (Ord. 865 §1(part), 2005)

13.05.170 Installation requirements and specifications.

Backflow prevention assemblies shall be installed in accordance with the requirements in the WAC and the most recent edition of the city's SOP manual. In the event the CCS allows a premises isolation assembly to be installed at an alternate location, there shall be no connections between the meter and the premises isolation assembly. (Ord. 865 §1(part), 2005)

13.05.180 Thermal expansion.

If a closed system has been created by the installation of a backflow prevention assembly, it is the responsibility of the property owner to eliminate the possibility of thermal expansion. (Ord. 865 §1(part), 2005)

13.05.190 Pressure.

Any reduction in water pressure caused by the installation of a backflow assembly is not the responsibility of the city. The city will give reasonable assistance to the owner regarding information on adequate sizing of assemblies and proper plumbing practices to provide for required pressure and flows for fire protection. (Ord. 865 §1(part), 2005)

13.05.200 Parallel installation.

Premises where noninterruption of water supply is critical shall have two assemblies of the same type installed in parallel. They shall be sized in such a manner that either assembly will provide the minimum water requirements while the two together will provide the maximum water requirements. (Ord. 865 §1(part), 2005)

13.05.210 New construction.

A. On all new nonresidential construction, an approved backflow assembly shall be installed at the service connection. The type of the assembly will be commensurate with the degree of hazard as determined by a CCS.

B. When a building is constructed on commercial premises, and the end use of the building is not determined or could change, a reduced pressure principle backflow prevention assembly shall be installed at the service connection to provide protection of the public water supply in the event of the most hazardous use of the building. (Ord. 865 §1(part), 2005)

13.05.220 Residential service connections.

Any residential property which has been determined to have an actual or potential cross-connection and/or has violated the plumbing code or this chapter in any way shall be required to install an approved backflow prevention assembly in accordance with this chapter. (Ord. 865 §1(part), 2005)

13.05.230 Rental properties.

The property owner is responsible for the installation, testing and repair of all backflow assemblies on their property. When the tenants change, or, if the plumbing is altered in any way, it is the responsibility

of the owner to notify the city. (Ord. 865 §1(part), 2005)

13.05.240 Retrofitting.

Retrofitting shall be required on all service connections where an actual or potential cross-connection exists, and wherever else the city deems retrofitting necessary. (Ord. 865 §1(part), 2005)

13.05.250 Costs of compliance.

All costs associated with the purchase, installation, inspections, testing, replacement, maintenance, parts, and repairs of the backflow assembly are the financial responsibility of the property owner. All costs associated with any disconnect fees associated with the enforcement of this chapter are the sole responsibility of the water user and/or property owner. On residential irrigation systems, the city may purchase, install, test, and maintain the backflow assemblies. The cost for these services will be passed on to the end user and/or property owner on their water bill and may be amortized over a period of time upon request. (Ord. 865 §1(part), 2005)

13.05.260 Recovery of costs.

Any water customer violating any of the provisions of this chapter and who causes damage to or impairs the city's water system, including, but not limited to, allowing contamination, pollution, any other solution or used water to enter the city's water system, shall be liable to the city for any expense, loss or damage caused by such violation. The city shall collect from the violator for the cost incurred by the city for any cleaning, purifying, repair or replacement work or any other expenses caused by the violation. Refusal to pay the assessed costs shall constitute a violation of this chapter and shall result in the termination of service. (Ord. 865 §1(part), 2005)

13.05.270 Emergency suspension of service.

The director or his/her designee may, without prior notice, suspend water service to any premises when such suspension is necessary to stop the eminent threat of any actual or potential cross-connection as defined in this chapter and the most recent edition of the city's SOP manual. (Ord. 865 §1(part), 2005)

13.05.280 Nonemergency suspension of service.

The director or his/her designee may, with twenty-four-hour prior notice, suspend water service to any premises where the conditions as defined in this chapter and the most recent edition of the city's SOP manual have been violated. (Ord. 865 §1(part), 2005)

13.05.290 Penalties.

Any person, property owner, firm, corporation or business entity violating (a) this chapter, or (b) any regulation, rule or permit of the city issued pursuant to this chapter, shall be liable to the city for civil penalty. The amount of such civil penalty shall be two thousand dollars per violation. Each continuing day's violation under this chapter shall constitute a separate offense. The penal provisions imposed under this chapter shall not preclude the city from filing suit to enjoin the violation. The city of Mabton retains all legal rights and remedies available to it pursuant to local, state and federal law. (Ord. 865 §1(part), 2005)

13.05.300 Falsifying information.

Any person who knowingly makes any false statement, representation, record, report or other document filed or required to be maintained pursuant to this chapter, or who falsifies, tampers with, or knowingly renders inaccurate any backflow assembly, device or method required under this chapter shall, in addition to civil and/or criminal penalties provided by state law, be guilty of a misdemeanor subject to the penalty clause of the Mabton Municipal Code. (Ord. 865 §1(part), 2005)

Title 14

(RESERVED)

APPENDIX Q

WATER SERVICE APPLICATION GUIDELINES

CITY OF MABTON
WATER SERVICE APPLICATION GUIDELINES

The applicant applying to the City of Mabton for a new water service connection shall be the owner of the property or authorized agent of the owner. Determination of ability to serve said property will be made by the staff of the City of Mabton for an individual connection to the water system.

An application to the City of Mabton requesting service for four (4) or more shall be reviewed by staff to determine if an environmental review will be required or if review by the engineering firm shall be sufficient to determine ability to serve.

ESTABLISHMENT OF NEW WATER OR GARBAGE SERVICE
OR CHANGE TO EXISTING SERVICE

PROPERTY ADDRESS_____ACCOUNT #_____

PROPERTY OWNER_____

RENTER'S NAME_____
(IF PROPERTY IS BEING RENTED)

AS THE PROPERTY OWNER, I EITHER RESIDE AT THIS ADDRESS OR I AM AUTHORIZING THE ABOVE NAMED INDIVIDUAL TO ESTABLISH A NEW WATER AND /OR GARBAGE ACCOUNT AT THIS ADDRESS. THE PERSON NAMED ON THIS ACCOUNT WILL HAVE (IN ADDITION TO THE OWNER) THE ABILITY TO REQUEST SERVICES BE TURNED/ON OR TURNED/OFF.

I UNDERSTAND THAT, AS THE PROPERTY OWNER, I AM ULTIMATELY RESPONSIBLE FOR THE PAYMENT OF ANY SERVICES PROVIDED TO THIS ADDRESS.

MAILING INFORMATION:

OWNER	**RENTER**
_____ MAILING ADDRESS	_____ MAILING ADDRESS
_____ CITY/STATE/ZIP CODE	_____ CITY/STATE/ZIP CODE
_____ HOME PHONE	_____ HOME PHONE
_____ WORK PHONE	_____ WORK PHONE

MONTHLY INVOICE SHOULD BE SENT TO:_____

DELINQUENT NOTICES ARE SENT TO BOTH OWNER AND RENTER.

FOR GARBAGE SERVICE:

RESIDENTIAL:_____CAN/S COMMERCIAL:_____CAN/BIN

SENIOR CITIZEN: YES/NO 62 YEARS OR OLDER

SIGNATURE OF PROPERTY OWNER:_____DATE:_____

SIGNATURE OF RENTER:_____DATE:_____

A NEW FORM MUST BE COMPLETED EACH TIME A NEW RENTER MOVES IN. WATER WILL NOT BE TURNED BACK ON UNLESS BILL IS PAID IN FULL.

APPENDIX R

WATER RATES

PATES

P. O. Box 655
Mabton, Washington 98935
Phone: 509-894-4096
Fax: 509-894-4813

FAX COVER
City of Mabton

To: Jim
From: Yolanda
Fax:
Date: 6/19/12
Phone:
Pages: 8

Re:
CC:

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

COPY

ORDINANCE NO. 988

AN ORDINANCE OF THE CITY OF MABTON, WASHINGTON, AMENDING SECTION I OF ORDINANCE NUMBER 970 REGARDING SEWER CHARGES FOR VEGETATION NURSERIES

WHEREAS, ORDINANCE NUMBER 970 WAS PASSED BY THE CITY COUNCIL ON NOVEMBER 2011 AMENDING SEWER RATES, AND

WHEREAS, SAID ORDINANCE INADVERTENTLY ELIMINATED A PROVISION WHEREBY VEGETATION NURSERIES WERE CHARGED AS RESIDENTIAL, AND

WHEREAS, WHILE SUCH NURSERIES USE A LARGE VOLUME OF WATER, SAID WATER DOES NOT GO INTO SEWER SYSTEM, AND IT WAS INTENT OF THE COUNCIL TO EXEMPT THEM FROM THE COMMERICIAL RATES ON SEWER USAGE,

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MABTON, WASHINGTON, AS FOLLOWS;

ORDINANCE NUMBER 970, SECTION I WHICH READS AS FOLLOWS:

SECTION I. FOR THE UTILITY BILLING PERIOD COMMENCING ON NOVEMBER 2011, AND THEREAFTER, THE COMMERCIAL USERS SHALL BE CHARGED A FLAT RATE FOR SEWER SERVICE OF $43.06 PER MONTH, OR $4.28 PER 1,000 GALLONS OF WATER USED BY SAID USER PER MONTH, WHICHEVER IS HIGHER, VEGETATION NURSERIES SHALL BE CHARGED AS RESIDENTIAL CONSUMERS.

BE AND IS HEREBY AMENDED TO READ AS FOLLOWS:

SECTION I. FOR THE UTILITY BILLING PERIOD COMMENCING ON MAY 2012, AND THEREAFTER, THE COMMERICIAL USERS SHALL BE CHARGED A FLAT RATE FOR SEWER SERVICE OF $43.06 PER MONTH, OR $4.28 PER 1,000 GALLONS OF WATER USED BY SAID USER PER MONTH, WHICHEVER IS HIGHER, VEGETATION NURSERIES SHALL BE CHARGED AS RESIDENTIAL CONSUMER.

SECTION II. THIS ORDINANCE SHALL TAKE EFFECT AND BE IN FORCED FIVE (5) DAYS FROM AND AFTER ITS PASSAGE, APPROVAL, AND PUBLICATION, AS PROVIDED BY LAW.

PASSED BY THE **CITY COUNCIL** OF THE **CITY OF MABTON, WASHINGTON** AND **APPROVED** BY THE **MAYOR** THIS **22 ND** DAY OF **MAY 2012.**

MAYOR:

ANGEL REYNA

APPROVED AS TO FORM:

PHIL LAMB, CITY ATTORNEY

ATTEST:

RET STEWART, CLERK TREASURER

COPY

ORDINANCE NO. 987

AN ORDINANCE OF THE CITY OF MANTON, WASHINGTON, AMENDING SECTION 1 OF ORDINANCE NUMBER 969 FIXING NEW SEWER RATES FOR COMMERICAL CONSUMERS FOR THE CITY OF MABTON

WHEREAS, The City Council of the City of Mabton reviewed commercial sewer rates for the City of Mabton during the budget process for year 2012; and

WHEREAS, It is determined that rates must be increased to maintain operations,

NOW, THEREFORE, BE IT ORDAINED by the City Council of the City of Mabton, Washington, as follows;

Ordinance Number 969, Section 1 which reads as follows:

Section I. For the utility billing period commencing November 2011 and thereafter, the commercial users shall be charged a flat rate for sewer service of $40.06 per month, or $4.28 per 1,000 gallons of water used by said user per month, whichever is higher.

BE AND IS HEREBY AMENDED TO READ AS FOLLOWS:

Section I. For the utility billing period commencing May 2012, and thereafter, the commercial users shall be charged a flat rate for sewer service of $43.06 per month, or $4.28 per 1,000 gallons of water used by said user per month, whichever is higher.

Section II. This ordinance shall take effect and be in force five (5) days from and after its passage, approval, and publication, as provided by law.

PASSED by the **CITY COUNCIL** of the **CITY OF MABTON, WASHINGTON** and **APPROVED** by the **MAYOR** this 22th day of **May 2012.**

MAYOR:

ANGEL REYNA

APPROVED AS TO FORM:

PHIL LAMB, CITY ATTORNEY

ATTEST:

RET STEWART, CLERK-TREASURER

COPY

ORDINANCE NO. 986

AN ORDINANCE OF THE CITY OF MABTON, WASHINGTON, AMENDING SECTION I OF ORDINANCE NUMBER 968 ESTABLISHING NEW SEWER RATES FOR RESIDENTIAL CONSUMERS FOR THE CITY OF MABTON

WHEREAS, THE CITY COUNCIL OF THE CITY OF MABTON REVIEWED RESIDENTIAL SEWER RATES FOR THE CITY OF MABTON DURING THE BUDGET PROCESS FOR YEAR 2012; AND

WHEREAS, IT IS DETERMINED THAT RATES WOULD BE RAISED THREE DOLLARS;

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MABTON, WASHINGTON, AS FOLLOWS;

ORDINANCE NUMBER 968, SECTION I WHICH READS AS FOLLOWS:

SECTION I. FOR THE UTILITY BILLING PERIOD COMMENCING ON NOVEMBER 2011, THERE IS HEREBY CHARGED TO EACH SINGLE-FAMILY DWELLING UNIT SERVICED WITH CITY WATER SERVICE AND FOR EACH DWELLING UNITY THAT IS CONNECTED TO THE CITY SEWER SYSTEM SERVICE CHARGE IN THE AMOUNT OF$ 40.06. SENIOR CITIZENS WILL BE CHARGED A MONTHLY SEWER CHARGE IN THE AMOUNT OF $35.06

BE AND IS HEREBY AMENDED TO READ AS FOLLOWS:

SECTION I. FOR THE UTILITY BILLING PERIOD COMMENCING ON MAY 2012, THERE IS HEREBY CHARGED TO EACH SINGLE --FAMILY DWELLING UNIT SERVICED WITH CITY WATER SERVICE AND FOR EACH DWELLING UNIT THAT IS CONNECTED TO THE CITY SEWER SYSTEM WILL BE CHARGED A MONTHLY SEWER SERVICE CHARGE IN THE AMOUNT OF $43.06. SENIOR CITIZENS WILL BE CHARGED A MONTHLY SEWER CHARGE IN THE AMOUNT OF $38.06.

SECTION II. THIS ORDINANCE SHALL TAKE EFFECT AND BE IN FORCED FIVE(5) DAYS FROM AND AFTER ITS PASSAGE, APPROVAL, AND PUBLICATION, AS PROVIDED BY LAW.

PASSED BY THE **CITY COUNCIL** OF THE **CITY OF MABTON, WASHINGTON** AND **APPROVED** BY THE **MAYOR** THIS **22 ND** DAY **MAY 2012**.

MAYOR:

ANGEL REYNA

APPROVED AS TO FORM:

PHIL LAMB, CITY ATTORNEY

ATTEST:

RET STEWART, CLERK TREASURER

ORDINANCE NO. 977

AN ORDINANCE OF THE CITY OF MABTON, WASHINGTON, AMENDING SECTION II A.2 OF ORDINANCE NUMBER 945 INCREASING THE WATER RATES BY $3 IN THE CITY OF MABTON EFFECTIVE JANUARY 31, 2012.

WHEREAS, the City Council has been reviewing water rates for the City of Mabton during the budget process for year 2012; and

WHEREAS, the City Council held a public hearing on January 24, 2012 to hear comments on the proposed rate increase, and

WHEREAS, after listening to all comments, it was determined that rates will be increased effective January 31, 2012

NOW, THEREFORE, BE IT ORDAINED by the City Council of the City of Mabton, Washington as follows:

Section I. Ordinance Number 945, Section II A.2 that reads as follows:

Meter Size	Consumption	Minimum	Overage per 134 c.f.
¾" or smaller	First 536 c.f.	$23.35/$15.35 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
1"	First 536 c.f.	$24.59/$16.59 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
1 ¼" to 1 1/2"	First 536 c.f.	$31.11/$23.11 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
2"	First 938 c.f.	$33.21/$25.21 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08
3"	First 938 c.f.	$56.29/$48.29 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08
4"	First 938 c.f.	$96.26/$88.26 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08
6"	First 938 c.f.	$189.51/$181.51 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08

BE AND IS HEREBY AMENDED TO READ AS FOLLOWS:

Section II. **A.2:** Water rates within the corporate city limits of Mabton shall be as follows:

Meter Size	Consumption	Minimum	Overage per 134 c.f.
¾" or smaller	First 536 c.f.	$26.35/$18.35 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
1"	First 536 c.f.	$27.59/$19.59 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
1 ¼" to 1 1/2"	First 536 c.f.	$34.11/$26.11 Senior Rate	
	Next 402 c.f.		$1.24
	Over 938 c.f.		$1.28
2"	First 938 c.f.	$36.21/$28.21 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08
3"	First 938 c.f.	$59.29/$51.29 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08
4"	First 938 c.f.	$99.26/$91.26 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08
6"	First 938 c.f.	$192.51/$184.51 Senior Rate	
	Next 4,020 c.f.		$ .98
	Over 4,958 c.f.		$1.08

Section II. This Ordinance shall take effect and be in force five (5) days from and after its passage, approval, and publication, as provided by law.

PASSED by the **CITY COUNCIL** of the **CITY OF MABTON, WASHINGTON** and **APPROVED** by the **MAYOR** this 24th day of January, 2012

MAYOR:

ANGEL REYNA

APPROVED AS TO FORM:

PHIL LAMB, CITY ATTORNEY

ATTEST:

RET STEWART, CLERK-TREASURER

APPENDIX S

WATER USE EFFICIENCY REPORT

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Date Submitted: 6/27/2012

Water Use Efficiency
Annual Performance Report - 2011

WS Name: MABTON, CITY OF Water System ID# : 49650 WS County: YAKIMA

Report submitted by: *christopher morris*

Meter Installation Information:

Estimate the percentage of metered connections: *More Than 75%*

If not fully metered - Current status of meter installation:

Need to get 2 city parks metered and one source meter is currently being installed

Production, Authorized Consumption, and Distribution System Leakage Information:

12-Month WUE Reporting Period: *01/01/2011* To *12/31/2011*

Incomplete or missing data for the year? *Yes*

If yes, explain:

with the changes of employees most of the information is not available at this time. However, we will continue to gather information for next years report.

Distribution System Leakage Summary:

Total Water Produced and Purchased (TP) – Annual Volume	gallons
Authorized Consumption (AC) – Annual Volume	gallons
Distribution System Leakage – Annual Volume TP – AC	gallons
Distribution System Leakage – Percent DSL = [(TP – AC) / TP] x 100	*0.0* %
3-year annual average	%

Goal-Setting Information:

Date of Most Recent Public Forum: *01/01/2012* Has goal been changed since last performance report? *No*

Note: Customer goal must be re-established every 6 years through a public process

WUE Goals:

Customer Goal (Demand Side):

Currently our only goal is to get a full years information so that next years report can be completed

Describe Progress in Reaching Goals:

Customer (Demand Side) Goal Progress:

Information for WUE was included in this year's annual water quality report.

Additional Information Regarding Supply and Demand Side WUE Efforts

Include any other information that describes how you and your customers use water efficiently:

Possibly set up a new irrigation rule where customers water every other day. Example, if the homeowner has an even numbered house, they only water on the even numbered days, and the same for odd numbered homes. The city will also start a new water meter replacement program to better account for water usage. Check for leaks, in a timely matter, for those customers who show high water usage that month. Meter hydrant usage and flushing

Do not mail, fax, or email this report to DOH

VALLEY Environmental Laboratory

Washington State Certified Lab #153 - DOE Accredited Lab C345

Lead

Lab/Sample No: Below	Date Collected: 02/28/12	
Date Received: 03/02/12	Date Reported: 03/14/12	Supervisor: BKO
	Sampled By: Jim Bricel	
Sample Location: Paint		Invoice#: 21411

Send Report To:	Sample Information	Matrix: Solids
Jim Bricel PO Box 2069 Yakima, WA 98907		

Lead

VEL Sample Number:	15330204	15330205	15330206	15330207				
Sample ID/Location:	East 1 Int.	Middle #2 Int	West #3Int.	Outside Mix				
Analyte	Units	Results	Results	Results	Results	MRL	Method	Date Analyzed	Analyst
Lead	%	1.04	1.36	<0.1	2.68	0.01	SM 3113B	03/08/12	BKO

MRL (Method Reporting Level): Indicates the minimum reporting level required and obtained by the laboratory (always >MDL).

Trigger: DOH Drinking Water response level.

MCL (maximum contaminant level): Highest level recommended by the federal government for public water systems.

ND (Not Detected): Indicates this compound was analyzed and not detected at a level greater than or equal to the MRL.

Approved By:

201 East D Street Yakima, WA 98901 509-575-3999 Fax: 509-575-3068

30204-pb

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Date Submitted: 12/21/2011

Water Use Efficiency
Annual Performance Report - 2010

WS Name: MABTON, CITY OF Water System ID# : 49650 WS County: YAKIMA

Report submitted by: *Angel Reyna*

Meter Installation Information:

Estimate the percentage of metered connections: *100%*

If not fully metered - Current status of meter installation:

N/A

Production, Authorized Consumption, and Distribution System Leakage Information:

12-Month WUE Reporting Period: *01/01/2010* To *12/31/2010*

Incomplete or missing data for the year? *Yes*

If yes, explain:

With the changes of employees most of the information is not available at this time; however, we will continue to gather information and amend the report as needed. We will also attempt to gather data from 2008 and 2009 and report that information as well.

Distribution System Leakage Summary:

Total Water Produced and Purchased (TP) – Annual Volume	gallons
Authorized Consumption (AC) – Annual Volume	gallons
Distribution System Leakage – Annual Volume TP – AC	gallons
Distribution System Leakage – Percent DSL = [(TP – AC) / TP] x 100	*0.0* %
3-year annual average	%

Goal-Setting Information:

Date of Most Recent Public Forum: _____ Has goal been changed since last performance report? *No*

Note: Customer goal must be re-established every 6 years through a public process

WUE Goals:

Customer Goal (Demand Side):

Information is not available at this time; however, goals will be established in 2012.

Describe Progress in Reaching Goals:

Customer (Demand Side) Goal Progress:

Currently we do not have any goals but are working towards comliance in 2012.

Additional Information Regarding Supply and Demand Side WUE Efforts

Include any other information that describes how you and your customers use water efficiently:

For 2012 we will implement a goal to reduce water usage by at least 5%. The following two measures will be implemented in order to achieve the 5% water reduction; 1. A new irrigation ordinance where customers can only water every other day; for example if the homeowner has an even numbered home they can only water on an even numbered day and the same for the odd numbered homes. 2. The city will start a new water metere replacement program in order to better account for water usage.

Do not mail, fax, or email this report to DOH

APPENDIX T

CONSUMER CONFIDENCE REPORT

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

Consumer Confidence Report Certification Form

For calendar year 2010 Consumer Confidence Reports are due before July 1, 2011

You need to complete the following:

1. Mail or deliver copies of your 2010 Consumer Confidence Report (CCR) to your water system customers **before July 1, 2011**. Keep a copy for your records.

2. Submit a copy of your CCR to the regional office for your county (address on back) **before July 1, 2011.**

3. Complete and submit this certification form to the regional office for your county **by October 1, 2011.**

Note: You can send the copy of your 2010 CCR and this certification form to the regional office at the same time. We are better able to identify and properly credit your water system when both documents are received together.

Certification for:

Water System Name CITY OF MABTON

Water System ID Number 49650R

Water System County YAKIMA

In compliance with the CCR requirements (WAC 246-290-72001 through 246-290-72012), I confirm that this CCR has been distributed to customers who use this water system, (and appropriate notice of availability has been given). I confirm that all information contained in this report is correct. I confirm that the CCR contains compliance monitoring data previously submitted to the Washington State Department of Health, Office of Drinking Water.

Certified by:

Signature Francisco Tijerina

Printed Name Francisco Tijerina

Phone 509-894-4096

Date 6/30/2011

Department of Health Office of Drinking Water
Regional Office Addresses

For water systems located in the following counties: **Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima**, send to:

Attn: Consumer Confidence Report
Washington State Department of Health
Office of Drinking Water
Eastern Regional Office
16201 E Indiana Ave Ste 1500
Spokane Valley WA 99216

Phone: (509) 329-2100
Fax: (509) 329-2104

For water systems located in the following counties: **Island, King, Pierce, San Juan, Skagit, Snohomish, and Whatcom**, send to:

Attn: Consumer Confidence Report
Washington State Department of Health
Office of Drinking Water
Northwest Regional Office
20435 - 72nd Ave S Ste 200
Kent WA 98032

Phone: (253) 395-6750
Fax: (253) 395-6760

For water systems located in the following counties: **Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Kitsap, Lewis, Mason, Pacific, Skamania, Thurston, and Wahkiakum**, send to:

Attn: Consumer Confidence Report
Washington State Department of Health
Office of Drinking Water
Southwest Regional Office
PO Box 47823
Olympia WA 98504-7823

Phone: (360) 236-3030
Fax: (360) 664-8058

If you need this publication in an alternate format, call (800) 525-0127. For TTY/TDD, call (800) 833-6388.

2010 CITY OF MABTON ANNUAL WATER QUALITY REPORT

Spanish (Espanol)

Este informe contiene informacion muy importante sobre la calidad de su agua potable. Por favor lea este informe o comuniquese con alguien que pueda traducir la informacion.

Is my water safe? YES

We are pleased to present this year's Annual Water Quality Report (Consumer Confidence Report) as required by the Safe Drinking Water Act (SDWA). This report is designed to provide details about where your water comes from, what it contains, and how it compares to standards set by regulatory agencies. This report is a snapshot of last year's water quality. We are committed to providing you with information because informed customers are our best allies.

Do I need to take special precautions? NO

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Water Drinking Hotline (800-426-4791).

Where does my water come from?

Your water comes from two municipal wells sunk approximately 700 to 1100 feet into an under ground aquifier.Both wells are on the south side of town:One at the govenors park corner of 6th and south street.Second is located at the corner of South Street and Boundary Road.The water is treated with chlorine prior to releasing into the main distribution system.

Source water assessment and its availability

Customers may obtain copies at city hall during business hours-8am-4:30pm Monday-Friday

Why are there contaminants in my drinking water?

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's (EPA) Safe Drinking Water Hotline (800-426-4791).

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity: microbial contaminants, such as viruses and bacteria, that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife; inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban stormwater runoff, industrial, or domestic wastewater discharges, oil and gas production, mining, or farming; pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses; organic Chemical Contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems; and radioactive contaminants, which can be naturally occurring or be the result of oil and gas production and mining activities. In order to ensure that tap water is safe to drink, EPA prescribes regulations that limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration (FDA) regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

How can I get involved?

Citizens may get involved by attending City Council Meetings,which are held 2nd and 4th Tuesdays of each month.

Description of Water Treatment Process

Your water is treated by disinfection. Disinfection involves the addition of chlorine or other disinfectant to kill dangerous bacteria and microorganisims that may be in the water. Disinfection is considered to be one of the major public health advances of the 20th century.

Water Conservation Tips

Did you know that the average U.S. household uses approximately 400 gallons of water per day or 100 gallons per person per day? Luckily, there are many low-cost and no-cost ways to conserve water. Small changes can make a big difference – try one today and soon it will become second nature.

- Take short showers - a 5 minute shower uses 4 to 5 gallons of water compared to up to 50 gallons for a bath.
- Shut off water while brushing your teeth, washing your hair and shaving and save up to 500 gallons a month.
- Use a water-efficient showerhead. They're inexpensive, easy to install, and can save you up to 750 gallons a month.
- Run your clothes washer and dishwasher only when they are full. You can save up to 1,000 gallons a month.
- Water plants only when necessary.
- Fix leaky toilets and faucets. Faucet washers are inexpensive and take only a few

minutes to replace. To check your toilet for a leak, place a few drops of food coloring in the tank and wait. If it seeps into the toilet bowl without flushing, you have a leak. Fixing it or replacing it with a new, more efficient model can save up to 1,000 gallons a month.

- Adjust sprinklers so only your lawn is watered. Apply water only as fast as the soil can absorb it and during the cooler parts of the day to reduce evaporation.
- Teach your kids about water conservation to ensure a future generation that uses water wisely. Make it a family effort to reduce next month's water bill!
- Visit www.epa.gov/watersense for more information.

Cross Connection Control Survey

The purpose of this survey is to determine whether a cross-connection may exist at your home or business. A cross connection is an unprotected or improper connection to a public water distribution system that may cause contamination or pollution to enter the system. We are responsible for enforcing cross-connection control regulations and insuring that no contaminants can, under any flow conditions, enter the distribution system. If you have any of the devices listed below please contact us so that we can discuss the issue, and if needed, survey your connection and assist you in isolating it if that is necessary.

- Boiler/ Radiant heater (water heaters not included)
- Underground lawn sprinkler system
- Pool or hot tub (whirlpool tubs not included)
- Additional source(s) of water on the property
- Decorative pond
- Watering trough

Source Water Protection Tips

Protection of drinking water is everyone's responsibility. You can help protect your community's drinking water source in several ways:

- Eliminate excess use of lawn and garden fertilizers and pesticides – they contain hazardous chemicals that can reach your drinking water source.
- Pick up after your pets.
- If you have your own septic system, properly maintain your system to reduce leaching to water sources or consider connecting to a public water system.
- Dispose of chemicals properly; take used motor oil to a recycling center.
- Volunteer in your community. Find a watershed or wellhead protection organization in your community and volunteer to help. If there are no active groups, consider starting one. Use EPA's Adopt Your Watershed to locate groups in your community, or visit the Watershed Information Network's How to Start a Watershed Team.
- Organize a storm drain stenciling project with your local government or water supplier. Stencil a message next to the street drain reminding people "Dump No Waste - Drains to River" or "Protect Your Water." Produce and distribute a flyer for households to remind residents that storm drains dump directly into your local water body.

Monitoring and reporting of compliance data violations

None

Additional Information for Lead

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. CITY OF MABTON WATER SYSTEM ID # 49650R is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

Unit Descriptions	
Term	**Definition**
NA	NA: not applicable
ND	ND: Not detected
NR	NR: Monitoring not required, but recommended.

Important Drinking Water Definitions	
Term	**Definition**
MCLG	MCLG: Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
MCL	MCL: Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
TT	TT: Treatment Technique: A required process intended to reduce the level of a contaminant in drinking water.
AL	AL: Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
Variances and Exemptions	Variances and Exemptions: State or EPA permission not to meet an MCL or a treatment technique under certain conditions.
MRDLG	MRDLG: Maximum residual disinfection level goal. The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
MRDL	MRDL: Maximum residual disinfectant level. The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
MNR	MNR: Monitored Not Regulated
MPL	MPL: State Assigned Maximum Permissible Level

For more information please contact:

Contact Name: FRANK TIJERINA
Address:
P.O. BOX 655
MABTON, WA 98935
Phone: (509)894-4096

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

CONSUMER CONFIDENCE REPORT CERTIFICATION FORM

For Calendar Year 2008 Reports due before July 1, 2009

You need to complete the following:

1. Mail or deliver copies of your 2008 CCR to your water system users **before July 1, 2009**. File a copy for your records.

2. Submit a copy of your CCR to the regional office for your county (addresses on back) **before July 1, 2009.**

3. Submit this completed certification form to the regional office **by October 1, 2009.**

Note: You can send both the copy of your 2008 CCR and this certification form to the regional office at the same time. We are better able to identify and properly credit your system when both documents are received together. However, the certification form must be received no later than **October 1, 2009.**

CERTIFICATION FOR:

Water System Name City of Mabton

Water System ID Number 49650R

Water System County YAKIMA

In compliance with the state Consumer Confidence Reporting regulations, I confirm that this CCR has been distributed to customers who use this water system, (and appropriate notice of availability has been given). I confirm that all information contained in this report is correct. I confirm that the CCR contains compliance monitoring data previously submitted to the Washington State Department of Health, Office of Drinking Water.

CERTIFIED BY:

Signature _____

Printed Name Velva Herrera

Phone 509-894-4096

Date 10-4-09

2009 CITY OF MABTON
ANNUAL WATER QUALITY REPORT

MABTON MEETS THE STANDARDS FOR SAFE DRINKING WATER IN YEAR 2009

The City of Mabton's water distribution system Reported **no violations** in meeting the standards for safe, clean water during 2009. It is a requirement that the water is teased monthly for contaminants and the city was in compliance all twelve months. In addition to the monthly testing, the Department Of Health requires that the water is tested for more Than 80 possible contaminants. These tests were last Performed in 1998 and 6 contaminants were detected And none exceeded acceptable levels as defined by the Environmental protection Agency (EPA) and Washington State. This test will be performed this year and any Violations will be posted in the Daily Sun newspaper.

SAFE WATER

Drinking water, including bottled water, may reasonably Be expected to contain at least small amounts of some Contaminants. The presence of contaminants does not Necessarily indicated that water poses a health risk. To Ensure that tap water is safe to drink, the EPA"s regulations. The Food and Drug Administration regulations establish Limits for contaminants in bottled water, which must Provide the same protection for Public Health. For more Information about contaminants and potential health effects Call the Environmental Protection Agency's Safe Drinking Water Hotline. (800-426-4791).

Este informe contiene informacion muy importante.
Traduscalo o hable con alquien que to entienda bien.

WATER SOURS

the sources for drinking water included rivers, lakes, streams, ponds, reservoirs, springs and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and radioactive material, and it picks up substances that result from animal and/or human activity.

WATER ORIGINS

Your water comes from two municipal wells sunk approximately 700 to 1100 feet into an under ground aquifer. Both wells are on the south side of town: one at the governors Park corner of 6th and South Street. Second is located at the corner of South Street and Boundary Road. The water is treated with chlorine prior to Releasing into the main distribution system.

INFORMATION

Citizens can obtain additional in Formation by attending City Council meetings, which are held 2nd & 4th Tuesdays of each month.

2009 CITY OF MABTON
ANNUAL WATER QUALITY REPORT

The following table lists all the drinking water contaminants that were detected during the 2006 calendar year. The presence of these contaminants in the water does not necessarily indicate that the water poses a health risk. The state requires us to monitor for certain contaminants less than once per year because the concentrations of these contaminants are not expected to vary significantly from year to ear. These tests will be performed again this year.

RADIOACTIVE CONTAMINANTS	MCL	MCLG	DETECTED	SOURCE OF CONTAMINANT
Beta/photon emitters (pCi/L)	50	0	9	Decay of natural & man made Deposits
Alpha emitters (pCi/L)	15	0	8	Erosion of natural deposits
INORGANIC CONTAMINANTS				
Fluoride	4	4	0.39	Erosion of natural deposits/water Additive to promote strong teeth
Lead (ppb)	**n/a**	0	< 0.0005	Corrosion of household Plumbing
Nitrate (ppm)	10	10	0	Runoff from fertilizer use Erosion of natural deposits

TERMS & ABBREVIATIONS USED ABOVE:

Nd = Not Detected AL – Action Level ppm = part per million
Ppb = parts per billion pCi/L = picocuries per liter (measure of radiation)
MCLG = Maximum Contaminant Level Goal: the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLG's allow for a margin of safety.
MCL = Maximun Contaminant Level: the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLs as feasible using the best available treatment technology.

SOME INDIVIDUALS MAY BE MORE VULNERABLE to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people elderly and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by **CRYPTOSPORIDIUM** and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791)

The state and EPA require us to test our water on a regular basis to ensure its safety. The results of these tests are forward to the State. The test results are available at City Hall for any residents who would like to review them.

L

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

received 7-1-08

CONSUMER CONFIDENCE REPORT CERTIFICATION FORM

For Calendar Year 2007 Reports due before July 1, 2008

You need to complete the following:

1. Mail or deliver copies of your 2007 CCR to your water system users **before July 1, 2008.** File a copy for your records.
2. Submit a copy of your CCR to the regional office for your county (addresses on back) **before July 1, 2008.**
3. Submit this completed certification form to the regional office **by October 1, 2008.**

Note: You can send both the copy of your 2007 CCR and this certification form to the regional office at the same time. We are better able to identify and properly credit your system when both documents are received together. However, the certification form must be received no later than **October 1, 2008.**

CERTIFICATION FOR:

Water System Name City of Mabton

Water System ID Number 49650 R

Water System County Yakima

In compliance with the state Consumer Confidence Reporting regulations, I confirm that this CCR has been distributed to customers who use this water system, (and appropriate notice of availability has been given). I confirm that all information contained in this report is correct. I confirm that the CCR contains compliance monitoring data previously submitted to the Washington State Department of Health, Office of Drinking Water.

CERTIFIED BY:

Signature

Printed Name Ubaldo Herrera

Phone 509-894-4096

Date 6-30-08

DOH Form #331-203 (Rev. 02/08)

Ref

2009

need to be done This Month

2007 CITY OF MABTON
ANNUAL WATER QUALITY REPORT

MABTON MEETS THE STANDARDS FOR SATE DRINKING WATER IN YEAR 2007

The City of Mabton's water distribution system reported no violations in meeting the standards for safe, clean water during 2007. It is a requirement that the water is tested twice a month for contaminants. In addition to monthly testing for coliforms, the City of Mabton is testing monthly for nitrates as well three, which is naturally high in nitrates was taken off line this well is only going to be used for emergency only. State and federal regulations require quarterly testing but The city is testing monthly to assure compliance with the Environmental Protection Agency (EPA) regulations. If a Violation were detected in our water tests, it would be posted In the Daily Sun newspaper and at the post office.

SAFE WATER

Drinking water, including bottled water, may reasonably be expected to contain at least small amount of contaminants, The presence of contaminants does not necessarily indicate that water poses a health risk. To ensure that tap water is safe to drink, the EPA prescribes regulation, which limit the amount of certain contaminants in water provided by public water systems. We treat and test our water according to EPA's regulations. The Food and Drug Administration regulations establish limits for Contaminants in bottled water, which must provide the same Protection for public health. For more information about contaminants and potential Protection Agency's Safe Drinking Water Hotline. (800-426-4791).

Este informe contiene informacion muy Importante. Traduscalo o hable con alguien que To entienda bien.

WATER SOURCES

The sources for drinking water include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally Occurring minerals and radioactive material, and it picks up substances that result from animal and/or human activity.

WATER ORIGINS

Your water comes from two municipal wells sunk approximately 700 to 1100 feet into an underground aquifer. The wells are on the south side of town: Well 5 is located on corner of 6th and south street Well 4 is located on boundary and south street. The water is

releasing into the main distribution system.

INFORMATION

Citizens can obtain additional information by attending City Council meetings, which are held on 2nd & 4th Tuesdays of each month.

2007- ~~2006~~ CITY OF MABTON
Annual Water Quality Report

The following table lists all the drinking water contaminants that were detected during the 2007 calendar year. We are required to test for the following contaminants every three years. The presence of these contaminants in the water does not necessarily indicate that the water poses a health risk. The state requires us to monitor for certain contaminants less than once per year because the concentrations of these contaminants are not expected to vary significantly from year to year.

RADIOACTIVE CONTAMINANTS	MCL	MCLG	DETECTED	SOURCE OF CONTAMINANT
Beta/photon emitters (pCi/L)	50	0	ND	Decay of natural & man made deposits
Alpha emitters (pCi/L)	15	0	ND	Erosion of natural deposits
INORGANIC CONTAMINANTS				
Fluoride	4	4	ND	Erosion of natural deposits/water Additive to promote strong teeth
Lead (ppb)	AL=15	0	ND	Corrosion of household Plumbing
Nitrate (ppm)	10	10	ND	Runoff from fertilizer use
Selenium (ppb)	50	50	ND	Erosion of natural deposits
Nitrate (ppm) YR 2006	10	10	ND	Runoff from fertilizer use

TERMS & ABBREVIATIONS USED ABOVE:

Nd = Not Detected AL = Action Level ppm = parts per million
Ppb = parts per billion pCi/L = picocuries per liter (measure of radiation)
MCLG = Maximum Contaminant Level Goal: the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLG's allow for a margin of safety.
MCL = Maximum Contaminant Level: the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

SOME INVIDIVUALS MAY BE MORE VULNERABLE to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by ***CRYPTOSPORIDIUM*** and other microbial contaminants are available from the Safe Drinking Water Hotline (800-426-4791)

The state and EPA require us to test our water on a regular basis to ensure its safety. The results of these tests are forwarded to the State. The test results are available at City Hall for any resident who would like to review them.

2007 CITY OF MABTON
ANNUAL WATER QUALITY REPORT

MABTON MEETS THE STANDARDS FOR SATE DRINKING WATER IN YEAR 2007

The City of Mabton's water distribution system reported no violations in meeting the standards for safe, clean water during 2007. It is a requirement that the water is tested twice a month for contaminants. In addition to monthly testing for coliforms, the City of Mabton is testing monthly for nitrates as well three, which is naturally high in nitrates was taken off line this well is only going to be used for emergency only. State and federal regulations require quarterly testing but The city is testing monthly to assure compliance with the Environmental Protection Agency (EPA) regulations. If a Violation were detected in our water tests, it would be posted in the Daily Sun newspaper and at the post office.

SAFE WATER

Drinking water, including bottled water, may reasonably be expected to contain at least small amount of contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. To ensure that tap water is safe to drink, the EPA prescribes regulation, which limit the amount of certain contaminants in water provided by public water systems. We treat and test our water according to EPA's regulations. The Food and Drug Administration regulations establish limits for Contaminants in bottled water, which must provide the same Protection for public health. For more information about contaminants and potential Protection Agency's Safe Drinking Water Hotline. (800-426-4791).

Este informe contiene informacion muy Importante. Traduscalo o hable con alguien que lo entienda bien.

WATER SOURCES

The sources for drinking water include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally Occurring minerals and radioactive material, and it picks up substances that result from animal and/or human activity.

WATER ORIGINS

Your water comes from two municipal wells sunk approximately 700 to 1100 feet into an underground aquifer. The wells are on the south side of town: Well 5 is located on corner of 6th and south street Well 4 is located on boundary and south street. The water is

releasing into the main distribution system.

INFORMATION

Citizens can obtain additional information by attending City Council meetings, which are held on 2nd & 4th Tuesdays of each month.

APPENDIX U

DOH BLENDING APPROVAL LETTER

WATERLINE SPECIFICATIONS

1 WATER PIPE

1.1 GENERAL

The work covered in this section shall include the furnishing, installation, and testing of the water piping, valves, tees, fittings, and other appurtenances and incidental work required to construct the water facility as shown on construction plans and in accordance with Washington State Standard Specifications 7-09 through 7-15, and as herein modified.

In case of discrepancies between the two different specifications, following is the order of procedure:

A. These City of Mabton Waterline Specifications.

B. Washington State Standard Specifications.

1.2 APPROVED PIPE

POLYVINYL CHLORIDE (PVC) PIPE shall conform to the requirements of AWWA designation C900 for Class 150 (DR18).

1.3 PIPE COUPLING

POLYVINYL CHLORIDE PIPE COUPLING shall be integral bell and spigot with elastomeric gasket seals, and shall be "Ring-Tite" as manufactured by Johns-Manville, or an approved equal.

1.4 INSTALLATION

Pipe shall be installed in accordance with the manufacturer's specifications for the type of approved pipe used. The Contractor shall construct the pipeline in accordance with the requirements of Standard Specifications 7-10 and 7-11 as herein modified.

1.5 TRENCH EXCAVATION AND BACKFILL

Trench excavation for water line construction shall be in accordance with Standard Specification 7-10.3(7) and shall provide a minimum of 42 inches of cover material over the top of the finished pipe grade. Trench backfill material shall be compacted by means approved by the Engineer, as required to preclude future settlement and to achieve a minimum of 95 percent maximum density when tested in accordance with Standard Specification 7-10.3(11). Hand operated jumping jacks or shoe type mechanical tampers will not be approved.

Trench excavation shall be unclassified unless rock excavation is listed as a separate pay item.

WATERLINE SPECIFICATIONS

1.6 PIPE LOCATOR RIBBON

Pipe locator ribbon is required by City of Mabton at a depth of 18 inches below ground surface.

1.7 TRACER WIRE

The Contractor shall install a tracer wire over all nonmetallic water mains. The tracer wire shall be #14 gauge copper wire with UF insulation, colored blue. The tracer wire shall be installed as shown on the detail included herein. Access points shall be provided at valve boxes, air release and blow-off installations.

1.8 DISINFECTION

The disinfection of new water lines, including all connections and appurtenances, shall be in accordance with Standard Specification 7-11.3(12) as herein modified. Water test points shall be at typical intervals of 500 to 800 feet or as approved by the Engineer. Sanitation test samples can be taken at fire hydrants and temporary blow-offs when available. When not available, a corp stop shall be installed by the Contractor at the nearest service location. The Engineer shall submit written notification to the City indicating the results of the sanitation tests to the City, including copies of the test results from a certified laboratory.

1.9 PRESSURE TESTING

The pressure testing of new water lines, including all connections and appurtenances, shall be in accordance with Standard Specification 7-11.3(11) as herein modified. The hydrostatic test pressure for all types of pipe to be tested shall be 150 psi. The Engineer shall submit written results of the pressure testing to the City. The results shall include the section of pipe tested, the length of the test and beginning and ending pressures.

1.10 TRENCH SAFETY SYSTEMS

All trench excavation which will exceed a depth of four feet shall have adequate safety systems for the trench excavation that meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW. The Contractor shall be fully responsible for providing the necessary back sloping, cribbing, trench boxes, etc., as required to meet the specified safety requirements for the trench.

1.11 MEASUREMENT AND PAYMENT

The unit contract price for each size of "Water Line," per linear foot when measured continuously along the pipe centerline, including the distances through structures, valves, and fittings, shall be full compensation for furnishing all labor, equipment, and materials, to trench, dewater, compact and backfill, lay and joint the pipe, make connections to existing stub lines, specified or required

salvage, test, disinfect, and all other incidentals required to perform the work in accordance with the plans and specifications or as directed by the Engineer.

Cost for Trench Safety Systems, if required, shall be paid for as a separate bid item.

2 ROCK EXCAVATION

2.1 GENERAL

When provided for in the bid proposal, a separate measurement and payment will be made for rock excavation. Rock excavation shall include solid rock formations requiring systematic drilling and blasting with explosives and any boulders or broken rock larger than one-half cubic yard in volume. Hardpan or cemented gravel, even though it may be advantageous to use explosives in its removal, shall not be classified as solid rock excavation. The bottom of the trench shall be brought up to grade by backfilling with selected backfill material and be compacted to the satisfaction of the Engineer.

The Contractor shall notify the Engineer at least 24 hours prior to any blasting. All blasting shall be done in accordance with local, county, and state regulations governing this class of work. Any damage to persons or property resulting from blasting operations shall be the sole responsibility of the Contractor and his surety.

2.2 MEASUREMENT

The measurement for "Rock Excavation" shall be made as follows:

2.2.A. LENGTH

Length will be the entire horizontal distance where rock is encountered measured on a linear foot basis along centerline of trench.

All water line structures; i.e., valve pits, transmission line blow-offs, pressure reducing stations, etc., will be excluded and will be measured separately. Measurement will commence at the first location where rock is encountered and continue to the point where the rock terminates.

2.2.B. WIDTH

The trench width for payment of rock excavation shall be as follows:

Size of Pipe	Pay Width of Trench

WATERLINE SPECIFICATIONS

4" - 15"	2.5 feet
18" - 36"	Outside pipe diameter plus 12"
42" & larger	Outside pipe diameter plus 24"

2.2.C. DEPTH

Measurement for depth will be the vertical distance from six inches (6") below the pipe invert to the top of the solid rock strata. Depth will be measured at intervals of 25 feet along centerline of trench, beginning at the first location that solid rock is encountered, and the average depth between measuring points will be the depth used for computing depth of rock.

2.2.D. ROCK EXCAVATION FOR STRUCTURES

Rock excavation quantities for water line structures; i.e., valve pits, transmission line blow-offs, pressure reducing stations, etc., shall be computed on a cubic yard basis from the actual profile depth as noted above, multiplied by the area within a line parallel to and one foot (1') outside of the actual dimensions of the structure base.

2.3. PAYMENT

The unit contract price for "Rock Excavation," per cubic yard, shall be paid in addition to the payment for "Water Line Pipe," per linear foot. Payment for rock excavation shall be full compensation for all work necessary to excavate and dispose of the rock material. No payment will be made for rock excavated below required grade or outside the widths mentioned above.

3 PIPE BEDDING

3.1 GENERAL

It is the intent of these specifications to use select native material from the site for backfill around the water main pipe. When unsuitable native material exists or is encountered during trench excavation, imported bedding material may be required by the Engineer, depending on the type of pipe being installed and the type of materials encountered. Where directed by the Engineer, the Contractor shall furnish and place imported pipe bedding.

3.2 NATIVE BEDDING MATERIALS

Select native material used for bedding pipes shall meet the requirements of Standard Specification 9-03.12 as herein modified. The minimum sand equivalent shall be 50. Select native material shall be free of organic materials, lumps, rocks and pavement chunks and shall meet the approval of the Engineer.

WATERLINE SPECIFICATIONS

3.3 IMPORTED BEDDING MATERIALS

Imported pipe bedding for pipes shall be in accordance with Standard Specification 9-03.12 as herein modified. The minimum sand equivalent shall be 50.

3.4 COMPACTION

The bedding material shall be placed and compacted in lifts not to exceed six inches (6"). The pipe bedding shall be compacted to not less than 95 percent of maximum density. Compaction shall be done in such a manner as to preclude future settlement.

3.5 MEASUREMENT

Measurement for payment shall be by the linear foot for imported bedding material incorporated in the project.

3.6 PAYMENT

The unit contract price for "Imported Pipe Bedding," per linear foot, shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to the installation of bedding material in accordance with the plans and specifications or as directed by the Engineer.

Select native materials, which are acceptable as bedding and utilized as bedding, shall be considered as incidental to the pipe installation and no additional payment will be made for its use as imported pipe bedding.

WATERLINE SPECIFICATIONS

4 FIRE HYDRANT ASSEMBLIES

4.1 GENERAL

Installation of fire hydrants shall conform to the requirements of the detail included herein and Standard Specification 7-14 as herein modified. Hydrants shall be three (3) port fire hydrants, as described in Section 4.2 of these specifications.

4.2 MATERIALS

Fire hydrants shall meet AWWA C502 and be dry top, break-away type. The hydrants shall allow for three (3) feet of cover over the inlet pipe and be traffic yellow in color. The main valve opening shall be five and one-quarter (5-1/4) inches. The shoe inlet shall be six (6) inches, MJ connection. Hydrants shall be equipped with two (2) two and one-half (2-1/2) inch hose nozzles and one (1) four and one-half (4-1/2) inch pumper nozzle with threads conforming to national standard thread. The operating nut shall be one and one-half (1-1/2) inch pentagon nut that opens left. Hydrants shall be equipped with bronze upper valve plate, bronze seat ring, and bronze drain ring. They shall have a self lubricating oil reservoir, sealed by dual "O" rings and equipped with an anti-friction washer and weather cap. Nozzle caps shall be attached to upper barrel with individual non-kinking chains. Bonnet and lower barrel flanges shall be concealed. The breakaway safety stem shall be recessed within hydrant barrel. The hydrants shall be Mueller Centurion A-423 or an approved equal. Any vertical adjustment shall be manufactured specifically for the hydrant used. When not protected by a curb, hydrants shall be protected by guard posts.

Fire hydrants shall be painted OSHA Safety Yellow above ground line. The hydrant waste orifice at the base of the hydrant shall be bronze and connected to the hydrant by means of a bronze on bronze fitting to prevent rust and normal soil corrosion from plugging or interfering with its operation. Hydrants shall be of standard manufacture and of a pattern approved by the Owner. The name or mark of the manufacture, size of the valve opening, and year made shall be plainly cast in raised letters and so placed on the hydrant barrel as to be visible after the hydrant has been installed.

The vertical adjustment assemblies shall be complete, including the flanged riser, stem and all required components to provide a complete adjustment kit.

All associated valves, valve boxes, fittings and thrust blocks installed under the "Fire Hydrant Assembly" shall be in conformance with Section 7 of these specifications.

4.3 INSTALLATION

Fire hydrants shall be installed according to Standard Specification 7-14 as herein modified, and the detail included herein. Fire hydrants shall be located as shown on the plans. Where conflicts

or conditions require deeper than standard bury, the Contractor shall provide an extra deep hydrant or add an adjustment to the standard hydrant. The following requirements shall prevail for the installation of the fire hydrant:

4.3.A The bottom of the lowest port shall be a minimum of eighteen inches (18") above the top of the finished surface of existing or future sidewalk.

4.3.B Hydrants are to be free of vegetation and barriers for a three foot (3') radius circle measured from the operating nut.

4.3.C Fire hydrants are to be hooded until operable and accepted.

4.3.D Valves on mains to hydrants shall be bolted directly to the tee serving the hydrant.

4.3.E Valves servicing fire hydrants on any fire line shall be installed as per fire hydrant installation detail included herein.

4.3.F Guard post shall be installed if the hydrant is not protected by a curb.

4.3.G Salvage shall be completed per these specifications, Section 19.

4.4 MEASUREMENT

Measurement for fire hydrant assembly shall be per each assembly. An assembly includes: the main line tee with flanged coupling adapters (when required), blocking for tee and hydrant, six inch (6") gate valve and valve box, six inch (6") connecting pipe, shackles, tie rods, pier blocks, coarse gravel, painting, and any other items that are required for the complete installation of the hydrant as specified. Measurement for a 6-inch or 12-inch hydrant vertical adjustment assembly installed when directed by the Engineer, shall be per each assembly complete in place, or in lieu of, the Contractor may at his option, provide an extra depth bury hydrant as the location requires. Measurement will be made for the hydrant bury greater than the standard 4'-0" bury, only when made necessary by conflicting utilities or by the grade of the ground at the hydrant location. Measurement will be made per each for "Fire Hydrant Guard Post" when required.

4.5 PAYMENT

The unit contract price for 6-inch or 12-inch hydrant vertical adjustment assembly, "Fire Hydrant Guard Post," "Fire Hydrant Assembly," per each, shall be full compensation for all necessary labor, materials, tools, and equipment to install the adjustment or the fire hydrant assembly in place, complete, including adjusting of the valve box to the finished grade in accordance with the plans and specifications or as directed by the Engineer.

WATERLINE SPECIFICATIONS

5 BLOW-OFF ASSEMBLY

5.1 GENERAL

This specification covers the construction and installation of a two inch (2") blow-off assembly to allow for the controlled flushing of water from the water distribution system.

5.2 MATERIALS AND CONSTRUCTION

With the exception of temporary installations, all materials used shall be new and assembled in accordance to the requirements of the detail included herein and the following requirements:

5.2.A Pipe shall be galvanized steel, Schedule 40, threaded by couple ends, and shall meet the requirements of ASTM designation A 120.

5.2.B Fittings shall be standard dimension, galvanized, malleable iron, manufactured in accordance with the requirements of ASTM 197, and capable of withstanding a working pressure at 150 psi.

5.2.C Gate valve shall be flanged with a nonrising two-inch square operating nut, counter-clockwise opening, similar or equal to the M&H Style 67-02.

5.2.D Valve boxes shall be as specified in Section 7.2.D of these specifications.

5.2.E Tapping saddle shall be a double strap saddle similar and equal to the Rockwell Model 313.

5.3 MEASUREMENT AND PAYMENT

The unit contract price for "Two-Inch Blow-Off Assembly," or "Temporary Two-Inch Blow-Off Assembly," per each, shall be full compensation for furnishing all labor, materials, equipment, trenching and backfill, valves, fittings, thrust blocks, adjusting the valve boxes to finished grade, all other incidentals required to install the complete blow-off assembly in place, including tapping into the water main and removal of the temporary installations.

6 AIR AND VACUUM RELEASE ASSEMBLY

6.1 GENERAL

This specification covers the construction and installation of an air and vacuum release assembly to allow for the automatic venting of air into and out of a water line during times when the line is being emptied or filled with water.

WATERLINE SPECIFICATIONS

6.2 MATERIALS AND CONSTRUCTION

All materials used shall be new and assembled in accordance to the requirements of the detail included herein and the following requirements:

6.2.A Pipe shall be galvanized steel, Schedule 40, threaded by couple ends, and shall meet the requirements of ASTM designation A120.

6.2.B Street elbows shall be standard dimension, galvanized, malleable iron, manufactured in accordance with the requirements of ASTM 197, and capable of withstanding a working pressure of 150 psi.

6.2.C Tapping saddle shall be a stainless steel, double strap saddle similar and equal to the Smith Blair 331.

6.2.D Gate valve shall be flanged with nonrising two-inch (2") square operating nut, counter-clockwise opening similar and equal to the M&H Style 67-02.

6.2.E Pipe coupling device shall be similar and equal to the Dresser Style 38.

6.2.F Air and vacuum valve shall have a cast iron body, cover and baffle with a stainless steel float and a Buna N seat. All internal parts such as float guides, bushings, and baffle retaining screws shall be either stainless steel or bronze. The valve shall be similar and equal to APCO No. 144, and shall be capable of handling operating pressures of 150 psi.

6.3 MEASUREMENT AND PAYMENT

The unit contract price for "Air and Vacuum Release Assembly," per each, shall be full compensation for furnishing all labor, materials, equipment, trenching and backfill, valves, fittings, valve chamber, and all other incidentals required to install the complete air and vacuum assembly in place, including tapping into the water main.

7 VALVES, VALVE BOXES AND FITTINGS

7.1 GENERAL

This specification covers all valves, valve boxes, and water line fittings (tees, elbows, crosses, blocks, etc.) necessary as indicated on constuction plans. All valves shall be bolted to tees and fittings unless otherwise specified.

7.2 MATERIALS

WATERLINE SPECIFICATIONS

7.2.A BUTTERFLY VALVES: Valves larger than twelve inches (12") shall be butterfly valves.

All butterfly valves shall conform to the AWWA Standard for "Rubber Seated Butterfly Valves," (AWWA C504), and shall meet the following requirements:

7.2.A.1 Valves shall be Class 150-B and shall open counter-clockwise with a standard two inch (2") square nonrising operator nut.

7.2.A.2 Flanged valves shall be furnished with flanges faced and drilled to 150 pound American Standard dimensions and, unless otherwise specified or shown on the drawings, may be either short-bodied or long-bodied.

7.2.A.3 Shaft seals shall be designed for use with standard split V type packing.

7.2.A.4 Valve discs shall be manufactured from material listed in 7.2 of the above referenced AWWA Standard.

Prior to the installation of all rubber seated valves, the Contractor shall lubricate the seat with Molykote Valve Seal, Catalog No. 98750-56, as manufactured by Dow-Corning, or approved equal.

7.2.B RESILIENT SEATED GATE VALVES

All valves twelve inches (12") and smaller shall be resilient seated gate valves.

The resilient seated gate valves shall conform to the requirements of AWWA C509. The valve shall open counter-clockwise with a two-inch (2") square nonrising operator nut. The ductile iron gate valve wedge or gate member shall be fully encapsulated in synthetic rubber. All seating surfaces within the valve body shall be inclined to the vertical, the valve stem shall be sealed by a minimum of two (2) O-rings and all stem seals shall be replaceable with the valve wide open and subjected to full rated pressure.

The valve body and bonnet shall be epoxy coated inside and out. The waterway shall be smooth and shall have no depressions or cavities in the gate seating area.

Resilient seated gate valves shall meet the above specifications and shall be Clow R/W, Waterous Series 500, Kennedy Ken-Seal, Mueller, Dresser M&H Style 3067, unless otherwise specified in the contract Special Provisions.

7.2.C TAPPING VALVES

The Contractor shall be required to install resilient seated gate valves when making 4-

inch to 12-inch live taps on mains. The resilient seated gate valves shall be in accordance with the requirements of Section 7.2.B of these specifications and shall be installed in a manner meeting the Engineer's approval.

7.2.D VALVE BOXES

Cast iron sliding type adjustable valve boxes with covers shall be provided for all buried valves. Valve boxes shall consist of top and bottom section with slide type extensions and large bottom base where specified. Drop type cover shall be marked "WATER." In unpaved areas, valve boxes shall be provided with a six-inch (6") thick concrete collar, 30 inches square at the ground surface. Valve boxes and covers shall be "Tyler No. 6855" series, or a foreign-made clone equal in all dimensions and weight. The cover shall have a skirt length of 1-1/2 inches minimum, a total lid depth of 3-1/2 inches minimum, and a lid weight of minimum 13 pounds. Valve boxes shall be installed as shown on the detail included herein.

7.2.E FITTINGS

Fittings for ductile iron and PVC pipe shall be cast or ductile iron. Cast iron fittings shall conform to the quality and wall thickness specified in the American Standard for "Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch for Water and Other Liquid" (AWWA C110), for "Fluid-Tite" joints specified in Section 1. All cast iron fittings, twelve inches (12") in diameter or larger, shall be lined with cement mortar in accordance with the requirements of the American Standard for "Cement Mortar Lining for Cast Iron and ductile Iron Pipe and Fittings for Water" (AWWA C104).

Ductile iron fittings shall be compact or standard bell and spigot, mechanical joint, or flanged as required on the plans. Standard fittings shall be in accordance with AWWA C110, "Gray Iron and Ductile Iron Fittings, 3 inch through 48 inch for Water and Other Liquids." Ductile iron compact fittings may be used in sizes through 12-inches. The fittings shall conform to all requirements of AWWA Standard C153 for ductile iron compact fittings 3-inch through 12-inch. The bell and spigot joints shall be rubber gasket sealed joints in accordance with AWWA C111. Ductile iron fittings, twelve inches (12") inside diameter or greater, shall be mortar lined in accordance with AWWA C104.

Cut-in tees and live tap tapping sleeves shall be as directed by the Engineer.

7.2.F THRUST BLOCKING

Concrete blocking shall be installed in accordance with the detail included herein and shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints of pipe or fitting. An 8 mil polyethylene sheet, or two layers of 4 mil, shall be placed between the fitting and the

thrust block.

7.3 INSTALLATION

Installation of valves, boxes, and fittings shall be in accordance with Standard Specifications 7-11 and 7-12 as herein modified.

7.3.A All valves are to be bolted directly to the tees or crosses as indicated in the plan. The flanges on valves and tees (or crosses) shall be plain faced. Flanges shall be faced and drilled to 150 pound American Standard dimensions.

7.3.B All other connections between pipe and fittings, or pipe and valve shall be flexible coupling, "Ring-Tite," "Fluid Tite," or approved equal, except as noted otherwise for installation of a cut-in tee where flanged coupling adaptors shall be used to connect the tee to the existing main.

7.4 MEASUREMENT

Valves and associated valve boxes, including their adjustment to finished grade, shall be considered as one item and shall be measured per each according to size of valve. All fittings shall be measured per each according to size and type. All valves, thrust blocks and fittings which are included in the unit items for "Fire Hydrant Assembly," "Blow-off Assembly," etc., shall be measured and paid as incidental to those unit items and no additional payment will be made for them.

7.5 PAYMENT

The unit contract price for each size of "Valve," per each, and each type and size of "Fitting," per each, shall be full compensation for furnishing all necessary labor, equipment, and materials, concrete thrust blocks, and all other incidentals required to install all valves and fittings in place in accordance with construction plans and these specifications or as directed by the Engineer.

When constructed in conjunction with a paving project, a separate measurement and payment will be made for adjusting to grade, after completion of paving, as per Section 8 of these specifications.

WATERLINE SPECIFICATIONS

8 ADJUST EXISTING AND NEW CASTING TO GRADE

8.1 GENERAL

When constructed in conjunction with a street construction project or pavement overlay, existing and new water valve boxes, air release and blow-off assembly castings, which are required to be adjusted to finished grade, shall be adjusted in accordance with the local street authority.

Where the new water valve boxes fall outside of the pavement restoration limits, in unpaved areas, the box shall be adjusted to conform to the adjoining grade and set in a 30" X 30" X 8" - thick concrete collar.

8.2 MEASUREMENT AND PAYMENT

All costs for the specified adjustments shall be considered incidental to the water line installation pay items provided in the bid proposal.

9 SALVAGE

9.1 GENERAL

All existing tees, valves, boxes, fire hydrants and miscellaneous fittings to be abandoned during construction, shall be removed by the Contractor for City salvage.

9.2 MEASUREMENT AND PAYMENT

Salvage of existing water line appurtenances shall be considered incidental to the unit contract price for "Water Line" and no additional compensation shall be allowed.

10 SCHEDULED WATER LINE SHUT DOWN

10.1 GENERAL

The Contractor shall give the City a 72-hour notice of required water line shut down. The Contractor shall verify that all required fittings necessary for connection are secured and in hand prior to scheduling shut downs. The Contractor shall be billed for cancelled shut downs, unless circumstances beyond the Contractor's control (as determined by the Engineer), have caused the Contractor to cancel the shutdown.

11 VALVE OPEN/CLOSE POLICY

WATERLINE SPECIFICATIONS

11.1 GENERAL

The City shall open/close all existing water line valves and new valves connected to existing water line at the Contractor's request. When a water line valve connected to the existing system is open, the Contractor shall, at all times, keep at least one downstream flow open to prevent back draw. Prior to the Contractor shutting down all of the downstream flows, the water line valve connected to the existing system must be closed. The Contractor shall provide reasonable notice to the Owner of the water system of the need for opening and closing valves.

12 TIE-IN TO EXISTING WATER LINES

12.1 GENERAL

Tie-in to the existing water lines and the installation of the required fittings and water line shall be under the direct observation of the Owner and the Engineer. Work shall not be started until all the materials, equipment, an labor necessary to properly complete the work are assembled on site. Extreme care shall be taken by the Contractor to keep the existing water lines and new fittings and water line clean and free from contaminates. The inside surfaces of the valve, pipe and fittings shall be thoroughly swabbed with, or filled with, a 75-parts per million chlorine solution 24 hours prior to the installation of all fittings. The fittings and water line shall be kept in a clean environment and delivered to the site within a protective covering. The fittings and waterline shall be swabbed again with the 75-parts per million chlorine solution just prior to their installation.

12.2 MEASUREMENT AND PAYMENT

All necessary labor, tools, dewatering, chlorine swabbing and incidentals as required to cut into existing water mains or remove existing fittings and valves as called for on the plans, shall be considered incidental to the unit contract price for water line, per linear foot, or fittings as allowed in the bid proposal.

13 COUPLINGS AND FLANGE COUPLING ADAPTERS

13.1 GENERAL

Couplings and flange coupling adapters shall be manufactured from cast iron and rated at a minimum of 150 psi. The minimum overall length shall be nine (9) inches and the minimum middle ring length shall be five (5) inches. Bolts shall be galvanized steel or cast-iron protected.

14 DIG AND VERIFY

WATERLINE SPECIFICATIONS

14.1 GENERAL

At the connection with existing water lines where shown and directed on the plans and as otherwise directed by the Engineer, the contractor shall expose and verify the exact pipe location, type, size and fittings required prior to ordering the fittings. After digging and verifying, the Contractor shall backfill, compact and cold patch the surfacing. Contractor shall provide the necessary traffic control and safety measures.

14.2 MEASUREMENT AND PAYMENT

The unit contract price for "Digging and Verifying," per each, shall be full compensation for all labor, materials, equipment and incidentals necessary to dig, verify, backfill, compact, provide traffic control and cold patch in accordance with construction plans and these specifications or as directed by the Engineer.

15 ADDITIONAL/ALTERNATE FITTINGS

15.1 GENERAL

Where a standard or specified fitting cannot be obtained or is not readily available, and the Contractor is required to add an MJ adapter to the fitting, the MJ adapter shall be separately paid for under the bid items for "Flange Adapter."

Elbows where noted on the plan sheet are indicated to the degree of bend that appears to fit best. The Contractor shall have the same diameter elbows of various degrees available for installation. If actual field conditions dictate that a degree of bend other than the one noted should be installed, the Contractor shall install the required fitting. Measurement and payment for "**-inch Elbow," per each, shall be full compensation for the actual degree of elbow installed as specified.

If fittings specified for an installation are not readily available, and involve revisions other than the addition of an MJ adapter, the Contractor may, when approved by the Engineer, install alternate fittings that complete the installation in the same manner. Alternate fittings, if used, will be measured and paid for by the unit bid price for the fittings that were specified for the installation.

WATERLINE SPECIFICATIONS

16 PRESSURE CAPS

16.1 GENERAL

Where specified on the construction plans or where directed by the Engineer as required by construction, the Contractor shall pressure cap and thrust block existing water lines. All work and materials shall be in accordance with these specifications.

16.2 MEASUREMENT AND PAYMENT

The unit contract price for "1-Inch to 4-Inch Pressure Cap," or "6-Inch to 8-Inch Pressure Cap," or "10-Inch to 16-Inch Pressure Cap," per each, shall be full compensation for all labor, equipment, materials and incidentals necessary to complete the pressure cap in accordance with construction plans and these specifications or as directed by the Engineer.

17 SIDE SEWER REPAIR

17.1 GENERAL

Although every effort has been made to show potential conflict with sewer services, the exact depth and location of sewer services are not known. The Contractor shall make every effort to prevent damage to sewer services. When sewer services are inadvertently broken or damaged, the Contractor shall repair the side sewer by installing a section of Schedule 40 ABS sewer pipe. The repair section of pipe shall be placed a minimum one foot into the trench walls to provide a solid foundation for the crossing of the new trench. The pipe ends shall be connected using repair clamps. Repair clamps shall be a flexible coupling with stainless steel clamps and shall be Fernco flexible couplings or approved equal. The area under the side service connection shall be bedded with compacted 5/8-inch minus top course rock. When directed by the Engineer or where rocky soils, unstable soils, or other conditions exist, where it may be difficult to detect a damaged side service, water shall be run from the home toilet or other source, to insure that all of the side services are undamaged, prior to beginning backfill operations.

17.2 MEASUREMENT AND PAYMENT

The unit contract price for "Sewer Service Repair," per each, shall be full compensation for all necessary labor, tools, equipment, excavation, backfill and incidentals necessary to make and complete the sewer service repair.

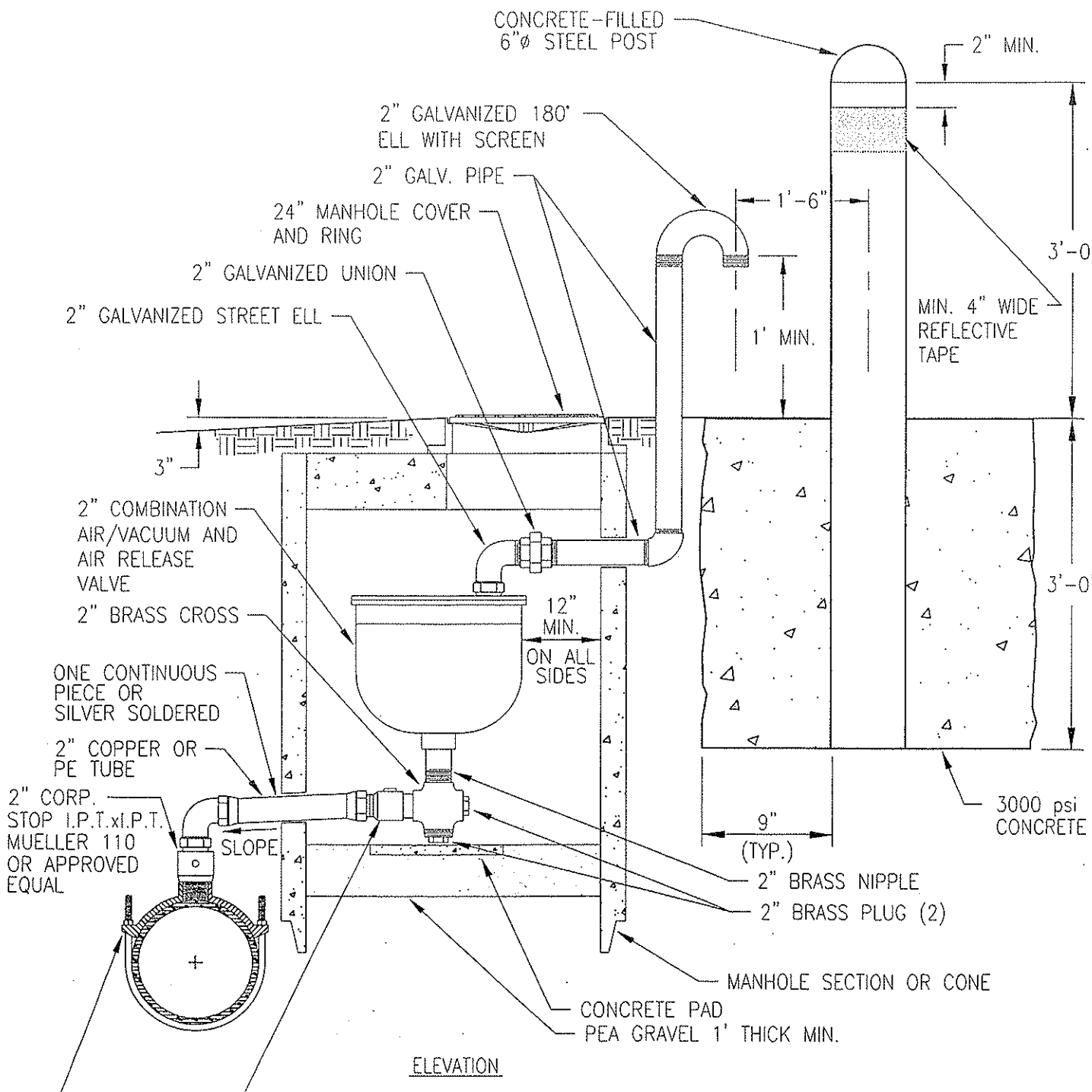
WATERLINE SPECIFICATIONS

18 ABANDONED CONDUITS

All pipes, conduits and other openings determined to be abandoned, which are cut or opened during the water line installation, shall be capped or concrete plugged prior to backfilling of the trench. Measurement and payment for required pipe cuts, labor, equipment, work and materials required to complete the specified plug shall be incidental to the pipe installation pay items.

19 ABANDONED FIRE HYDRANT REMOVAL

All fire hydrants connected to water mains scheduled for abandonment shall be removed by the Contractor and delivered to the City's storage yard for City salvage. Fire hydrants shall be removed intact, including the shoe. A separate measurement and payment will not be made for fire hydrant removal and all costs for removal and delivery shall be incidental to other bid items provided in the bid proposal.



ELEVATION

NOTES:

1. VALVE SIZE AND TYPE TO BE SPECIFIED BY THE DESIGN ENGINEER AND APPROVED BY THE CITY ENGINEER.
2. RISER SHALL BE PROTECTED FROM VEHICULAR OR PEDESTRIAN TRAFFIC AS APPROVED BY THE CITY ENGINEER.
3. PAINT GUARD POST(S) SAFETY YELLOW.
4. EXACT LOCATION OF GUARD POST(S) TO BE DETERMINED IN FIELD BY THE CITY ENGINEER.

SPINK ENGINEERING DWG FILE: 02134ARV.DWG

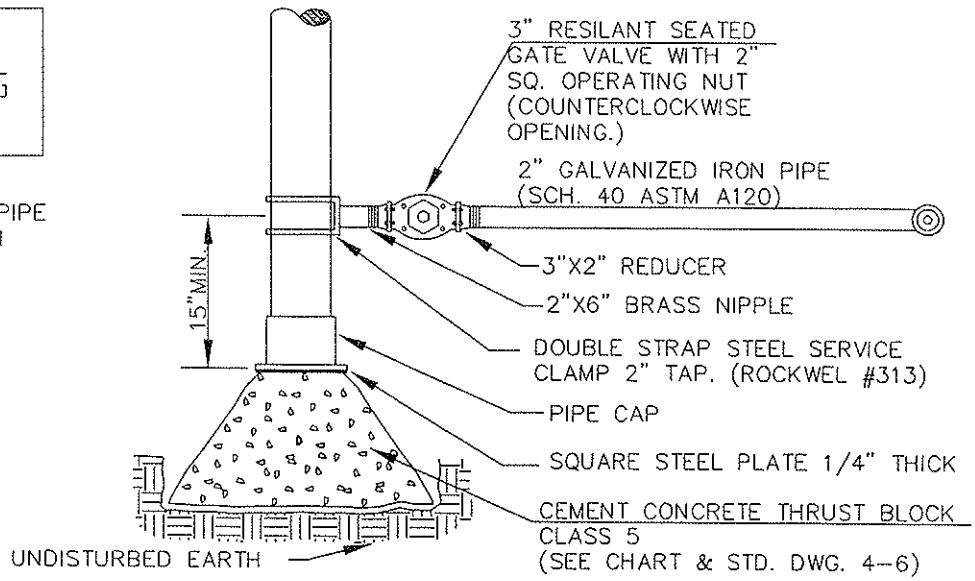
CITY OF MABTON

WATERLINE SPECIFICATIONS
AUGUST 2004

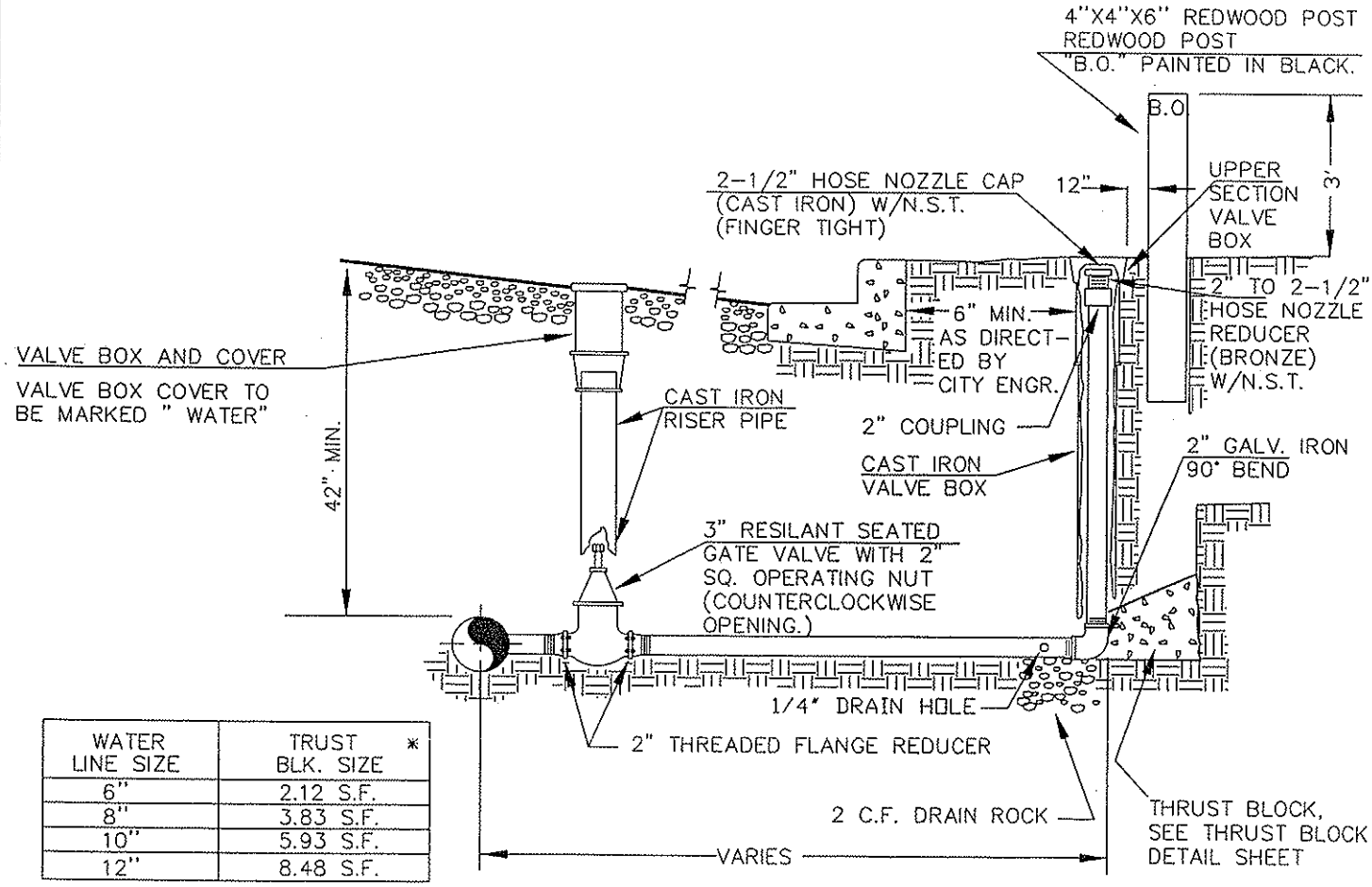
AIR RELEASE VALVE

CALL 48 HOURS
BEFORE YOU DIG
1-800-424-5555

NOTE:
TAP MAY BE OFF END OF PIPE
FOR 4" AND SMALLER MAIN
(SEE STD. DWG. # 4-1)



PLAN VIEW



WATER LINE SIZE	TRUST BLK. SIZE *
6"	2.12 S.F.
8"	3.83 S.F.
10"	5.93 S.F.
12"	8.48 S.F.

* BEARING AREA AGAINST TRENCH WALL.

ELEVATION

SPINK ENGINEERING DWG FILE: 021341580.DWG

CITY OF MABTON
WATERLINE SPECIFICATIONS
JULY 2003

BLOW-OFF DETAIL

CITY OF MABTON

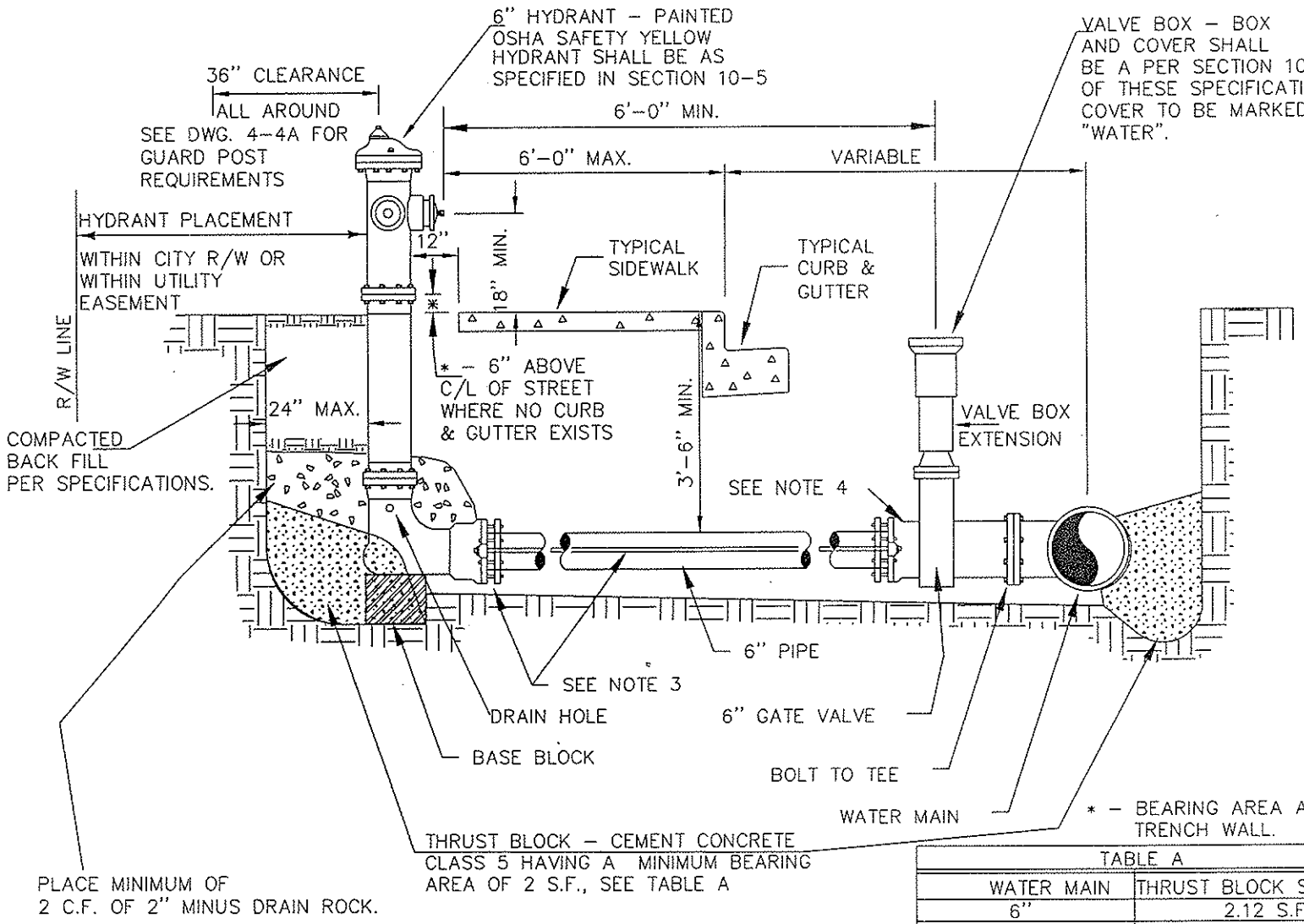
WATERLINE SPECIFICATIONS
JULY 2003

FIRE HYDRANT DETAIL

CALL 48 HOURS
BEFORE YOU DIG
1-800-424-5555

NOTES:

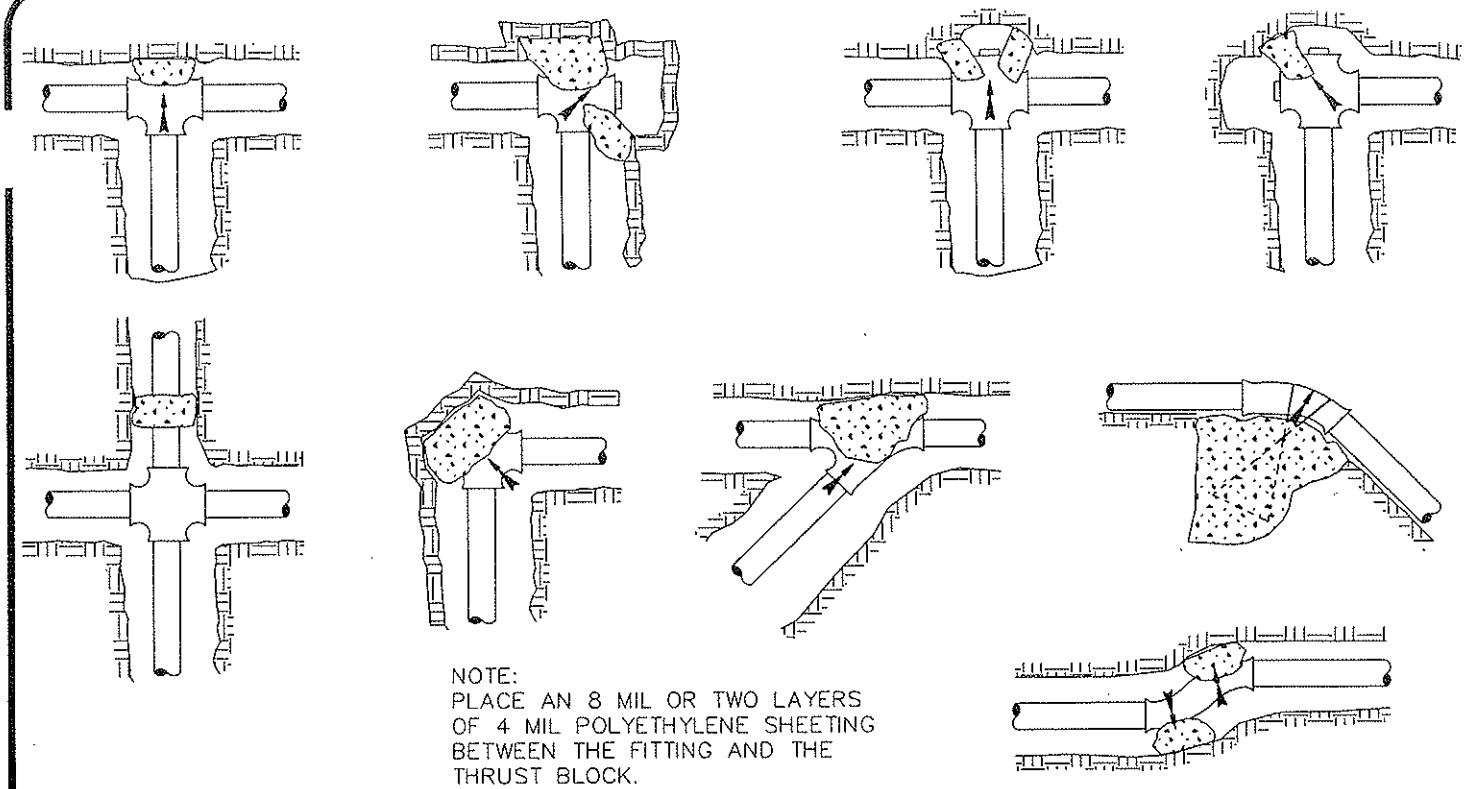
1) HYDRANTS SHALL BE 3 PORTS.
2) HYDRANTS SHALL BE PER SECTION 4 OF THESE SPECIFICATIONS.
3) 2 EA. 3/4" SHACKLE RODS MAY BE REQUIRED IN SPECIAL CIRCUMSTANCES AS DIRECTED BY THE ENGINEER.
4) HUB & FLANGE CASTING. (SEE NOTE 2)
5) HYDRANTS SHALL BE HOODED UNTIL OPERATIONAL.



* - BEARING AREA AGAINST THE TRENCH WALL.

TABLE A	
WATER MAIN	THRUST BLOCK SIZE
6"	2.12 S.F.*
8"	3.83 S.F.*
10"	5.93 S.F.*
12"	8.48 S.F.*

SPINK ENGINEERING DWG FILE: 02134FH.DWG



NOTE:
PLACE AN 8 MIL OR TWO LAYERS OF 4 MIL POLYETHYLENE SHEETING BETWEEN THE FITTING AND THE THRUST BLOCK.

PVC & DUCTILE IRON PIPE
150 PSI TEST PRESSURE

TABLE FOR BEARING AREAS OF THRUST BLOCKS IN SQUARE FEET
HANGING THRUST BLOCKS ARE IN CUBIC YARDS OF CONCRETE

PIPE SIZE	TEES AND DEAD ENDS	90 DEGREE BEND	45 DEGREE BEND	11 1/4 DEGREE 22 1/2 DEGREE BEND
4" & LESS	0.94	1.33	0.76	0.38
	HANGING THRUST BLOCK		0.38 CY	0.19 CY
6"	2.12	3.01	1.71	0.86
	HANGING THRUST BLOCK		0.84 CY	0.42 CY
8"	3.83	5.40	3.08	1.54
	HANGING THRUST BLOCK		1.52 CY	0.76 CY
10"	5.93	8.40	4.73	2.39
	HANGING THRUST BLOCK		2.34 CY	1.18 CY
12"	8.48	12.00	6.83	3.46
	HANGING THRUST BLOCK		3.37 CY	1.70 CY
14"	11.55	16.40	9.30	4.68
	HANGING THRUST BLOCK		4.59 CY	2.31 CY
16"	15.08	21.41	12.14	6.10
	HANGING THRUST BLOCK		6.00 CY	3.00 CY

NOTES:
1. CONCRETE THRUST BLOCKING SHALL BE POURED AGAINST UNDISTURBED EARTH AND SHALL BE CLASS 5 CONCRETE.
2. KEEP CONCRETE CLEAR OF JOINT AND ACCESSORIES.
3. BEARING LOAD IS CALCULATED AT 2,000 LB. PER SQ. FT.
4. FOR 200 PSI PRESSURE TEST FOR FIRE LINES MULTIPLY BY 1.34.

SPINK ENGINEERING DWG FILE: 02134TR.DWG

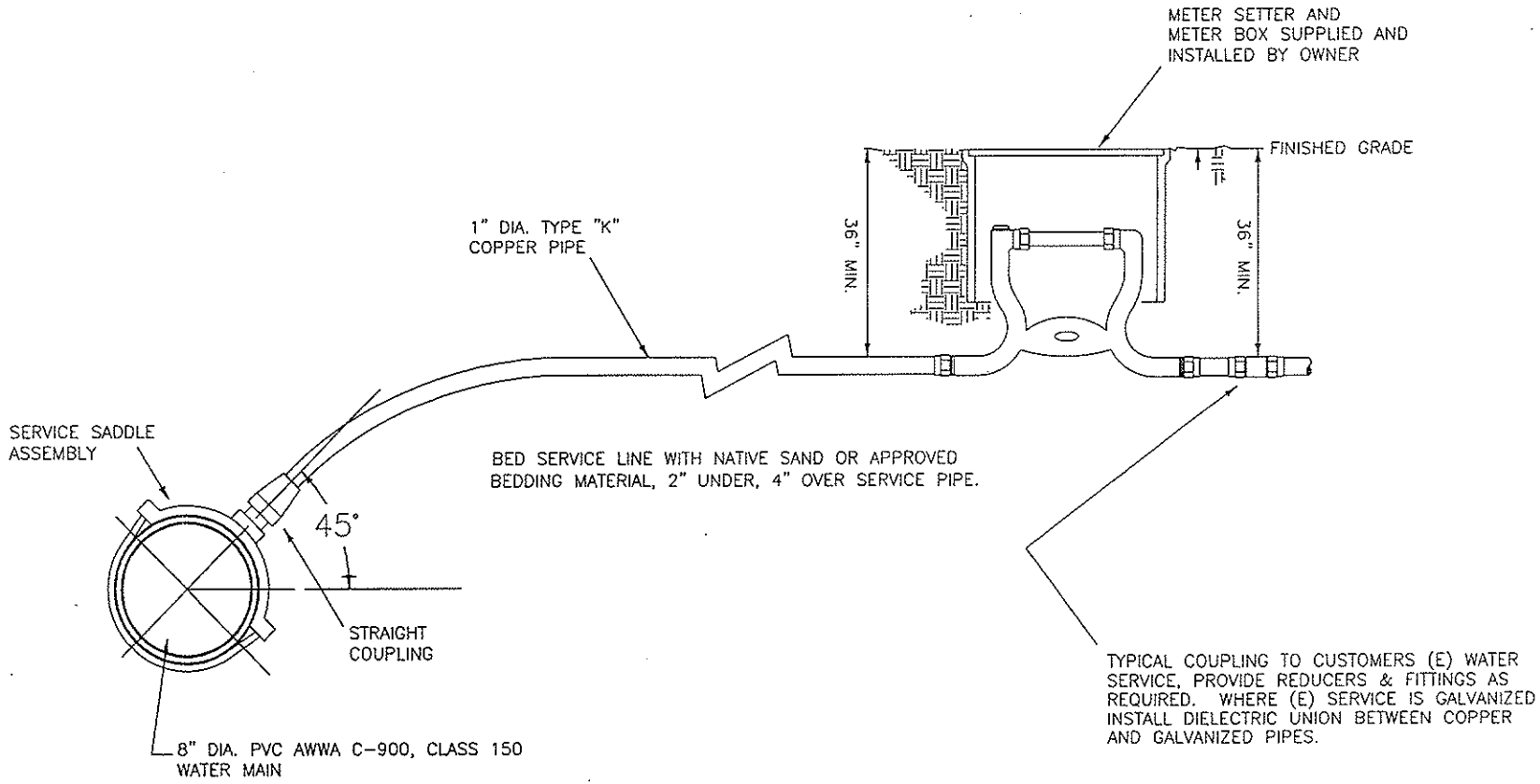
CITY OF MABTON
WATERLINE SPECIFICATIONS
JULY 2003

THRUST BLOCK DETAIL

CITY OF MABTON

WATERLINE SPECIFICATIONS
JULY 2003

WATER SERVICE DETAIL



WATER SERVICE DETAIL

SPINK ENGINEERING DWG FILE: 02134WS.DWG

APPENDIX V

CONSISTENCY STATEMENT LETTERS

Local Government Consistency Review Checklist

Water System Name: City of Mabton PWS ID: 49650

Planning/Engineering Document Title: Water System Plan Update Plan Date: March 2013

Local Government with Jurisdiction: City of Mabton

WAC 246-290-108 Consistency with local plans and regulations:
Consistency with local plans and regulations applies to planning and engineering documents under WAC 246-290-106, 246-290-107, and 246-290-110(4)(b (ii).

1) Municipal water suppliers must include a consistency review and supporting documentation in its planning or engineering document describing how it has addressed consistency with **local plans and regulations**. This review must include specific elements of local plans and regulations, as they reasonably relate to water service as determined by Department of Health (DOH). Complete the table below and see instructions on back.

Local Government Consistency Statement	Page(s) in Planning Document	Yes – No – Not Applicable
a) The water system service area is consistent with the adopted land use and zoning within the applicable service area.	Figure 1-4	Yes
b) The six-year growth projection used to forecast water demand is consistent with the adopted city/county's population growth projections. If a different growth projection is used, provide an explanation of the alternative growth projection and methodology.	2-10	Yes
c) Applies to cities and towns that provide water service: All water service area policies of the city or town are consistent with the utility service extension ordinances of the city or town.	1-13	Yes
d) Service area policies for new service connections are consistent with the adopted local plans and adopted development regulations of all jurisdictions with authority over the service area [City(ies), County(ies)].	1-13	Yes
e) Other relevant elements related to water supply are addressed in the water system plan, if applicable; Coordinated Water System plans, Regional Wastewater plans, Groundwater Area Management plans, and Capital Facilities Element of Comprehensive plans.	8-1	Yes

I certify that the above statements are true to the best of my knowledge and that these specific elements are consistent with adopted local plans and development regulations.

Signature 8/28/13 Date

Joseph Calhoun, Planner, YVCOG (Acting Planner for City of Mabton)
Printed Name, Title, & Jurisdiction

APPENDIX W

WELL NO.3 DOH BLENDING INSTRUCTIONS

Subject: Fw: Mabton (49650) Yakima County - S01 down and S03 online and summary of monitoring
Attachments: 49650_monitoringemail071212.pdf

----- Forwarded Message -----
From: "Stasney, Bryony E (DOH)" <Bryony.Stasney@doh.wa.gov>
To: cmorris.cityofmabton@yahoo.com
Cc: "Renfro, Britta (DOH)" <Britta.Renfro@doh.wa.gov>
Sent: Wednesday, August 21, 2013 4:23 PM
Subject: Mabton (49650) Yakima County - S01 down and S03 online and summary of monitoring

Hello Chris

Here is a copy of the email we have in our files that summarizes monitoring requirements when S03 is online.

Per our call today, here is a recap:

- Monthly raw source samples from S03 nitrate (mark as investigative) – send to the lab and ask the lab to send the results to the state
- Monthly blended sample - after water from S03 and the S05 wellfield blends (mark this sample as routine compliance with source #S92 and note which wells are running – S03 and S04) – send to the lab and ask the lab to send the results to the state
- Daily field nitrate after water from S03 and the S05 wellfield blends – record and send in to us each month

You will also collect a raw source sample this week from S03 for bacteria (mark as investigative) – send to the lab and ask the lab to send the results to the state.

You also noted on our call that S01 (well #4) is down. This well is one of the two wells in the S05 wellfield (the other is S04). The S01 well screens are being cleaned today. You plan to video the well tomorrow and pump test the well on Friday.

Thanks, Bryony

Bryony Stasney, L.HG., Source Water Quality Program Manager
Washington State Department of Health - Office of Drinking Water - Eastern Region
16201 East Indiana Ave., Suite 1500, Spokane Valley, WA 99216
Tel: 509-329-2100
Direct: 509-329-2132
Fax: 509-329-2104
Bryony.Stasney@doh.wa.gov

Renfro, Britta (DOH)

From: Renfro, Britta (DOH)
Sent: Thursday, July 12, 2012 1:37 PM
To: 'cmorris.cityofmabton@yahoo.com';
Cc: Cervantes, Andres (DOH); Stasney, Bryony E (DOH); Riley, Craig (DOH)
Subject: City of Mabton (ID# 49650R) Yakima County; nitrate monitoring/S03 to be online soon
Attachments: Mabton chlorination.docx

Hi Chris,

Thank you again for your call this morning to Bryony and me! Since water demand is going up, S05 (Wellfield/S01, S04) is not able to keep up with demand. Therefore, you will be turning on S03 for the season soon.

Next Week/prior to starting up S03:

- You plan on collecting a raw nitrate sample from S03 on Monday. This raw sample should be marked as "investigative" on the lab slip.
    - The purpose of the S03 raw source is to determine if the output of S03 needs to be limited, so that the nitrate level in the distribution system (blended) is below 10 mg/L.
    - It does not appear that we have any specific engineering documents in our office regarding this blending plan, but I want to check in with Andy Cervantes (DOH Regional Engineer for Yakima County) as well as check the Mabton Water System Plan first. *Andy is out of the office today, so I will get back to you about this after I am able to speak with him.*
- I don't think we discussed coliform sampling, but a coliform sample should also be collected from S03 when you take the nitrate sample next week. This is part of the start-up procedure for wells that are only used seasonally. Before collecting the samples, S03 should be thoroughly flushed. Please call our office if you have any questions about this.

Once S03 is online:

- **Each day** (at least 5 days per week) that S03 is in use, a field sample of the blended water needs to be collected. This can be done at any point after S03 and S05 have combined together. The purpose is to make sure water in the distribution system is below the nitrate MCL of 10.0 mg/L.
- **Each month** that S03 is online, a raw sample (unblended, S03 only) *and* a treated sample (S03 blended with S05) must be collected, and analyzed by a certified lab.
    - The S03 raw nitrate sample should be marked "investigative" each month that S03 is online, and the S03/S05 blended nitrate sample should be marked as "routine compliance" each month that S03 is online.
    - Be sure to note which sources are running in the comment section of the lab slip, and add "S92" for the source number on the lab slip *for the blended nitrate samples only*.
    - These monthly lab samples are in addition to the field monitoring you'll be doing each day when S03 is in use.

On a non-nitrate note, I have attached a blank free chlorine reporting form to this e-mail. The samples you collect at different locations (but on the same date) each month from the distribution system – *these samples are in addition to the daily residuals you report from the booster station* – can all just be put on one form; just manipulate the form so it works for you, or put the data into an Excel sheet if that is easier. Just make sure all the same information is on any chlorine reporting form you end up using; the headings ("REQ Daily Chlorination Report" on the top, then water system name, ID#, county, who is submitting the report), and the monitoring information (when/where free chlorine monitoring was done and the result).

We'll talk again once next week's nitrate test results are in. Thank you again for letting us know that S03 will be online soon!

Sincerely,

Britta Renfro
Environmental Specialist
Washington State Department of Health
Office of Drinking Water, Eastern Regional Office
16201 E. Indiana Ave., Suite 1500

APPENDIX X

CORRESPONDENCE

City of Mabton
Council Meeting Minutes
April 9 2013

Call to Order

Mayor Angel Reyna called the meeting to order 7:01 p.m.

Pledge of Allegiance & Moment of Silence

Mayor Pro Tem Hutson led the Pledge of Allegiance and a moment of silence.

Roll Call

The following were:

Present: Mayor Angel Reyna and Council persons Mario Martinez, Vera Zavala, Sophie Sotelo, Oping Hutson and Mark Gourneau

Also present: Clerk/Treasurer Ret Stewart Fire Chief Luke Cussins and Police Chief Rick Gutierrez

Absent: City Attorney Phil Lamb

Vote on the Agenda

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve the agenda as presented. The motion carried unanimously.

Consent Agenda

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve the following agenda:

- Approve the claims checks 24565 to 24586 in the amount of $13,725.74 dated April 9, 2013
- Approve the payroll checks 13103 to 13136 in the amount of $28,727.47 dated March 29, 2013
- Approve the minutes of the Study Session dated March 26, 2013
- Approve the minutes of the council meeting date March 26, 2013

The motion carried unanimously.

Citizens Comments

No one here

Public Forum

Public forum being held per D.O.H. Morie Block told the council that the real goal is water conservation. Opened at 7:02 and closed at 7:09. There were no citizens present.

Old Business

The council was reminded of Free Dump Day on April 13 from 8:00 to 3:00. Mr. Martinez made a motion and Mr. Gourneau seconded it to spend $100.00 for lunch for the various workers for dump day. The motion carried unanimously.

New Business

G & O (Mr. Block) gave an update of the water plan at the study session. Mr. Van Cleave gave an update for the wwtp at the study session. Mr. Martinez made a motion and Mrs. Hutson seconded it to

adopt the water use efficiency goals on Page 4.3 and 4.4 of the water facility plan draft. The motion carried unanimously. Mr. Martinez made a motion and Mr. Gourneau seconded it to authorize G & O to send the draft water plan facility to D. O. H. The motion carried unanimously.

Chief Gutierrez gave a brief update of the progress on hiring a new police officer.

Mr. Martinez gave a brief update of the website to the council. He said he will be looking for sponsors and charge them $250 a quarter for the main page and $100 a quarter for the secondary page.

There will be an update for the capture of dogs and the citizens obtaining their licenses at the next meeting.

Mr. Martinez made a motion and Mr. Gourneau seconded it to purchase a TORO lawn mower for $8,470.73 on a two year lease. The motion carried unanimously.

Mr. Martinez made a motion and Mr. Gourneau seconded it to pay $4,459.30 to the City of Yakima Home Consortium for the Spillman equipment. A budget amendment will be prepared for the amount over budget. The motion carried unanimously.

The contract with Yakima Co IT was reviewed for the portion for the website. The contract has already been approved.

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve Ordinance 1001 to increase the garbage rates effective 5-1-13 with Yakima Waste Systems and the City of Mabton. The motion carried unanimously.

Comment

Mrs. Zavala stated that there is a lot of parking over the sidewalks and would like to have it stopped.

Mrs. Hutson requested that she meet with Mayor Reyna and Ms. Stewart to go over various items that she feels have not been completed. He will meet with her at 1:00 on Friday.

Mayor Reyna reported that he has hired Mike Mendoza for the wastewater plant.

Mayor Reyna thanked Amber for her work with the City. She has taken a position with the Chelan newspaper.

Adjournment

Mayor Reyna adjourned the meeting at 7:59 p.m.

Mayor Angel Reyna

Ret Stewart, CMC Clerk/Treasurer

City of Mabton
Council Meeting Minutes
August 13, 2013

Call to Order

Mayor Vera Zavala called the meeting to order 7:04 p.m.

Pledge of Allegiance & Moment of Silence

Mayor Zavala led the Pledge of Allegiance & the council in a moment of silence.

Roll Call

The following were:

Present: Mayor Vera Zavala and Council persons Oping Hutson, Marlo Martinez, Mark Gourneau, Sophia Sotelo and (open position)

Also present: Clerk/Treasurer Ret Stewart, City Attorney Jamie Carmody and Chief Rick Gutierrez

Absent: Fire Chief Luke Cussins

Vote on the Agenda

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve the agenda as presented. The motion carried unanimously.

Consent Agenda

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve the following agenda:

- Approve the claims checks 24813 to 24849 in the amount of $117,996.86 dated August 13, 2013
- Approve the payroll checks 13345 to 13375 in the amount of $35,947.31 dated July 31, 2013
- Approve the minutes of the council meeting dated July 9, 2013
- No action Washington Liquor Control Board LA Barata

The motion carried unanimously.

Citizens Comments

Freddie Perales introduced himself.

Public Meeting

Mayor Zavala opened the public meeting at 7:07 p.m. There was not citizen comment. PW Chris Morris made a presentation about the plan for improving water using and to meet the needs of the WUE (water use efficiency) report. They include: putting meters on the wells and parks that did not have them, regulating the water usage for the irrigating the lawns, etc. Mayor Zavala closed the meeting at 7:18 p.m.

Old Business

Mr. Carmody gave an update on the purchase of the land for the WWTP. Mr. Martinez made a motion and Mr. Gourneau seconded it to authorize the Mayor to sign the Agreement for the Acquisition of the Property. The motion carried unanimously.

Mr. Carmody stated that there are three parts to be taken care of.

- Have the agreement signed
- Vacate Vance
- Annex the property with the cemetery included

New Business

Mr. Van Cleave from G & O presented an update for the water problem to the council along with photos.

Mr. Van Cleave asked the council to vote to authorize the Mayor to sign the TIB application with no match . Mr. Martinez made a motion and Mrs. Hutson seconded it to authorize the Mayor to sign upon receipt and mail it in. The motion carried unanimously.

Mayor Zavala read the letter of resignation for personal reasons for Council Position #5 from Johnnie Gusby.

Mr. Carmody stated that he is working with the attorney for the transfer of the church in Fezelle Park to the City.

There was discussion of the need to have the pump working before taking possession of the park currently owned by Catholic Housing.

Comments

Mrs. Sotelo stated that she has found two volunteers for her committee to review the Ordinances.

It was decided to check with Snipes Mountain to hold the annual budget meeting on September 7th from 11:00 to 4:00.

Adjournment

Mayor Zavala adjourned the meeting at 8:34 p.m.

Mayor Vera Zavala

Ret Stewart, CMC Clerk/Treasurer

Affidavit of Publication

STATE OF WASHINGTON
COUNTY OF YAKIMA SS

Timothy J. Graff, being first duly sworn on oath deposes and says that he is the Publisher of the DAILY SUN NEWS, a daily newspaper.

That said newspaper is a legal newspaper and it is now and has been for more than six months prior to the date of publications hereinafter referred to, published in the English language continually as a daily newspaper in the city of Sunnyside, YAKIMA County, Washington, nd it is now and during all of said time printed in an office maintained at the aforesaid place of publication of said newspaper, and that the said Daily Sun News was on the 4th Day of April, 1969 approved as a legal newspaper by the Superior Court of said Yakima County.

That the annexed is a true copy of a LEGAL PUBLICATION -
City of Mabton
Public Hearing Aug. 13
published in regular issues (and not in supplemental forms) of said newspaper once each week for a period of 1 consecutive issue(s) commencing 08/02/13 and ending on 08/02/13, both dates inclusive, and that such newspaper was regularly distributed to its subscribers during all of said period. That the full amount of the fee charged for the foregoing publication is the sum of $ 17.50, amount has been paid in full, at the rate of $7.00 per column inch per insertion.

PUBLIC HEARING
NOTICE IS HEREBY GIVEN that a public hearing will be held by the City of Mabton City Council in the city council chambers at City Hall, on August 13, 2013.
The purpose of this public hearing is to discuss the plan for water conservancy in order to meet the W.E.C. requirements.
Call 894-4096 if you have any questions, contact Ms. Ret Stewart, CMC, Clerk Treasurer at (509) 894-4096.
PUBLISH: DAILY SUN NEWS
August 2, 2013

Subscribed and sworn to before me 08/02/13

Notary Public in and for the State of Washington
100203-00007

NORA HERNANDEZ
Commission Expires
NOTARY PUBLIC
08-20-2015
STATE OF WASHINGTON

Water System Plan Submittal Form

This form must be completed and submitted along with the Water System Plan (WSP). It will expedite review and approval of your WSP. **All water systems should contact their regional planner before developing any planning document for submittal.**

Mabton, City of	49650	City of Mabton
1. Water System Name	PWS ID# or Owner ID#	System Owner Name
Christopher Morris	(509) 894-4096	Public Works Lead
Contact Name for Utility	Phone Number	Title
305 Main St	Mabton	WA 98935
Contact Address	City	State Zip
Jim Bricel	(509)-453-4833	PE
2. Project Engineer	Phone Number	Title
107 S. 3rd St.	Yakima	WA 98901
Project Engineer Address	City	State Zip
(same as above)		
3. Billing Contact Name (required if not the same as #4)	Billing Phone Number	Billing Fax Number
Billing Address	City	State Zip

4. How many services are presently connected to the system? (Total Calculated Connection)	632	
5. Is the system expanding? (seeking to extend service area or increase number of approved connections)	☒ Yes	☐ No
6. If number of services is expected to increase, how many new connections are proposed in the next six years?	39	
7. If the system is private-for-profit, is it regulated by the State Utilities and Transportation Commission?	☐ Yes	☒ No
8. Is the system located in a Critical Water Supply Service Area (i.e., have a Coordinated Water System Plan)?	☐ Yes	☒ No
9. Is the system a customer of a wholesale water purveyor?	☐ Yes	☒ No
10. Will the system be pursuing additional water rights from the State Department of Ecology in the next twenty years?	☒ Yes	☐ No
11. Is the system proposing a new intertie?	☐ Yes	☒ No
12. Do you have projects currently under review by the Department of Health?	☐ Yes	☒ No
13. Are you requesting distribution main project report and construction document submittal exception, and if so, does the WSP contain standard construction specifications for distribution mains?	☒ Yes	☐ No
14. Are you requesting distribution related project report and construction document submittal exception, and if so, does the WSP contain distribution facilities design and construction standards, including internal engineering review procedures?	☐ Yes	☒ No
15. The purveyor is responsible for sending a copy of the WSP to adjacent utilities for review or a letter notifying them that a copy of the WSP is available for their review and where the review copy is located. Has this been completed?	☒ Yes	☐ No
16. The purveyor is responsible for sending a copy of the WSP to all local governments within the service area. (County and City Planning Departments, etc). Has this been completed?	☒ Yes	☐ No
17. Are you proposing a change in the place of use of your water right?	☐ Yes	☒ No

If answer to questions 7,8, 11, 15and/or 16 is "yes," list who you sent the WSP to: Yakima County, Grandview, YVCOG (City of Mabton planner)_____

Is this plan: ☐ an Initial Submittal ☒ a Revised Submittal

Please enclose the following number of copies of the WSP:

3 copies for Northwest and Southwest Regional Offices **OR 2** copies for Eastern Regional Office (We will send one copy to Ecology)
1 additional copy if you answered "yes" to question 7. 2 Total copies attached

Please return completed form to the Office of Drinking Water regional office checked below.

☐ **Northwest Drinking Water Operations**
Department of Health
20425 72nd Avenue South, Suite 310
Kent, WA 98032-2358
(253) 395-6750

☐ **Southwest Drinking Water Operations**
Department of Health
PO Box 47823
Olympia, WA 98504-7823
(360) 236-3030

☒ **Eastern Drinking Water Operations**
Department of Health
16201 East Indiana Avenue Suite 1500
Spokane Valley, WA 99216
(509) 329-2100

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DOH COMMENT RESPONSE FORM

DOH Comment No.	DOH Comment	Water System Response	Page Number of Response	Other Water System Comments
1	Regarding Figure 1-4: There is an area of land in the north part of the Urban Growth Boundary on Vance Road that is in the existing service area but not in the water rights place of use (WRPOU) service area. If the City is providing service in this area using City water rights, it should be included in the WRPOU service area. The text on Page 1-11 under "Future Service Area" states, the future service area is defined by the UGA boundary and is shown on Figure 1-4. However, the future service area shown on Figure 1-4 is not the same as the UGA. Please correct either the text or the Figure.	This area has been included in the WRPOU service area. Figure 1-4 has been revised. The text on Page 1-11 has been revised.	Fig. 1-4 Pg. 1-11	
2	Include completed local government consistency forms from the City of Mabton planning office and Yakima County planning in the second draft.	The consistency statements from Yakima County and the City of Mabton planner have been included in appendix.	Appendix X "Consistency Statement Letters".	
3	The capacity determination for the City is limited, given the information is available. It is necessary to have a better estimate for the sustained capacity (gpm) of Well #4 (S01).	This well has recently been flow-tested at 240 gpm. In the plan, this well is conservatively estimated at 200 gpm.	Chapter 3 throughout.	
4	Investigate and provide a realistic capacity for Well #4 (S01). The text of the plan indicates the actual capacity of Well #4 is below the capacity shown on the Water Facilities Inventory. This analysis is used to determine the total number of approved connections possible, which must reflect the actual capacity (physically and legally) of the City.	This well has recently been flow-tested at 240 gpm. In the plan, this well is conservatively estimated at 200 gpm.	Chapter 3 throughout.	
5	Identify whether there is a potential risk in draining the reservoir, given the total capacity of the booster pump exceeds the capacity of the wells. In addition, the plan repeatedly states the capacity of S01 (Well#4) is significantly lower than previously known.	Yes, it is possible for the tank to be drained. See discussion on page 2-4. Regarding the capacity of S01, see notes above.	Pg. 2-4	The City is aware of this concern.
6	The Water Use Efficiency (WUE) goal noted on page 4-3 is to achieve water savings over the next six years. Document that the WUE goal for the time period 2013 through 2019 was established as required by WAC 246-290-830, by providing a copy of the meeting notice and a copy of the meeting minutes.	Documentation of the meeting notice and a copy of the meeting minutes are provided in the appendices.	Appendices "Correspondence"	

DOH Comment No.	DOH Comment	Water System Response	Page Number of Response	Other Water System Comments
7	The Department of Ecology has not issued a review letter for this WSP. If the Department of Ecology issues a review letter, please address any comments in the second draft of the WSP.	No letter has been received to date.	n/a	
8	Provide a copy of the operating procedures and monitoring and reporting requirements the City must implement , if it is necessary to operate S03 (Well #3). The procedures must include notifications, laboratory and field tests, as required by DOH.	The City follows DOH directed operating procedures for the use of Well No. 3. A copy of these procedures and communications are provided in the appendices.	Appendix W "Well No. 3 DOH Blending Instructions"	
9	Update the information in the Coliform Monitoring Plan, to include the correct sources in operations (S01, S05, S04, and S03). In addition, include any necessary sampling requirements that can result as part of the Groundwater Rule.	Coliform Monitoring Plan has been updated and is included.	Appendix F "Coliform Monitoring Plan"	
10	Provide an outline, policy, or narrative describing the review and submittal process the City will implement for reviewing distribution main projects. Please note, the city must have on staff under contract a Professional Engineer, licensed in the State of Washington, to review any plans for distribution mains waived under this chapter from the DOH review and approval process. The City must also maintain a file with copies of the construction completion reports from any project completed under this waiver.	The City has under contract a Professional Engineer, licensed in the State of Washington, to review any plans for distribution mains and will maintain a file with copies of the construction completion reports from any project completed under this waiver.	Pg. 7-1	
11	A waiver for distribution related projects, such as booster stations, reservoirs, and so on, requires significantly more detail than provided in the plan. Please contact our office if you will be requesting a waiver for more than just distribution mains.	The City is not requesting a waiver for more than just distribution mains.	Pg. 7-1	
ADDITIONAL COMMENT	The Water System must meet the consumer input process noted in WAC 246-290-100(8). Include in the Water System Plan a copy of the meeting notice used to notify the consumer of the meeting and a copy of the signed meeting minutes from that meeting.	Documentation of the meeting notice and a copy of the meeting minutes are provided in the appendices.	Appendix X "Correspondence"	

City of Mabton
Council Meeting Minutes
September 10, 2013

Call to Order

Mayor Vera Zavala called the meeting to order 7:00 p.m.

Pledge of Allegiance & Moment of Silence

Mayor Zavala led the Pledge of Allegiance & the council in a moment of silence.

Roll Call

The following were:

Present: Mayor Vera Zavala and Council persons Oping Hutson, Mario Martinez, Mark Gourneau, Sophia Sotelo and (open position)

Also present: Clerk/Treasurer Ret Stewart, City Attorney Jamie Carmody and Chief Rick Gutierrez

Absent: Fire Chief Luke Cussins

Vote on the Agenda

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve the agenda as presented. The motion carried unanimously.

Mr. Martinez made a motion and Mr. Gourneau seconded it to fill the council member position #5 with Arturo Dela Fuente. The motion carried unanimously. Mr. Martinez made a motion and Mr. Gourneau seconded it to allow Mr. Dela Fuente to continue to fill a position as a volunteer firefighter. The motion carried unanimously.

Consent Agenda

Mr. Martinez made a motion and Mr. Gourneau seconded it to approve the agenda with the following change:

- Approve the claims checks 24870 to 24910 in the amount of $88,687.79 dated September 10, 2013
- Approve the payroll checks 13428 to 13455 in the amount of $37,522.69 dated August 30, 2013 cks 13390 to 13418-void
- Approve the minutes of the study session dated August 27, 2013
- Approve the minutes of the council meeting dated August 27, 2013

The motion carried unanimously.

Citizens Comments NONE

Public Meeting None

Old Business None

i

New Business

Mr. Martinez made a motion and Mr. Gourneau seconded it to add to the current water system plan the following: 1. Well #6 2. Water rights 3. Water main 4. Reservoir for a total proposed amount of $4,840,000. The motion carried unanimously.

Mr. Martinez made a motion and Mr. Gourneau seconded it to accept the water system plan with the following additions: 1. Well 6 - $1,850,000 2. Reservoir $1,340,000 3. Water rights -$720,000 4. Water mains $930,000 Total - $4,840,000 The motion carried unanimously.

Mr. Carmody staed that he is still talking to the attorneys to transfer the church to the city.

Mr. Morris stated that the CCH still needs to purchase an electric box and have the clock hooked up.

Mrs. Hutson made a motion and Mr. Gourneau to authorize the Mayor to sign the CDBG for $759,000 for the sewer update. The motion carried unanimously.

The council indicated that they will be attending the YVCOG dinner on September 18th.

The 2nd quarter financial results were handed out to the council.

The council was informed that the clerk/treasurer interviews will be held on Friday, September 13th.

There are two more police reserve officers being processed to be a part of the police academy.

Adjournment

Mayor Zavala adjourned the meeting at 7:30 p.m.

Ret Stewart, CMC Clerk/Treasurer

Mayor Vera Zavala

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
EASTERN DRINKING WATER REGIONAL OPERATIONS
16201 E Indiana Avenue, Suite 1500, Spokane Valley, Washington 99216-2830
TDD Relay 1-800-833-6388

RECD – YAKIMA
SEP 30 2013
JOB #

September 27, 2013

Christopher Morris
City of Mabton
PO Box 655
Mabton, WA 98935

Subject: Mabton, City of; PWS #49650R; Yakima County
Water System Plan; DOH Project # 13-0424; **DOH Approval**

Dear Mr. Morris:

The City of Mabton Water System Plan (WSP) received in this office on April 18, 2013, with revisions submitted on September 19 and September 26, 2013, has been reviewed and in accordance with the provisions of WAC 246-290-100, is hereby **APPROVED.**

An approved update of this WSP is required **on or before September 27, 2019,** unless the Department of Health (DOH) requests an update or plan amendment pursuant to WAC 246-290-100(9). Approval of this WSP is valid as it relates to current standards outlined in Washington Administrative Code (WAC) 246-290 revised November 2010, WAC 246-293 revised September 1997, and RCW 70.116, and is subject to the qualifications herein. Future revisions in the rules and statutes may be more stringent and require facility modification or corrective action.

The WSP estimates water usage for single-family residential connections, equated to Equivalent Residential Units (ERUs), to be an average day demand (ADD) of 323 gallons per day and a maximum day demand (MDD) of 679 gallons per day. According to the updated WFI the water system currently serves 671 total connections. Using information in Worksheet 6-1, these connections and Distribution System Leakage (DSL) or non-revenue water equate to a total water usage equivalent to 1,105 ERUs.

This WSP includes capacity information (based on assumed capacity for well #4 of 200 gpm) that demonstrates the physical and legal ability of this water system to provide water during the six-year period for which the approval of the WSP is valid. Based on the analysis presented in the WSP, the limiting factor in determining the approved number of connections (when well #4 source capacity is confirmed at 200 gpm or greater) will be water rights Qa. When the system

notifies DOH in writing that the necessary repairs have been made to well #4 and source capacity has been confirmed to be 200 gpm or greater, the approved number of connections that will be reflected on the Water Facilities Inventory (WFI) form will be 815.

Currently DOH will base approved connections on the capacity of the system without the benefit of well #4 source capacity **and therefore the approved number of connections that will be reflected on the Water Facility Inventory form is the existing number of connections, 671**

The City of Mabton is responsible for permitting new service connections in a manner consistent with the water system plan so that the physical capacity and water right limitations are not exceeded. As new water services are requested, the City of Mabton must evaluate each connection for the expected water demands and adjust the remaining connection allowance. The water system should keep an updated list that compares the overall ERUs expended against the overall number of connections placed into service. This will allow a better estimate of the system's adequacy.

This approval does not provide any guarantee and should not be considered to provide any guarantee concerning legal use of water or any subsequent water right decisions by the Department of Ecology. The Department of Ecology did not issue a comment letter regarding your water rights. This approval does not affect any uncertainties regarding your water rights or the resolution of those uncertainties. Depending on the resolution of the uncertainties, further planning and/or other action may be necessary.

Pursuant to RCW 90.03.386(2), the "Retail Service Area/Future Service Area/Water Rights Place of Use" identified on Figure 1-4 *City Limits, UGA, Service Areas* map in the WSP now represents "place of use" for this system's water rights. Future changes in service area should be made through a WSP amendment.

The City of Mabton has a duty to provide new water service within its retail service area. This WSP includes service policies to describe how your system plans to provide new service within your retail service area.

Submittal of the WSP included local government consistency determinations from the City of Mabton and Yakima County. This WSP meets local government consistency requirements for WSP approval pursuant to RCW 43.20 for these entities.

Standard Construction Specifications for distribution main extensions in this WSP are approved. Consistent with WAC 246-290-125(2), this system may proceed with the installation of distribution main extensions provided this system completes and keeps on file the enclosed construction completion report form in accordance with WAC 246-290-125(2) and WAC 246-290-120(5) and makes it available for review upon request by DOH.

The City of Mabton is located within the Lower Yakima Watershed (WRIA # 37). Ecology has not determined whether the WSP was not inconsistent with an approved watershed plan. DOH encourages the water system to contact Ecology regarding this matter.

Thank you for your cooperation. DOH recognizes the significant effort and resource commitment involved in the preparation of this WSP. If you have questions or wish to check our records, please contact either of us at (509) 329-2120 or (509) 329-2121, respectively.

Sincerely,

Andres Cervantes, PE
Regional Engineer
Office of Drinking Water
Division of Environmental Public Health

Heather Cannon
Regional Planner
Office of Drinking Water
Division of Environmental Public Health

Enclosures: Construction Completion Report

cc: Yakima Health District
Yakima County Planning Department
Jim Bricel, PE, Gray & Osborne Inc, Yakima
Sage Park, Department of Ecology, Eastern Regional Office
George Simon, DOH Compliance Manager
Katrina Anderson, DOH WFI Coordinator

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
15 W Yakima Ave, Ste 200 • Yakima, WA 98902-3452 • (509) 575-2490

RECEIVED
OCT 02 2013
By

October 1, 2013

Christopher Morris
City of Mabton
PO Box 655
Mabton WA 98935-0655

Heather Cannon
Department of Health
16201 E Indiana Avenue, Suite 1500
Spokane Valley WA 99216-2836

Subject: City of Mabton, Water System Plan Review, March 2013

Thank you for the opportunity to review the draft Water System Plan (WSP) for the City of Mabton. Based on my review:

- The WSP is "not inconsistent" with an approved watershed plan adopted under 90.82 RCW or 90.54 RCW.

- Based on my review, I have the following comments on the Water Rights Self-Assessment, Table 4-6:
  - The individual rights listed do agree with Ecology's records.
  - The instantaneous flow rates (Qi) are additive.
  - Also, the 2 acre-feet/year in G3-00381C is additive to the 452.4 acre-feet/year from G3-00027C and G4-29212C. This would give the city a total maximum volume of 454.4 acre-feet/year for all 3 water rights.

- Ecology agrees that the flow meter for Pump 4 should be replaced in order to provide more reliable water use data.

- The water needs for the projected growth in 20 years are greater than the city's current supply. The city should pursue acquiring additional water to address projected future growth.

Please contact me if you have any questions at (509) 457-7112.

Sincerely,

David Holland,
Environmental Planner
Department of Ecology
Central Regional Office

DH:hd
130912

cc: Sage Park, Permitting Unit Supervisor

PACIFIC groundwater GROUP

POTENTIAL GROUNDWATER MONITORING STATIONS
YAKIMA GROUNDWATER MANAGEMENT AREA

DECEMBER 3, 2013

POTENTIAL GROUNDWATER MONITORING STATIONS
YAKIMA GROUNDWATER MANAGEMENT AREA

Prepared for:

HDR Inc., Yakima County, and
Lower Yakima Valley Groundwater Advisory Committee

Prepared by:

Pacific Groundwater Group
2377 Eastlake Avenue East, Suite 200
Seattle, Washington 98102
206.329.0141
www.pgwg.com

December 3, 2013
JE1302

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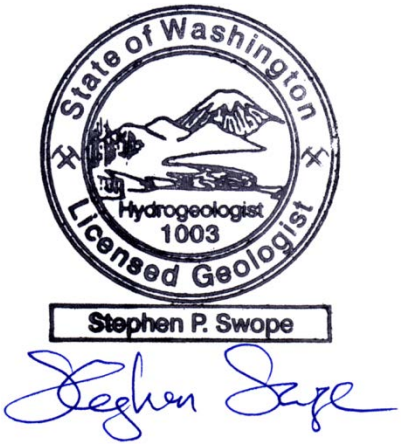
SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.



Stephen Swope
Principal Hydrogeologist
Washington State Hydrogeologist No. 1003

1.0 EXECUTIVE SUMMARY

The purpose of this report is to present analysis of water quality trends, evaluation of spatial data gaps, and selection of monitoring stations for long term groundwater monitoring.

Nitrate data were provided to Pacific Groundwater Group (PGG) by Yakima County, who compiled data from the United States Geologic Survey (USGS), Yakima Health District, Valley Institute for Research and Education (VIRE), and Yakima County's own nitrate survey database. Additional data from the United States Environmental Protection Agency (EPA) were added by PGG but data from the area covered by the consent order between EPA and several dairies were not included. Data were imported into a consistently formatted water quality database to be submitted as an electronic deliverable to Yakima County. The WQ database contains nitrate results from 2,532 samples.

The WQ database includes geographic locations and a unique well ID for all nitrate samples, although the geographic locations are often approximate. Most nitrate samples also contain address locations.

Well depths are available for 63 percent of the samples and range from 1.17 feet in alluvium to 2,715 feet below ground surface in basalt. Half of the well depths are shallower than 136 feet. Nitrate concentrations are at or below the natural background level of 0.3 mg/L in 14.3 percent of samples. Nitrate concentrations exceed the GWMA-adopted water quality goal of 10 mg/L in 12.9 percent of samples. PGG evaluated the database, including use of statistics, to identify the number and distribution of monitoring stations, and the numbers of samples that are necessary to meet several of the GWMA monitoring objectives listed below:

- Fill spatial data gaps
- Monitor hot spots
- Track increasing concentration trends
- Measure basin-wide average concentration
- Monitor common water supply aquifers
- Measure effects of current and future practices
- Address health risks

Yakima County will visit the wells recommended by PGG through this evaluation, and verify conditions at the prospective monitoring stations. These visits will be combined with the Education and Outreach Committee's High Risk Well Assessment Survey. Wells that meet accessibility and construction criteria will be used as monitoring stations to meet each objective. Final design of the sampling programs to meet these objectives will be contained in a future deliverable scheduled for February 2014. The following paragraphs summarize analysis and recommendations for each objective:

Spatial Data Gaps: The largest five areas without nitrate data were identified as spatial data gaps. The areas range from 4.7 to 12.9 square miles. Existing wells were identified in those areas for field verification with the goal of identifying a single well in each area to serve as a monitoring station.

Hot Spots: PGG identified 71 "hot spots" with maximum nitrate concentrations in excess of 20 mg/L. Assuming an acceptance rate of 15 percent (owner acceptance, good physical conditions, etc.) to be verified by field visits, we expect to monitor approximately 15 percent of these hot spots (10 monitoring stations).

Increasing Trends: Of the 46 wells with at least 10 samples that have been collected over time, seven had a statistically significant increasing trend in nitrate concentrations, and nine had a statistically significant decreasing trend. The sample locations with increasing trends warrant monitoring because they are likely most to sensitive to land use changes, and may also pose a health risk if the increase is rapid enough. PGG thus recommends field verification and monitoring of the seven wells with increasing trend. All these wells are public water supply wells that are sampled for nitrate to meet WDOH requirements. As part of final evaluation of these stations, the GWMA will consider the frequency of monitoring conducted to meet WDOH requirements, frequency of monitoring necessary to meet GWMA objectives, and whether special QA/QC requirements imposed by the GWMA project dictate that the GWMA project collect its own samples.

Basin-Wide Average: PGG used the simple random approach to identify the number of monitoring stations that need to be sampled to measure the basin-wide-average at a level of confidence that supports use of the data for GWMA purposes. Those purposes include comparison of a current average to past and future averages, and comparison of averages to the GWMA-adopted water quality goal of 10 mg/L nitrate. The largest number of samples is required for a comparison of averages collected at different times. On the order of 1,000 samples appear to be necessary to confidently identify differences in basin-wide averages over time. That number of samples could be generated by a range of strategies; including sampling each of 170 to 250 stations four to six times over a year. PGG has provided Yakima County a list of wells to be field evaluated for use as future monitoring stations. Owner acceptance and physical conditions, to be confirmed through field verification, may limit the number of stations available to address this objective.

Common Water Supply Aquifers: The random sample set developed for the basin-wide average will likely include representative samples from common water supply aquifers. In addition, public water supply wells (sampled for WDOH) will be concentrated in these zones. Thus no separate set of wells was developed to address this objective. The ability of the basin-wide data set and WDOH water supply wells to monitor common water supply aquifers will be verified after the monitoring stations are selected.

Measure Effects of Current and Future Practices: Wells in the existing database are typically designed to supply drinking water not to reflect the effects of current or future nitrogen management practices. Many years or even decades of monitoring will be required to confidently distinguish changes in groundwater nitrate concentrations using existing wells. Thus quickly measuring the effects of current and future practices should not rely solely on wells in the existing database. Nitrate concentrations in specially designed water table monitoring wells (shallow wells) will currently reflect the effects of existing BMPs, and will respond much more quickly to future changes. Thus such wells are recommended to help meet this objective.

Specially designed shallow wells are recommended where BMPs are known to be changing. The number of wells and locations should be specified in a work plan

generated at a time coordinated with changes to nitrogen management changes. To allow the wells to reflect recent historic practices as well as future practices, the wells should be installed as soon as appropriate locations can be identified. We therefore recommend allocation of budget to this work, and laying the groundwork for implementation.

Health Risks: Drinking water wells causing human health risks will be identified by Yakima County under a separate GWMA task. Based on that work, an unknown number of monitoring stations will be added to the monitoring network.

2.0 PURPOSE

The Lower Yakima Valley Groundwater Advisory Committee (GWAC), through Yakima County Public Services, selected HDR Engineering (HDR) and Pacific Groundwater Group (PGG) to perform two Scopes of Work under HDR contract #CON0082545. The first scope (led by HDR) is a study to identify applicable local, state, and federal regulatory requirements that control and manage nitrates in groundwater, identify Best Management Practices (BMPs), and evaluate the effectiveness of these BMPs. The second scope (led by PGG) focuses on development of a monitoring plan to evaluate changes in nitrate concentrations in groundwater.

This report describes methods used to select potential monitoring stations to be visited and inspected by Yakima Health District (YHD). The purpose of these YHD site visits is to complete the High Risk Well Assessment Survey and to verify the accessibility and suitability of the locations for long term monitoring (Field Verification).

In order to prepare a list of potential monitoring stations, PGG used the groundwater quality database developed for the Lower Yakima Valley Groundwater Management Area (GWMA) to characterize existing data, hereafter referred to as the WQ database (Section 3.2). Nitrate concentration trends are described in Section 5.0. In Section 6, PGG identifies existing wells for proposed for YHD field verification and future nitrate monitoring using well selection criteria listed in HDR contract #CON0082545. These wells are provided to the GWAC in an electronic database that is not reproduced as a table in this report. Specific tasks under the HDR contract covered in this report include:

- Task 1b (partial): Select potential monitoring stations for field verification; develop draft Field Verification Work Plan
- Task 2a: Water quality trend analysis
- Task 2b: Evaluate data gaps and provide recommendations on new sampling stations

This work was performed, and this report prepared, in accordance with hydrogeologic practices generally accepted at this time in this area. The resulting report is for the exclusive use of the Lower Yakima Valley Groundwater Advisory Committee, Yakima County, and HDR, for specific application to the Lower Yakima Valley.

3.0 DATA SOURCES

The following subsections describe three databases referenced in this report. The databases are linked through common data fields.

3.1 NITRATE WATER QUALITY DATABASE

A database was developed as part of this study to gather all groundwater nitrate data that had been collected to date. Sources of nitrate data provided by Yakima County (County) included the United States Geologic Survey (USGS), Yakima Health District (YHD), the Valley Institute for Research and Education (VIRE), and Yakima County's own nitrate survey database. Additional nitrate data from the United States Environmental Protection Agency (EPA) were added by PGG, but data from the area covered by the consent order between EPA and several dairies were not included. All data were imported into a consistently formatted water quality database.

3.2 WELL LOCATION DATABASE

A database of 7,790 domestic and public well locations and ownership information was developed as part of this study. This Well Location Database is used to propose potential monitoring stations (Section 6). Well location and ownership information for 7,695 domestic wells was provided by Yakima County, and was generated as part of the County's Nitrate Treatment Pilot Program. Well location and ownership information for 95 public water system wells were collected and added by PGG. PGG also supplemented the database with well depths from well logs where available.

3.3 INFORMATIONAL PUBLIC QUESTIONNAIRE, SURVEY #2

The Education and Public Outreach Working Group under the direction of the LYV GWAC created a 19-question survey to find out what residents served by private wells know about:

- Their drinking water and their opinion of its safety,
- Nitrate in groundwater, and
- The GWAC meetings.

The survey, conducted by Heritage University students during August and September of 2013, targeted eight areas and 300 households in the LYV GWMA (Lisa Freund, Yakima County, personal communication, 2013). The areas chosen were known to either have high nitrate in groundwater or were in areas where little data on nitrate levels exist.

Of the 300 households, 136 households responded to the survey, and 45 respondents (15 percent) agreed to be part of the more in-depth survey that includes water quality sampling for nitrate. These results will help determine where a second, more in-depth study of private wells in the Lower Yakima Valley should occur and the response percentages that could be expected from future surveys. The follow-up survey, which will

include visits to proposed monitoring stations as described in section 5, is scheduled to take place later this year.

4.0 NITRATE CONCENTRATIONS IN THE LYV GWMA

The following table presents summary statistics for nitrate concentrations in the LYV GWMA, with non-detect values included at a value of half the detection limit. All nitrate concentrations in this report are milligrams nitrogen per liter (mg/L). A map showing monitoring well locations and sample locations is presented in Figure 1. Sample collection dates range from October 16, 1978 to March 5, 2013, although 85 percent of the samples were collected since 2000.

Statistic	Value
n(samples)	2,532
non-detect	375 (14.8%)
n(locations)	678
Minimum	0.03
Maximum	98.1
Mean	5.815
Median	4.7
Variance	51.78
Standard Deviation	7.196

Well depths are available for 428 of 678 locations (63 percent). Well depths range from 1.17[1] feet in alluvium to 2,715 feet below ground surface in basalt. Half of the well depths are shallower than 136 feet. Figure 2 indicates the distribution of well depths follows an approximately lognormal distribution.

Quality Assurance and Quality Control (QA/QC) data were not available for any of the data included in the WQ database, and 25 samples were excluded due to incomplete nitrate concentration values. The Groundwater Monitoring Quality Assurance/Quality Control Plan (PGG, 2013) indicates that data without associated QA/QC information not included in long-term monitoring data. However, the WQ data may be used for long-term monitoring point selection. The following sections characterize the nitrate data available for long-term monitoring point selection:

Data Distribution - The nitrate data with or without non-detect values do not follow a normal, lognormal, or gamma distribution and are therefore treated as non-parametric.

Comparison to Natural Background - According to the Ecology Preliminary Assessment (2010), "Concentrations above 0.3 mg/L indicate some process is leading to increased nitrogen in groundwater beyond what would be observed in a pristine watershed." A total of 363 of 2532 (14.3 percent) nitrate concentrations were detected or non-detect at or below the natural background level of 0.3 mg/L. Well locations where

[1] This well depth comes from the USGS NWIS database, and is listed as a well, not a spring, completed in alluvium. The information in the USGS NWIS database is generally considered to be of good quality.

the maximum value was at or below 0.3 mg/L are shown on Figure 3. Most of these wells cluster towards the edges of the GWMA.

Comparison to Ground Water Quality Criterion - The Washington State Groundwater Quality Criterion (GWQC) for nitrate is 10 mg/L. A total of 327 of 2,532 (12.9 percent) nitrate concentrations were detected above the GWQC of 10 mg/L.

Variability with Depth – Maximum nitrate concentration data are plotted in Figure 4 by three depth intervals: 0 to 100 feet, 100 to 200 feet, and greater than 200 feet. Geologic analysis to divide the dataset by aquifer was not performed. Where well depths are known, the three depth intervals generally divide the dataset into three equally-sized groups. Figure 4 shows that the wells where the maximum nitrate concentrations were at or below 0.3 mg/L tend to be completed at depths greater than 200 feet, with a cluster of wells with depths of 0 to 100 feet between Mabton and Sunnyside.

A boxplot of maximum nitrate concentration for each well location by well completion depth interval is presented in Figure 5. The boxplot shows that the mean and median nitrate concentration values generally decrease with depth up to 1,000 feet[2].

Depth Interval (feet below ground surface)	Number of Wells (n)	Mean[1]	Median[1]	Standard Deviation[1]
0 to 100	123	9.38	5.32	11.56
100 to 200	119	8.15	5.11	8.27
200 to 500	79	6.10	4.73	5.84
500 to 1000	19	3.88	1.30	4.39
Greater than 1000	22	3.92	1.50	6.16

[1] nitrate mg/L

Of the 22 sampled wells that are deeper than 1,000 feet, eight have maximum concentrations below 0.3 mg/L, 10 have maximum concentrations between 0.3 and 10 mg/L, and four have maximum concentrations above the GWQC of 10 mg/L.

5.0 NITRATE CONCENTRATION TRENDS

Concentration trends were evaluated on the entire nitrate data set over time, and for individual wells where time series data are available.

5.1 TREND FOR COMBINED DATASET

We evaluated the apparent long-term nitrate trend in the combined dataset by grouping maximum nitrate results per well location from the WQ database into five year periods (e.g. 1980 to 1984, 1985 to 1989), and making comparison between the groups. A list of statistics for each five year period is presented below. The median and number of high nitrate concentration values have increased over time; however, a bias toward an

[2] Possible outliers were not identified or removed prior to calculating these statistics.

increasing trend could be as a result of more recent sampling programs targeting shallower wells that are more subject to nitrate contamination; whereas older data tends to be from deeper water supply wells that were routinely sampled to meet WDOH drinking water monitoring requirements. Evaluations using data from individual wells, discussed in the following subjection, are not subject to this bias and should be favored as a measure of trend in the GWMA.

Date Range of Well Samples	Number of Wells (n)	Mean Nitrate[1]	Median Nitrate[1]	Standard Deviation[1]
1975 to 1979	4	1.45	1.10	1.66
1980 to 1984	51	3.48	1.70	4.10
1985 to 1989	40	3.33	1.80	3.63
1990 to 1994	76	3.52	2.60	3.89
1995 to 1999	69	4.06	3.90	3.29
2000 to 2004	295	6.36	4.00	8.56
2005 to 2009	90	4.74	4.44	3.60
2010 to 2014	323	13.51	11.50	11.17

[1] nitrate mg/L

5.2 MANN-KENDALL TREND TEST FOR INDIVIDUAL WELLS

Forty-six wells had more than 10 samples over time and were therefore evaluated for individual trends (Figures 6 through 15). All sample locations were public water system wells with data from the WDOH Sentry database. Quality Assurance and Quality Control (QA/QC) information was not available for the WDOH dataset, but cursory inspection suggests there are QA/QC issues with these data. For example, on Figure 10, Station 2897016 shows anomalously high variability in nitrate concentrations between samples.

The wells for which time-series data are available tend to be deeper than average, with a median depth of 342 feet compared to 136 feet for all wells. Therefore, although free of the type of bias that may be present in the grouped data discussed in Section 5.1, they may not reflect trends in shallower wells.

PGG identified wells with statistically significant trends using the Mann-Kendall trend test (Table 1). The Mann-Kendall test is a nonparametric trend test which uses ranks instead of concentration values. The Mann-Kendall trend test results for wells with upward trends are presented below. Statistical significance can be affected by outlier values; outliers were not identified or removed as part of this analysis.

Results show 16 statistically significant trends, 7 upward and 9 downward. Locations where statistically significant upward trends occur are listed below and are shown in Figure 17. An upward trend is indicated by a positive tau and a significant trend is indicated by a p of less than 0.05. Wells with upward trends are widely spread through the GWMA, although 3 wells cluster near Grandview. The similarity in number of upward and downward trends suggests an absence of strong uniform trend throughout the GWMA.

Well ID	number of samples (n)	Std dev	p	tau	Up/ Down	Location
2897001	32	3.63	7.0E-03	0.34	Up	Grandview
2897010	139	4.67	1.1E-06	0.28	Up	Grandview
2897011	29	1.24	2.8E-02	0.29	Up	Grandview
6494002	21	1.62	3.4E-03	0.47	Up	Outlook Elem School
6591901	37	3.37	2.7E-02	0.26	Up	Panorama Place Water Assn
8540005	12	0.98	1.9E-02	0.53	Up	City of Sunnyside
AB70001	10	4.34	1.2E-02	0.64	Up	Wineglass Cellars

std dev = standard deviation; p = statistical significance; Tau = test statistic; Trend considered significant for p<=5.0E-02 (0.05)

6.0 IDENTIFICATION OF POTENTIAL SAMPLING STATIONS

PGG developed a list of potential monitoring stations (provided to Yakima County electronically as a database) using well selection criteria listed in HDR contract #CON0082545. PGG used two databases, the nitrate WQ database and the Well Location database described above to select stations using the criteria listed below and further described in Subsections 6.1 through 6.7:

1. Spatial data gaps – Investigating spatial data gaps will identify whether additional hot spots exist. Monitoring stations are proposed for the largest 5 areas where no existing nitrate information is available. Spatial data gaps were selected by measuring the distance between all known nitrate concentrations.

2. Hot spots - Monitoring well stations are proposed at or near wells with maximum nitrate concentrations equal or greater than 20 mg/L (or twice the GWCL of 10 mg/L) to achieve the objective of monitoring groundwater quality and change over time.

3. Increasing concentration trends – Monitoring well stations are proposed at or near wells with statistically significant increasing nitrate trends. These wells will likely be among the first to show changes in nitrate concentration.

4. Basin-wide monitoring - Monitoring well stations are proposed using a simple random selection process with sample size large enough to achieve a confident comparison of baseline average to future average nitrate concentration.

5. Common water supply aquifers - Monitoring well stations proposed for the basin-wide monitoring will likely include representative samples in common water supply aquifers. This will be verified by comparing the depth profile of the basin-wide monitoring locations to the depth profile of all wells.

6. Measure Effects of Current and Future Practices (Best Management Practice (BMP) effectiveness) - Monitoring is recommended in water table (shallow) wells constructed specifically for this purpose. Specifics should be proposed in a subsequent work product.

7. Health risks- Drinking water wells causing human health risks will be identified by Yakima County under a separate GWMA task.

Several of the subsections below refer to "field verification." Yakima County will evaluate numerous possible wells identified by PGG for possible future use as a GWMA monitoring station. Those wells that are made accessible by owners and are physically accessible to field staff will be used for future monitoring. We anticipate additional well depth information will be gathered during field verification. A single well may be used to meet more than one objective.

This report identifies numbers of wells targeted for sampling but does not propose specific sampling strategies to meet the objectives. Sampling strategy will be provided in the Monitoring Plan that will be submitted to the GWAC as a subsequent task.

6.1 SPATIAL DATA GAPS

PGG identified the 5 largest areas within the GWMA without nitrate data, but where wells are available for monitoring. Using ArcGIS software, we mapped the distance from every point in the LYV to existing wells with nitrate sample data or the GWMA boundary, whichever was closer; then used the minimum distance map to find the five largest areas (Figure 16). The areas range from 4.7 to 12.9 square miles.

Only the five largest areas were selected because there appeared to be a break in size between the next smallest data gap area. Due to the low response rate and incomplete well depth information, well depth was not accounted for in the spatial data gaps analysis.

Within the five areas there are 215 possible monitoring wells. Based on a response rate of 15 percent (as achieved by the YHD Health Survey), there should be a sufficient number of wells to select one monitoring well for each spatial data gap. For the purpose of the upcoming survey, wells were ranked for each of the 5 areas based on proximity to the centroid of the spatial data gaps. And for each of the 5 areas, 10 wells were provided to the LYV GWAC for field surveying.

6.2 HOT SPOTS

PGG identified 71 wells with maximum nitrate concentrations equal or greater than 20 mg/L, a concentration twice the GWCL of 10 mg/L (chosen to define a "hot spot"). See Figure 4 for nitrate concentrations by well depth and Figure 17 for a summary of well locations where maximum nitrate is greater than 20 mg/L.

Those wells that are made accessible by owners and are physically accessible to field staff will be used for future monitoring. Assuming an acceptance rate of 15 percent, approximately 10 of these wells may be available as future monitoring stations.

6.3 INCREASING CONCENTRATION TRENDS

PGG identified 7 wells with upward trends using the Mann-Kendall trend test as described in Section 5. Despite some irregularities in the data for some of these 7 wells, all 7 wells will be retained as future monitoring stations if they remain available.

As noted above, none of the existing data include QA/QC data, however, the Groundwater Monitoring Quality Assurance/Quality Control Plan (PGG, 2013) allowed for continued use of WDOH data. WDOH requires that Group A and B public water supply systems sample for nitrate, regardless of sampling performed to meet the GWMA objectives. Thus the GWMA may continue to rely on data gathered within the WDOH program.

Many years to decades may be necessary to confidently detect changes in nitrate concentration in wells typical of the existing database, and additional supply wells added through field verification. The long time frames are caused by slow groundwater flow rates and variability which obscures actual change (signal to noise). For these and other reasons, monitoring for BMP effectiveness should not rely solely on water supply wells. Monitoring of specially designed and sited water table monitoring wells (shallow wells) is recommended to determine levels and trends in nitrate concentrations. They will respond much more quickly to local land use change than deeper and more variable wells in the WQ database and Well Location database.

6.4 BASIN-WIDE MONITORING

PGG used the simple random approach to identify the number of monitoring stations that would need to be sampled to measure the basin-wide-average at a level of confidence that supports use of the data for future GWMA purposes. Those purposes include comparison of a current average to past and future averages, and comparison of averages to the GWMA-adopted water quality goal of 10 mg/L nitrate. The largest number of samples are required for a comparison of averages collected at different times. To meet that objective, PGG estimates on the order of 1,000 samples would be required. That number of samples could be generated by a range of strategies – including sampling each of 170 to 250 stations four to six times over a year. Owner acceptance and physical conditions, to be confirmed through field verification, may limit the number of stations available to address this objective.

Target well locations for field verification were identified using a simple random sampling plan. Simple random sampling means that each of the 7,790 well locations has an equal chance of being one of the selected measurements a future monitoring station. This method is used for estimating means, medians, and trends when the population does not in general contain major trends, cycles, or patterns, which appears to be a valid assumption in this case. With this sampling method, a large number of samples are necessary to confidently identify changes in the basin-wide average nitrate concentration between baseline and data sets collected after land use change.

The simple random method assumes that the sampling frame, which is our master list of well locations in the Well Location database, is a complete list for the GWMA or is representative of the entire population of wells in the GWMA. If the sampling frame is

grossly incomplete or biased, a random sample of wells from the Well Location database may be biased relative to the entire population of wells.

Only 15 percent of well owners agreed to have their wells sampled when approached by YHD (Section 3.1). A high nonresponse rate may result in a biased well monitoring network if the nonrespondent wells differ systematically from the respondent wells. For example, if private well owners are highly nonresponsive, but public water system well owners are responsive, the resultant monitoring network could be biased as to location, depth, or nitrate concentration. Since the response rate is expected to be low, the final monitoring well network will be compared to the simple random sample target well list to evaluate for bias in well owner type, well depth, or well location.

6.5 COMMON WATER SUPPLY AQUIFERS

The simple random sampling plan as described above will also be used to identify stations to monitor common water supply aquifers. The random sample will likely include a representative sample of well depths, and a representative sample of common water supply aquifers. This assumption will be verified after the final monitoring stations are selected.

6.6 MEASURE EFFECTS OF CURRENT AND FUTURE PRACTICES (BMP EFFECTIVENESS)

Wells in the existing database are typically designed to supply drinking water not to reflect the effects of current or future nitrogen management practices. Many years or even decades of monitoring will be required to confidently distinguish changes in groundwater nitrate concentrations using existing wells. Thus quickly measuring the effects of current and future practices should not rely solely on wells in the existing database. Nitrate concentrations in specially designed water table monitoring wells (shallow wells) will currently reflect the effects of existing BMPs, and will respond much more quickly to future changes. Thus such wells are recommended to help meet this objective.

Specially designed shallow wells are recommended where BMPs are known to be changing[3]. The number of wells and locations should be specified in a work plan generated at a time coordinated with changes to nitrogen management changes. To allow the wells to reflect recent historic practices as well as future practices, the wells should be installed as soon as appropriate locations can be identified.

6.7 HEALTH RISKS

Areas of elevated human health risk will be identified using results of the Education and Outreach Committee's High Risk Well Assessment Survey. Factors such as presence of a seal, number of affected population served, nitrate concentration will be used to evaluate

[3] In future phases of this project, changes to BMPs will be made to reduce the release of nitrate to groundwater. The shallow water table below locations where these changes are made will likely show the most rapid changes in nitrate concentration.

human health risk. This evaluation will be performed in association with the WDOH. The number of wells monitored will depend on the number of responses to the survey.

7.0 REFERENCES

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Table 1. Mann-Kendall Trend Test Results

Well ID	n	Standard Deviation	p, Statistical Significance	Tau	Significant Trend? (Up/Down)
4965001	158	3.757434616	2.36E-15	-0.44383	Down
4965004	78	1.89009415	5.65E-07	-0.4372	Down
628702	55	4.538235117	2.37E-06	-0.43898	Down
9980003	17	0.922267825	0.001970103	-0.56298	Down
AA43202	56	3.188313314	0.014880689	-0.22617	Down
2897008	17	2.190488295	0.018875547	-0.42647	Down
415701	18	0.953212148	0.025326289	-0.39344	Down
2897016	102	5.180332219	0.042952381	-0.13641	Down
1624202	17	3.084524942	0.043545581	-0.36765	Down
2897010	139	4.66576742	1.09E-06	0.280523	Up
6494002	21	1.621034502	0.003399434	0.466667	Up
2897001	32	3.630838346	0.007041277	0.339095	Up
AB70001	10	4.343853896	0.012266059	0.644444	Up
8540005	12	0.97557287	0.019440878	0.534367	Up
6591901	37	3.371602995	0.027055988	0.255639	Up
2897011	29	1.242397174	0.0281302	0.291359	Up
8540008	19	1.206685083	0.057831056	0.327433	
3035001	10	2.545829705	0.063697524	0.50128	
9980001	28	1.436279871	0.065804727	-0.25067	
4965002	21	3.665686709	0.074193016	0.288475	
2241801	12	1.617658943	0.080057926	0.413167	
8512101	17	0.673063125	0.083351925	0.317345	
2897017	12	9.085462372	0.086471118	0.393939	
6618501	14	0.994219833	0.188887477	-0.27473	
4965003	95	3.14459843	0.197246656	0.090287	
3430101	16	0.825814497	0.206981122	0.24268	
8540009	21	1.239719054	0.213335901	0.218521	
359401	11	0.421730202	0.241476879	-0.29359	
1624201	20	3.620006397	0.269223869	0.185682	
2897007	110	3.727389015	0.29422757	-0.06812	
6990001	23	1.6916734	0.340254098	0.148011	
2897012	13	1.680576061	0.360121638	-0.20513	
9191301	46	4.239114351	0.399168849	0.087337	
2897014	22	0.09500057	0.472785711	-0.1341	
2897003	30	0.664776257	0.475308478	-0.09447	
2959701	18	0.562694556	0.517352164	0.140028	
628701	23	1.12963739	0.52119571	0.102968	
AA48401	13	3.627026754	0.624854445	-0.11613	
8540006	23	0.305602496	0.631960332	-0.08802	
2897013	80	2.64923693	0.644453287	-0.03751	
2897002	34	2.18098009	0.667067051	-0.05372	
8540007	25	1.154570627	0.766732275	-0.05238	
430201	15	1.544543391	0.804336071	-0.05742	
477601	16	5.74453969	1	-0.00837	
2900001	21	0	1	1	
9980002	17	0.764660632	1	0.015401	

stdev = standard deviation

p = statistical significance

Tau = test statistic

Trend considered significant for p<=0.05

Figure 1
Monitoring Well Locations

PgG

- Well Sampled for Nitrate
- Well with No Nitrate Data Available
- Water System Service Areas (from WADOH)
- GWMA Boundary
- EPA Dairy Cluster Buffer Boundary
- Yakama Nation Boundary (from Yakima County)

0 Miles 3

0 Feet 15,000

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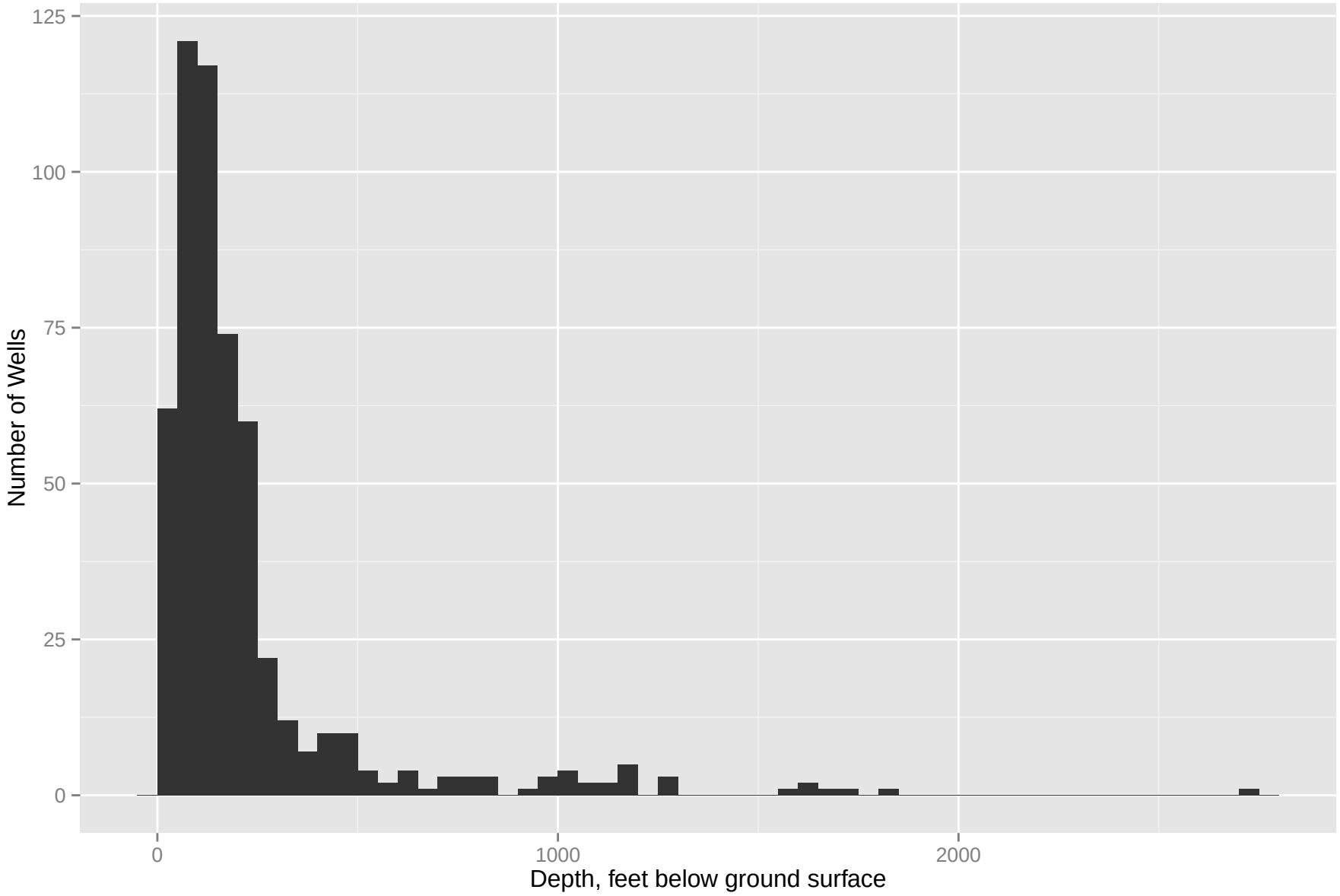

Figure 2. Well Depth Histogram

Prepared 12/03/2013

PgG

Figure 3

Nitrate Concentrations less than 0.3 mg/L

PgG

- Wells Sampled with Nitrate < 0.3mg/L*
- Water System Service Areas (from WADOH)
- GWMA Boundary
- EPA Dairy Cluster Buffer Boundary
- Yakama Nation Boundary (from Yakima County)

*Wells with Non-Detects are mapped at half the reporting limit

0 Miles 3

0 Feet 15,000

Union Gap
Wapato
Yakima R
Rattlesnake Hills
Yakama Nation
Toppenish
Zillah
Granger
Sniples Mountain
Sunnyside
Grandview
Mabton
Toppenish Cr
Toppenish Ridge
Satus Cr
Mule Dry Cr
Horse Heaven Hills
Yakima County
Benton County
82
24
241
223
97
22

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Figure 4

Nitrate Concentrations by Well Depth

PgG

Well Completed Between 0 and 100 Feet Below Ground Surface

Well Completed Between 100 and 200 Feet Below Ground Surface

Well Completed Greater than 200 Feet Below Ground Surface

Well Depth Not Known

Maximum Nitrate Concentration Result*

- <= 0.3 mg/L
- 0.4 - 10.0 mg/L
- 10.1 - 20.0 mg/L
- > 20.1 mg/L
- Water System Service Areas (from WADOH)
- GWMA Boundary
- EPA Dairy Cluster Buffer Boundary

*Wells with Non-Detects are mapped at half the reporting limit

0 Miles 5

0 Feet 25,000

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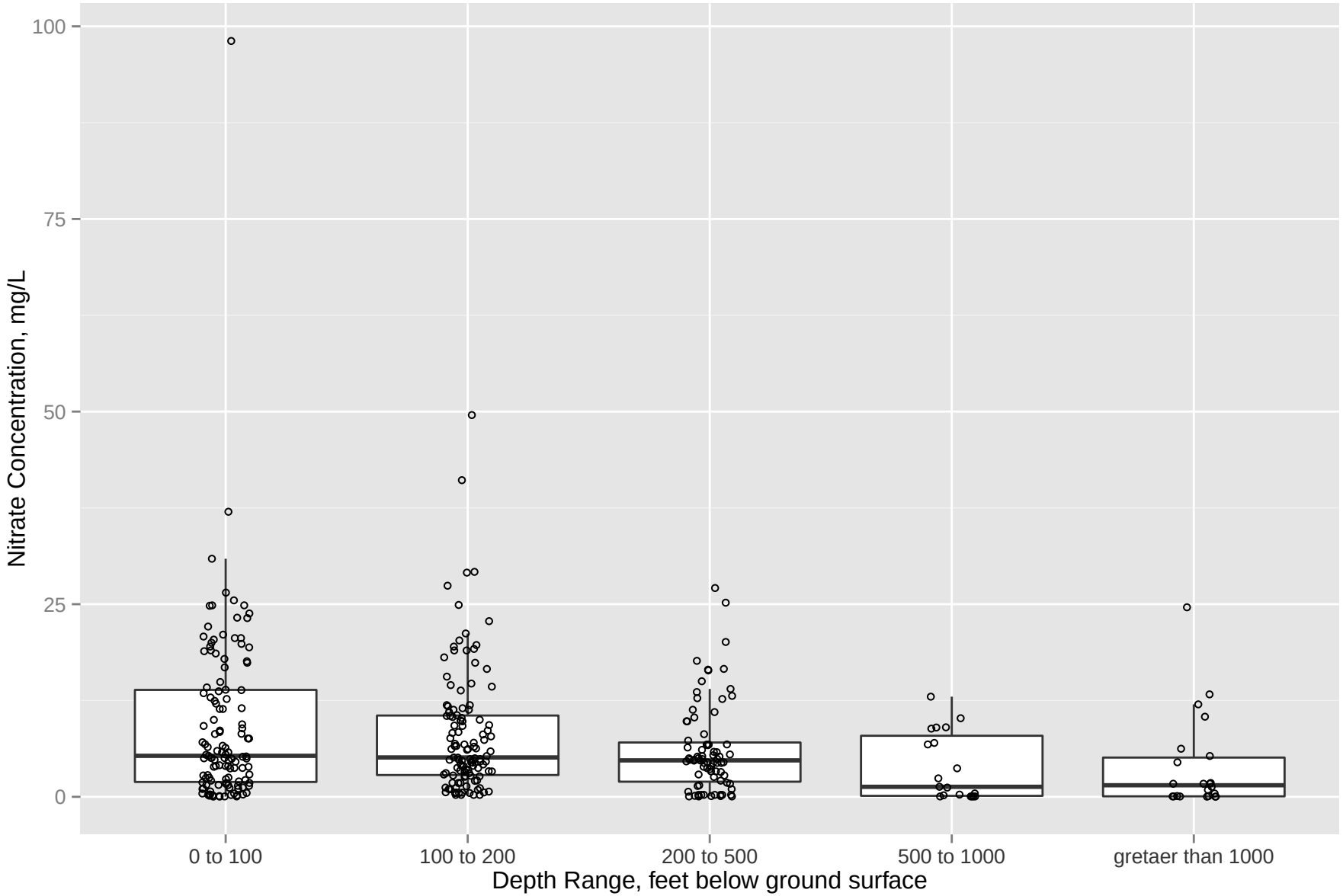


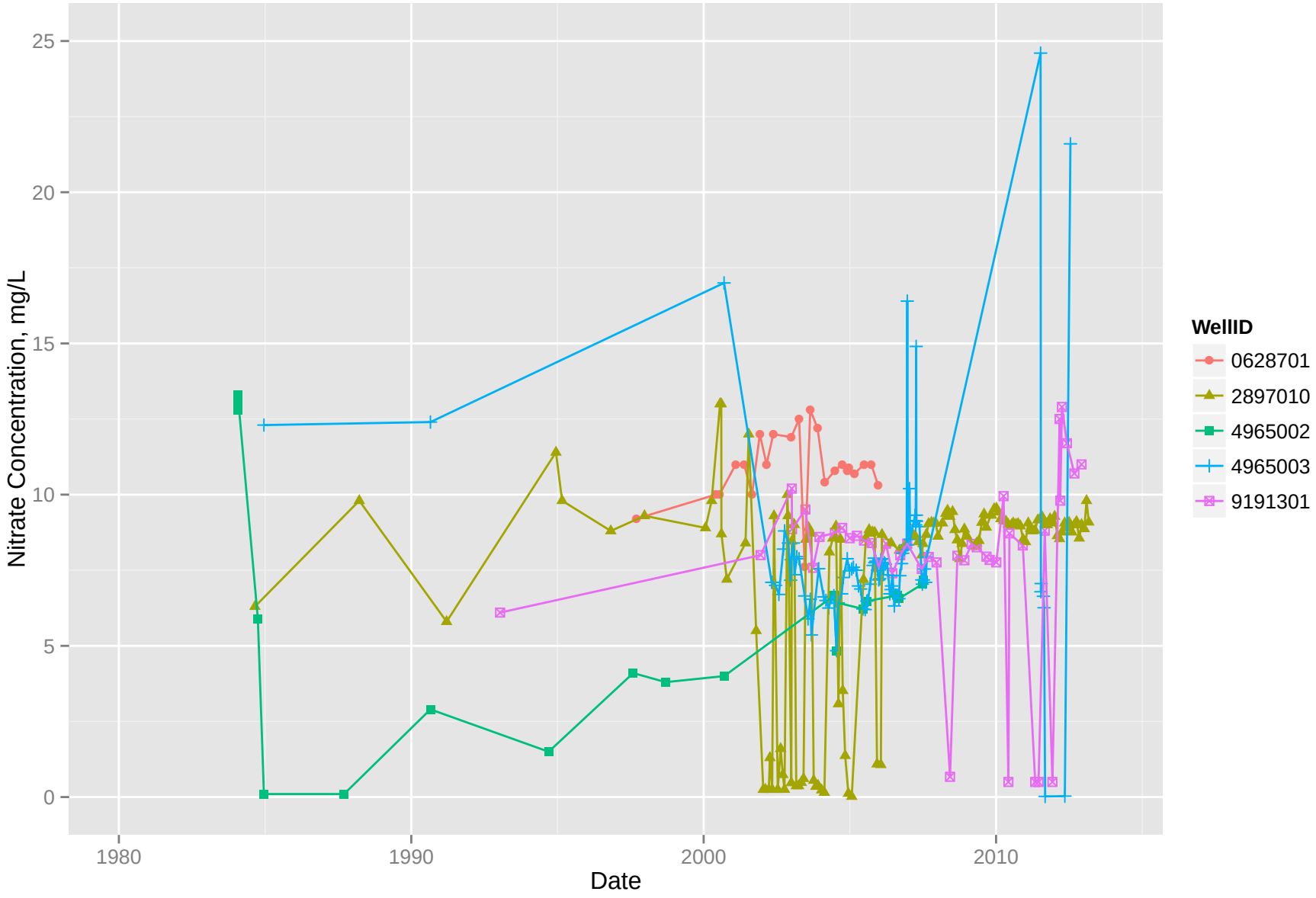
Non−detect values plotted at half the Method Reporting Limit value
black open circles represent actual data points, shifted in position to avoid directly overplotting other points
Maximum value selected for each well location

Max (<1.5*IQR)
75th Percentile
Median
25th Percentile
Min (<1.5*IQR)
IQR = Interquartile Range

Prepared 12/03/2013

Figure 5. Boxplot of Max Nitrate by Well Depth

PgG



Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 6. Nitrate Times Series
Max Nitrate >12.5 mg/L

PGG



Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 7. Nitrate Times Series
Max Nitrate 11 to 12.5 mg/L

PGG

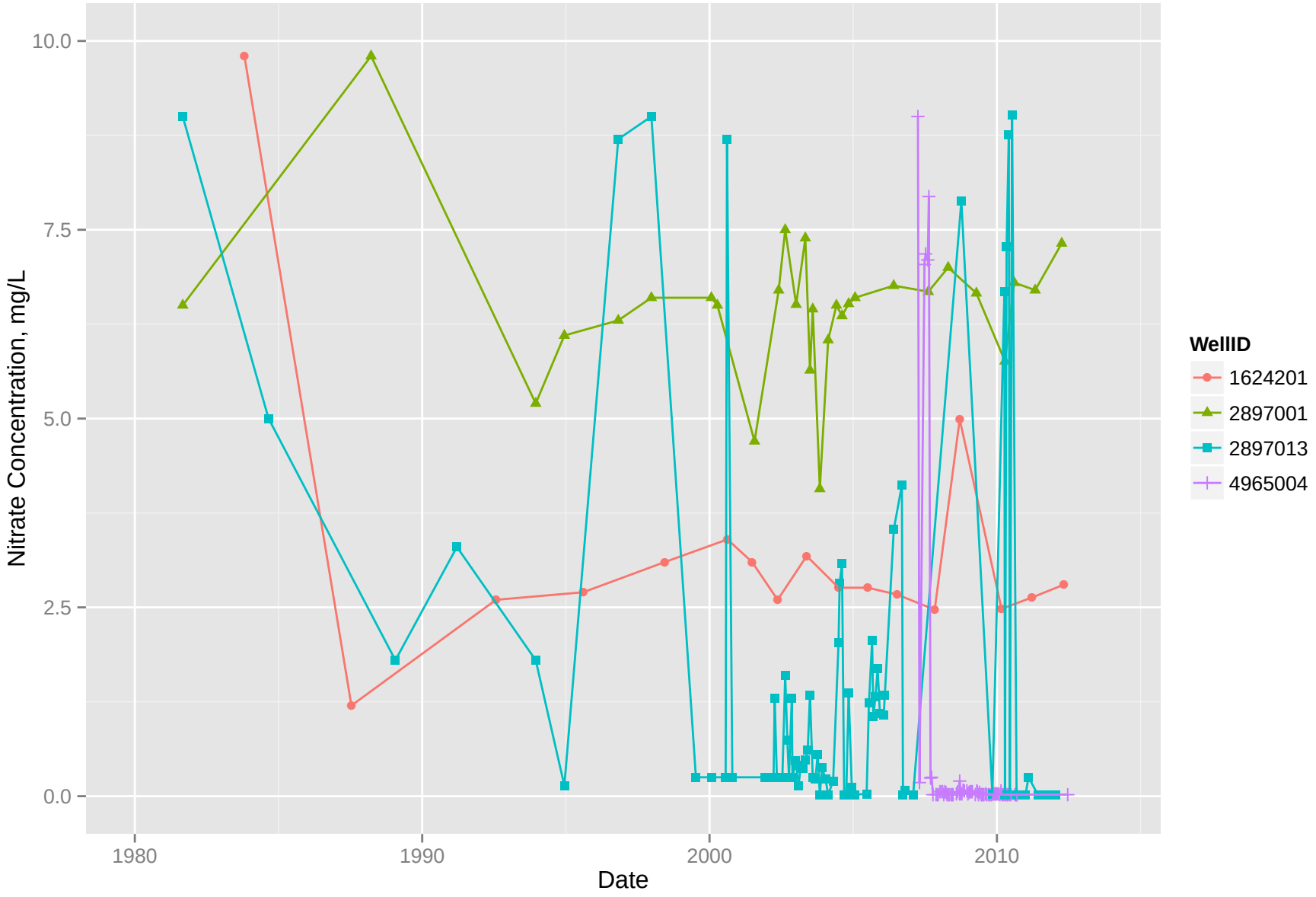


Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 8. Nitrate Times Series
Max Nitrate 10 to 11 mg/L

PGG



Non−detect values plotted at half the Method Reporting Limit value

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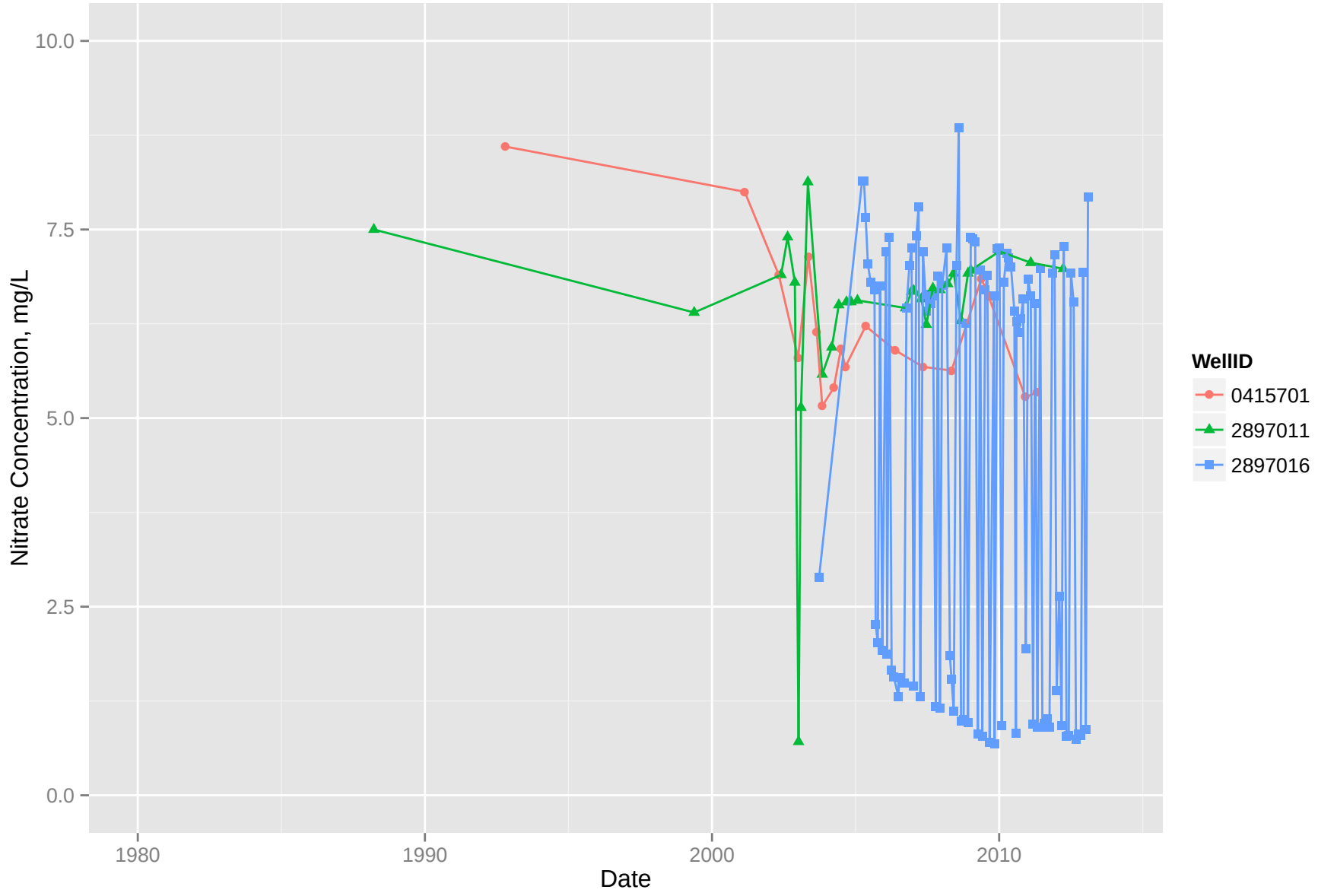
Figure 9. Nitrate Times Series
Max Nitrate 9 to 10 mg/L

PGG

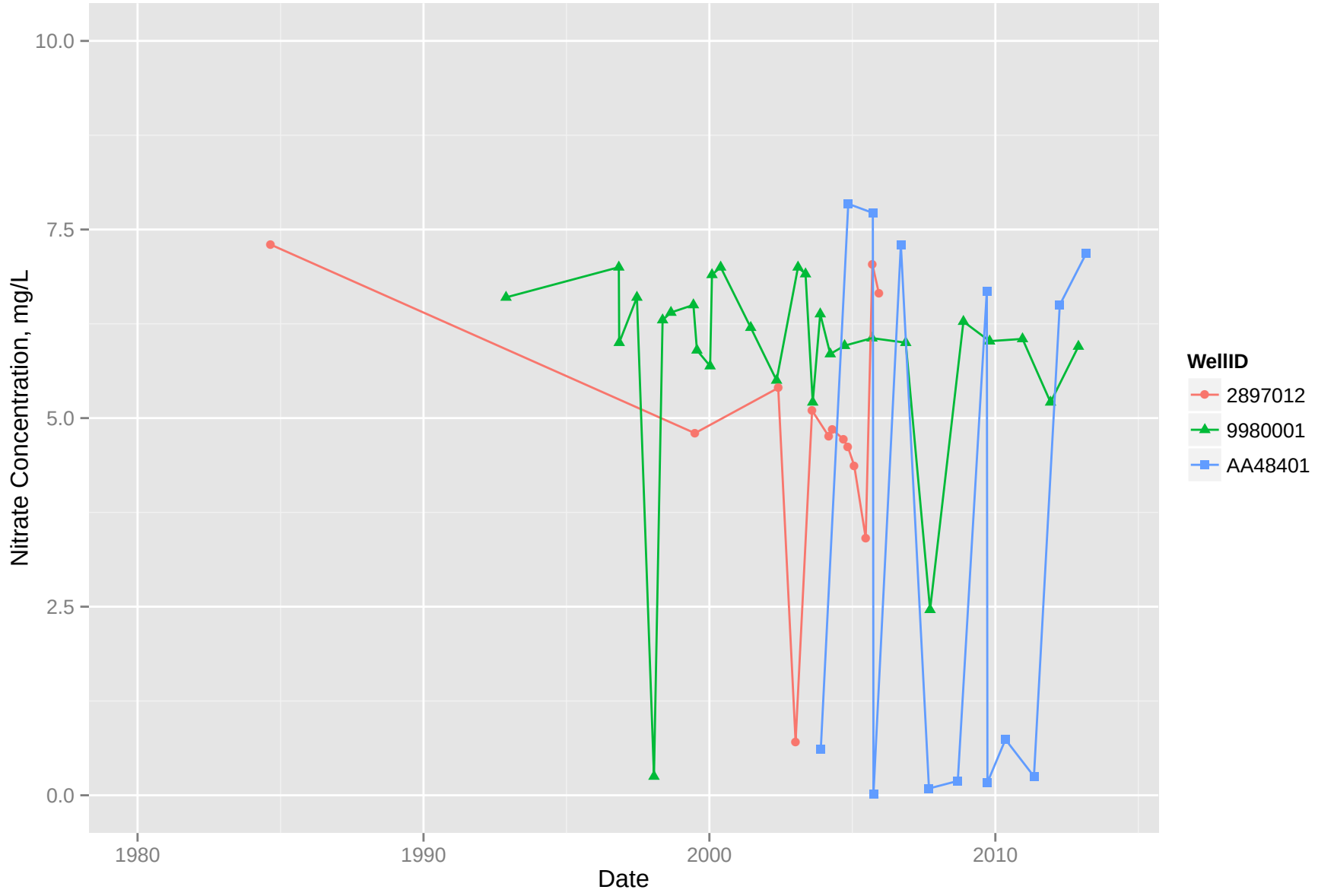


Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 10. Nitrate Times Series
Max Nitrate 8 to 9 mg/L

PgG

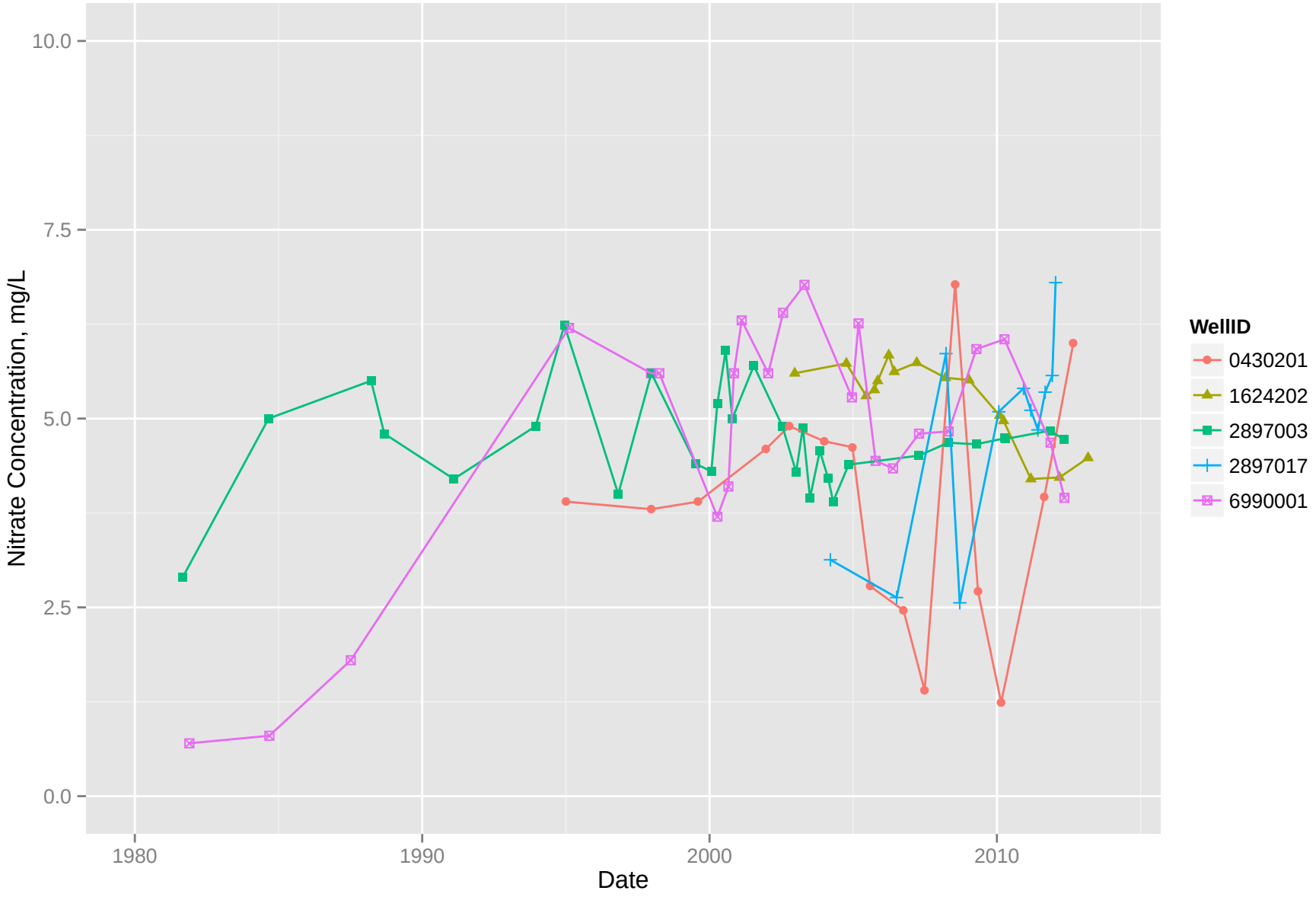


Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 11. Nitrate Times Series
Max Nitrate 7 to 8 mg/L

PGG



Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 12. Nitrate Times Series
Max Nitrate 5 to 7 mg/L

PgG

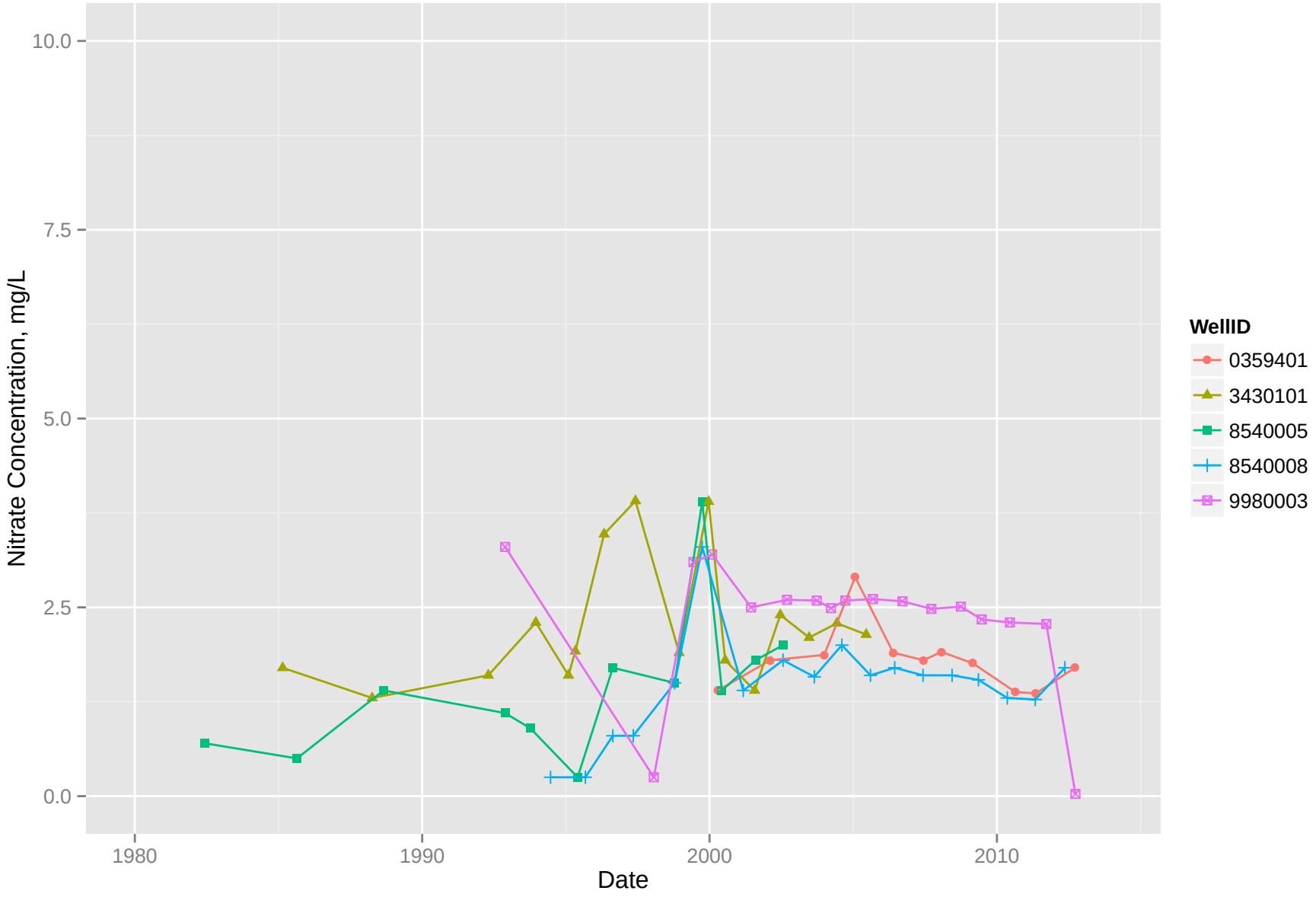


Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 13. Nitrate Times Series
Max Nitrate 4 to 5 mg/L

PGG

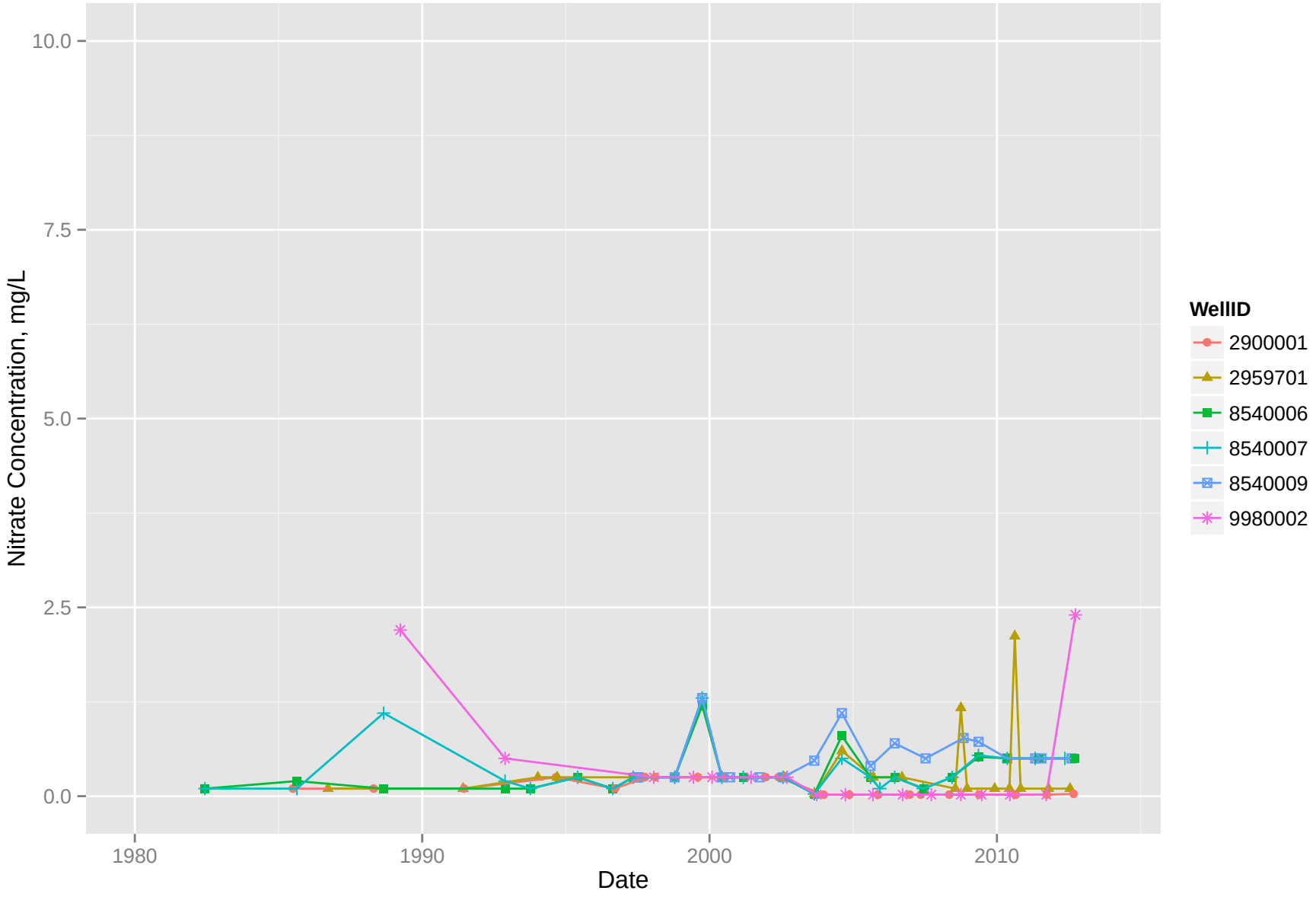


Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 14. Nitrate Times Series
Max Nitrate 2 to 4 mg/L

PGG



Non−detect values plotted at half the Method Reporting Limit value

Prepared 12/03/2013

Figure 15. Nitrate Times Series
Max Nitrate <2 mg/L

PgG

Figure 16

Spatial Data
Gaps in Nitrate Data

PgG

- Well Sampled for Nitrate
- Well with No Nitrate Data Available
- Spatial Data Gaps
- Water System Service Areas (from WADOH)
- GWMA Boundary
- EPA Dairy Cluster Buffer Boundary
- Yakama Nation Boundary (from Yakima County)

0 Miles 3

0 Feet 15,000

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Figure 17

Proposed Monitoring Locations for Spatial Data Gaps, Trends and Hot Spots

PgG

Proposed Monitoring Locations

- Wells Located in Spatial Data Gaps
- Wells with Maximum Nitrate Concentration >20.0 mg/L (Hotspots)
- Spatial Data Gaps
- Water System Service Areas (from WADOH)
- GWMA Boundary
- EPA Dairy Cluster Buffer Boundary
- Yakama Nation Boundary (from Yakima County)

N

0 Miles 3

0 Feet 15,000

Union Gap
Wapato
Toppenish
Zillah
Granger
Sunnyside
Grandview
Mabton
Yakama Nation
Rattlesnake Hills
Snipes Mountain
Toppenish Ridge
Horse Heaven Hills
Yakima County
Benton County
Yakima R
Toppenish Cr
Satus Cr
Mule Dry Cr
82
24
241
223
97
22

K:\PONY\Yakima Basin GWMA\GIS\Tabloid_Proposed\MW_Locations.mxd 11/5/2013

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Flawed Management of the GWMA Decision Making Process for Selection of Alternative Management Solutions

The GWMA leadership began the process of selecting alternative solutions to the problem of nitrates in groundwater without data that describes and quantifies the problem. The group had not agreed upon the major sources of nitrate contamination and did not prioritize solutions based on that foundation.

The GWAC frequently asked for cost information prior to decision making. That information was not delivered until late April when the number of solutions had been narrowed to 66. In May the GWAC was asked to perform a screening.

Members of the group stated that they had more to discuss, but on June 21, 2018 the leadership asked for a vote to use the alternative solutions that received a positive vote as the final list for the GWMA plan. Twelve members voted in favor and that list of alternative solutions became the solutions proposed in the GWMA plan.

During the GWMA meetings from June 2017 to June 2018 promises were made and promptly forgotten. Examples:

- August 10, 2017 – Promise to measure the effects of GWAC program on Yakima County economics
- August 10, 2017 – Will not share the Nitrogen Availability Assessment until it has been fully vetted
- September 21, 2017 – Will discuss solutions that address the needs of people in the GWMA target area whose wells have nitrates greater than 10 mg/L
- October 19, 2017 – Will craft language that includes the EPA's Community Multiscale Air Quality Modeling System in solutions to address emissions to the ambient air and atmospheric deposition
- October 19, 2017 – Will convene the GWMA Funding Work Group to discuss cost for proposed alternative solutions
- November 2, 2018 – Will add analysis of nitrates from bio-solids to the Nitrogen Availability Assessment
- December 7, 2017 – Ecology and DOH will analyze survey data from the High Risk Well Assessment
- February 15, 2018 – Will convene the GWMA Funding Work Group to discuss cost estimates for proposed alternative solutions
- February 15, 2017 – WSDA will put some numbers together for the group of quarterly and annual costs analysis, sampling and review of data for well testing

Review of GWMA Meeting Summaries July 2017 to June 2018:

June 29, 2017:

Jim Davenport introduced a list of 247 Alternative Solutions to address elevated nitrates in the LYV groundwater. **Note: The GWAC had no Area Characterization, no High Risk Well Survey Analysis, no Deep Soil Sampling Analysis, no System of Purpose Built Wells, no Data from Domestic Well Monitoring, and no Nitrogen Loading Assessment.**

Here is a breakdown of the solutions compiled by Yakima County:

Education and Public Outreach (N = 47)

- EPO to Farmers (N = 25)
- EPO Private Wells and Septics (N = 7)
- EPO Educate the Public about Pollution and the GWMA (N = 2)
- EPO Health (N = 2)
- Communication with the Spanish speaking population (N = 2)

Data Collecting and Analysis (N = 26)

State Regulatory Authority (N = 22)

Domestic Wells (N = 21)

Incentives (N = 20)

Septics (N = 18)

Nutrient Management Plans (N = 16)

Local ordinances re Ag (N = 13)

Best Management Practices (N = 12)

Abandoned Wells (N = 8)

Local ordinances re people (N = 4)

Lagoons & Ponds (N = 2)

Composting (N = 2)

Note: There were 18 proposed solutions addressing septic systems – 2% contribution to nitrates in GW, and 2 proposed solutions addressing lagoons and

ponds – 19% contribution to nitrates in GW. There were 8 proposed solutions addressing abandoned wells – a very small and unconfirmed source, and 2 proposed solutions addressing composting operations with > 500 acres of manure stacked on bare ground. There were no proposed solutions to assist the people with polluted wells. There were no proposed solutions to address the large amounts of reactive nitrogen that are emitted from animal livestock operations and manure applications to cropland.

July 27, 2017:

The GWAC began discussing alternative solutions. Several alternative solutions were added, including requirements to address emissions to air.

August 10, 2017:

The GWAC agreed to discuss Alternative 46: Measure the effects of GWAC program on Yakima County economics at a later date. **Did not happen.**

Regarding the NAA "Vern went on to say that whether this action was right or wrong the group needed to agree that they would not share information that had not been fully vetted."

In fact WSDA and Yakima County went on to finalize the document in mid-2018 without GWMA approval. It has been presented to the public by WSDA.

September 21, 2017:

"One member wished to discuss how the GWAC's ultimate recommendations would be paid for. Another member wished to discuss solutions that address the needs of people in the GWMA target area whose wells have nitrates greater than 10 mg/L, citing the 'Immediate Public Health Needs' on page 21 of the GWMA Work Plan. Another member wished to discuss the initial results from the USGS sampling program. All these matters were deferred."

"Funding sources will be discussed at a future meeting." **There were frequent requests from the GWAC to analyze costs before narrowing down the list of potential solutions.**

"Solutions that address the needs of people in the GWMA target area whose wells have nitrates greater than 10 mg/L will be discussed at a future GWAC meeting." **Did not happen.**

October 5, 2017:

Member asked for a report from the Funding Group. Vern Redifer told the member to read the meeting summary.
Alternatives related to enforcing the Washington State Clean Air Rule will be discussed at the next GWAC meeting.

October 19, 2017:

Vern informed the group that Jean Mendoza had rewritten the alternatives related to enforcing the Washington State Clean Air Rule and displayed Jean's five rewrites on the screen.

Ultimately the group agreed that Vern and Lucy would work together to craft language for these alternatives to reflect the GWMA's support of this EPA endeavor outlined by Lucy for the LYV GWMA.

Group had completed review of the Alternative Solutions and it was time to put them in a cogent form. **There were still no cost estimates**

"Once the list was agreed upon in its final format the alternatives would be discussed at the Funding Working Group meeting in order to explore funding possibilities." **There were no meetings of the Funding WG after September 2017.**

The GWMA Funding Work Group met on June 14, July 12 and September 13, 2017.

November 2, 2018:

There was discussion about conversion of organic matter to nitrate. "Gary (Bahr) responded that a one percent difference amounted to 20 pounds N/acre."

This is incorrect. Page 36 of the original NAA states: "In general, organic matter in soils can mineralize to provide between 20 and 65 lbs N/ac per 1% organic matter for crop utilization." and, "WSDA used 2.17% organic matter (based on the deep soil sampling results) and conversion rates of 20, 42.5, and 65 lb N/ac (for low, medium and high estimates) for each 1% organic matter."

Mr. Bahr is one of the authors for the NAA. Another author was sitting in the audience and she said nothing. They simply led the GWAC to believe something that is not true.

Comment 80: "The report does not include an analysis of Biosolids." Vern stated that an analysis of biosolids would be included in the next draft of the NAA. **Bio-solids were never added to the NAA, in spite of the fact that EPA had gathered data on the amount of nitrogen available from bio-solids in Yakima County. The EPA documented that as high as 419,000 lbs of nitrogen per year had been added to Yakima County cropland. (EPA Lower Yakima Valley Project Nitrogen Loading Screening Analysis, 2012, page 14)**

The lack of analysis on compost was also raised. Gary stated that this was being looked into by WSDA. **There is convincing data on leaching from compost. This information was never added to the NAA.**

The group agreed to continue the discussion of the NAA at the next GWAC meeting. An updated list of summarized comments would be distributed to members, with subjects resolved at this meeting crossed out. **Didn't happen.**

A member commented that the whole point of the GWMA was to help the people of the Lower Valley, and the group was quickly running out of time and money

December 7, 2017:

Jim Davenport presented the first four chapters of the GWMA Plan:

- Introduction
- Area Characterization
- Sources of Nitrate and the Regulatory Environment
- Yakima County's Role in Groundwater Quality Protection

Vern said that Melanie Redding and Andy Cervantes were reviewing the data (High Risk Well Survey**). Based on response to a public records request FOTC believes that there were no survey results and Mr. Redifer knew this when he stated that people were reviewing it.**

The GWAC agreed to meet twice a month from January to June if there was material to discuss. The agencies were very slow delivering material. Meetings were: February – 1, March – 1, April -1, May – 2, June 1.

The list of Alternative Solutions had been narrowed down to 84. **Still no cost estimates.**

February 15, 2018:

Jim Davenport stated that the county had gone to the agencies for funding input. After that came back the county would talk to the Funding Work Group about the estimates. **The Funding WG never re-convened.**

At the July 12, 2017 Funding WG Gary Bahr had committed to "put some numbers together for the group of quarterly and annual costs analysis, sampling and review of data for well testing from the work he had done (spreadsheets of examples – not a bid)." FOTC asked for the second time whether that information would be provided. Mr. Bahr said "yes". **He did not follow through.**

March 1, 2018:

Discussion of regulations in the plan. Jim Davenport stated that any alternatives with regulations were rejected by the group last year. **FOTC would not have agreed to this. FOTC shared a document from the beginning of the GWMA, *2010 Vital Elements of a Groundwater Protection Body,* that underlined the importance of regulations. David Bowen stated that any request for a change in regulations would best be supported by a white paper. FOTC followed up with a short paper (Attachment 33) and request for enforcement in RCW 90.64. This proposed alternative was never brought to the GWAC.**

"A member recalled that the GWAC had agreed not to proceed with proposed strategies and recommendations until cost data is available, so as to better prioritize solutions."

May 3, 2018:

GWAC was led to believe that bidding to drill 30 purpose built wells would start soon..

Yakima County had narrowed down the list of proposed alternatives to 66 items. GWAC asked for an opportunity to discuss the alternatives in light of cost estimates but instead the group was asked to rank the 66 alternatives. **By this time any thoughts of outreach to the Spanish speaking community were long forgotten.**

May 17, 2018:

There was discussion about the ranking of alternative solutions, but no pathway for resolving the concerns. 17 Members of the GWAC had ranked 66 proposed alternative solutions.

One proposed alternative was listed twice. The proposed solution was to "Explore investment in animal and agricultural waste to energy technology. " It received 22 points at one voting location and 16 points at the other.

June 21, 2018:

Jim Davenport introduced Volumes I & II of the GWMA Plan

Funding Group

The GWMA Funding Work Group met on June 14, July 12 and September 13, 2017.

Promises were made at these meetings. There was little follow through.

According to summary for the July 12, 2017 meeting of the Funding Group

"A member wanted to know if well monitoring costs would include funding for analysis, sampling and review of data. Vern indicated that the Data Collection Working Group would be coming up with a plan for analysis of this data and added that all of the costs associated with monitoring would be in one package."

The Data Work Group did not discuss a plan for data analysis. There is no package for monitoring, analysis and associated costs.

"Vern (Redifer) asked Laurie (Crowe) to give some thought to what kind of program she would put together considering the potential alternatives discussed and approved at GWAC meetings, what it would include and what it would cost. . . . . Laurie agreed."

This draft program was never delivered by SYCD (Laurie Crowe)

See Attachment 60

Dec. 27, 2017

Jean,

I do not believe that any of the plans or cost estimates to which you refer in your questions have been provided as requested. Regarding the item of building from the Nitrogen Availability Assessment, I did have the conversation with Gary Bahr. He advised me that he would need to talk to WSDA upper administration before he could describe WSDA's future work on taking the Nitrogen Availability Assessment to a Nitrogen Loading Assessment.

I am sorry that I do not have a better answer for your questions.

Jim

On Tue, Dec 26, 2017 at 6:36 AM, Jean Mendoza <jeanrmendoza@icloud.com> wrote:

Hello Vern & Jim,

The July 2017 summary for the Funding Work Group states, "A member wanted to know if well monitoring costs would include funding for analysis, sampling and review of data. Vern indicated that the Data Collection Working Group would be coming up with a plan for analysis of this data and added that all of the costs associated with monitoring would be in one package."

Can you send me or make available for everyone a copy of the plan that the Data Working Group developed?

The July 2017 summary for the Funding Work Group describes discussion about the time frame for monitoring, frequency and cost for monitoring. It states, "Gary (Bahr) thought tests would be about $40 and stated that at the peak of his regional and localized monitoring in Idaho the cost was approximately $350,000 per year for testing. Gary agree to put some numbers together for the group of quarterly and annual costs from the work he had done." Later, "Gary Bahr agreed to put some numbers together for the group of quarterly and annual costs analysis, sampling and review of data for well testing from the work he had done (spreadsheets of examples – not a bid)."

Can you send me or make available for everyone the data that Gary Bahr provided?

The July 2017 summary for the Funding Work Group states, "Gary (Bahr) stated that he might have spreadsheets on monitoring BMP effectiveness."

If those spreadsheets are available can you send them to me or make them available for everyone?

In the July 2017 summary for the Funding Work Group, "Proposed Next Steps" states, "Jim agreed to ask David Cole how much it would cost for YHD to prepare a Onsite Sewage System Operation and Maintenance (O & M) Plan in accordance with WAC"

I understand that Mr. Cole's death may have prevented this follow up. If the data is available can you send it to me or make it available to everyone?

Under "Three educational campaigns – agricultural producer, urban and hobby, and health risk", the September 2017 summary for the Funding Work Group states, "Vern (Redifer) asked Laurie (Crowe) to give some thought to what kind of program she would put together considering the potential alternatives discussed and approved at GWAC meetings, what it would include and what it would cost. . . . . Laurie agreed."

Can you send me or make available for everyone this document?

Under "Building from WSDA's Nitrogen Availability Assessment" there was discussion about data collection from deep soil studies. The September 2017 summary for the Funding Work Group stated, "Jim (Davenport) will talk to Gary Bahr (WSDA) about the NAA and have him summarize his recommendations and estimate the cost and frequency of each."

Can you send me or make available to everyone Mr. Bahr's response?

Matt Bachman told me at the last GWAC meeting that Yakima County will be distributing the results of the 2017 domestic well monitoring and drain sampling.

Can you send me that data or make it available to everyone?

Best wishes.

Jean Mendoza

FOTC Suggested Refinements to the 2018 GWMA Nitrogen Availability Assessment

The Washington State Department of Agriculture (WSDA) and Yakima County have written a Nitrogen Availability Assessment (NAA) that forms a starting point for further analyses of nitrate pollution of groundwater in the Lower Yakima Valley. The purpose was "to provide a scientific baseline estimate of the potential amount of nitrogen available for transport from different nitrogen sources within the GWMA boundaries."

WSDA/Yakima County Summary statements utilize two tables that describe the amounts of available nitrogen from multiple sources:

Table 1. Estimated nitrogen available for transport from all sources in tons/year and % of total

Source		Scenario A (low)		Scenario B (medium)		Scenario C (high)	
		Tons N/year	% of total N	Tons N/year	% of total N	Tons N/year	% of total N
Irrigated agriculture		298	47	2,595	63	7,452	73
CAFO	Pens	70	11	502	12	935	9
	Lagoons	142	22	781	19	1,421	14
RCIM	All septic (ROSS, LOSS, COSS)	47	7	83	2	135	1
	Residential fertilizer	10	2	26	1	41	0
	Small scale farms	4	1	11	0	18	0
Atmospheric deposition		67	11	89	2	268	3

Table 2. Estimated nitrogen available for transport per acre from all sources

Source		Area (acres)	Scenario A (low) (lb/acre-year)	Scenario B (medium) (lb/acre-year)	Scenario C (high) (lb/acre-year)
Irrigated agriculture		85,775	0-58	0-148	0-284
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential fertilizer	4,381	4.7	11.7	18.6
	Small scale farms	2,096	4.3	10.7	17.1
Atmospheric deposition		87,082	1.53	2.05	6.15

The Friends of Toppenish Creek believe that certain refinements will improve the reliability and utility of this baseline estimate for the LYV GWMA.

Table 1. Estimated nitrogen available for transport from all sources in tons/year and % of total

Source		Scenario A (low)		Scenario B (medium)		Scenario C (high)	
		Tons N/year	% of total N	Tons N/year	% of total N	Tons N/year	% of total N
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CAFO	Pens	70	11	502	12	935	9
	Lagoons	142	22	781	19	1,421	14
RCIM	All septic (ROSS, LOSS, COSS)	47	7	83	2	135	1
	Residential fertilizer	10	2	26	1	41	0
	Small scale farms	4	1	11	0	18	0
Atmospheric deposition		67	11	89	2	268	3

Add composting yards

Deduct acreage for synthetically lined lagoons, make mathematical corrections

Add Bio-solids

Add Waste Water Spray-fields

Table 2. Estimated nitrogen available for transport per acre from all sources

Source		Area (acres)	Scenario A (low) (lb/acre-year)	Scenario B (medium) (lb/acre-year)	Scenario C (high) (lb/acre-year)
Irrigated agriculture		85,775	0-58	0-148	0-284
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential fertilizer	4,381	4.7	11.7	18.6
	Small scale farms	2,096	4.3	10.7	17.1
Atmospheric deposition		87,082	1.53	2.05	6.15

Estimate nitrogen for the 10,000 plus acres with minor crops

Calculate atmospheric deposition for the entire 175,161 acres in the GWMA and make appropriate deductions from agricultural parcels.

Assume that at least half of residential fertilizer is taken up by plants

Rationale and Explanation:

1. The WSDA performed in-depth analyses for the 15 major crops in the GWMA target area. These 15 crops cover about 87% of the irrigated agriculture acreage in the area or 85,775

acres. (WSDA, 2018) Other minor crops cover about 13% of the irrigated acreage or approximately 10,000 acres. In order to estimate nitrogen availability for this subset, FOTC calculated nitrogen available per acre in low, medium and high scenarios for the major crops and multiplied these numbers by the acreage in minor crops.

2. Add composting yards: WSDA calculates 536 acres of manure composting in the GWMA target area. In 2015 WSDA commissioned local people to perform deep soil sampling in pens, corrals and compost yards from the area. Here are the results:

Table 7. Results of DSS in Pens & Corrals

Depth in pen (ft)	0	1	2	3	4	5	6
Minimum (mg/Kg NO_3-N)	22.6	21.8	10.6	8.3	6.1	6.5	3.8
Maximum (mg/Kg NO_3-N)	962.6	409.7	199.2	186.5	109.6	93.4	124.7
Average (mg/Kg NO_3-N)	273.3	165.9	98.5	71.2	45.7	36.7	36.4
Median (mg/Kg NO_3-N)	118.6	153.8	89.9	63.6	38	29.6	17.1
Standard Deviation (mg/Kg NO_3-N)	308.6	115.3	54.5	45.9	31.1	26.4	36.8

(From *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*)

Table 8. Results of DSS in Compost Yards

Site	Surface	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft
1C1	364.0	116.3	95.6	82.6	31.1	15.4	15.6	8.3
1C2	292.7	49.8	24.5	28.6	27.1	21.0	19.8	
5C1	159.0	118.8	133.8	225.0	153.9	116.7	28.0	8.5
2Cl	139.0	1.3	6.3	1.0	3.2	1.9	8.5	
2Cu	649.4	30.0	2.2	36.9	150.0	175.1	151.5	
4C1	48.3	164.5	226.1	216.9	222.5	132.1	59.1	
6C	123.2	73.5	34.7	24.7	17.7	9.1		
Ave.	253.7	79.2	74.7	88.0	86.5	67.3	47.1	8.4
Range	48.3-649.4	1.3-164.5	2.2-226.1	1-216.9	3.2-222.5	1.9-175.1	8.5-151.5	8.3-8.5

(From *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*)

Compare Average Readings for Pens & Corrals to Averages for Composting Yards

Site Average	Surface	1 Ft	2 Ft	3 Ft	4 Ft	5 Ft	6 Ft
Compost	253.7	79.2	74.7	88.0	86.5	67.3	47.1
Pens & Corrals	273.3	165.9	98.5	71.2	45.7	36.7	36.4

For general purposes FOTC believes that the estimates of 67 lbs/acre, 480 lbs/acre and 892 lbs/acre from pens and corrals are appropriate for compost yards. This is certainly closer to reality than estimating 0 lbs per acre.

3. Adjust lagoon surface area:

A. FOTC made an adjustment for a mathematical error in the WSDA calculations. WSDA had assumed that a lagoon with 1:3 side slopes, filled to 43% capacity would have a liquid depth of 4.9 ft. WSDA then calculated the liquid surface area for a square or rectangular lagoon with a depth of 4.9 ft. In fact a square lagoon filed to 43% capacity will have a liquid depth of 6 ft and the associated liquid surface area will be 6% greater than WSDA's calculation.

For this reason FOTC increased the total lagoon acreage by 6% to 222.6 acres

B. WSDA documents that 9% of the lagoons in the GWMA target area have synthetic liners. (WSDA, 2018, page 24). It is likely that the lagoons with liners are larger lagoons so the total lagoon area with synthetic liners is likely to be > 9%. Nevertheless, FOTC used the 9% estimate to reduce the total lagoon area to 202.6 acres.

There are many important variables for lagoons nitrogen measurements. FOTC has only examined two. We note that the lagoon acreage in the GWMA study is about .002 acres per cow, while the lagoon acreage in the California study is about .003 acres per cow.

4. Add Bio-solids: In 2012 the EPA performed a *Nitrogen Loading Screening Analysis* for Yakima County in an attempt to characterize the nitrogen balance. The data gathered by the EPA is valid and appropriate for addition to the GWMA's NAA. See the table below from page 14 of the EPA study:

Table 3: Amount of Biosolids Utilized in Yakima County

	2005	2006	2007	2008	2009
Total Lbs Nitrogen/year applied	58,305	105,669	419,174	175,300	173,667
# acres biosolids applied	346	831	2994	1982	1381
# fields biosolids applied	11	28	63	41	59

FOTC calculated an average of 1,500 acres per year that receive bio-solids in the area. We assumed agronomic application and applied the nitrogen available per acre in low, medium and high scenarios for other fertilizers to this subset of data. (See adjustments in item 1 above)

5. Add Waste Water Spray-fields: FOTC is aware of one waste water spray field in the LYV. There may be more. The Port of Sunnyside has a Waste Water Treatment Plant and a National Pollutant Discharge Elimination System (NPDES) permit, No. WA0052426, that permits the facility to spread up to 432 lbs of nitrogen per acre per year on 398 acres.

Again, we assumed agronomic applications, although 432 lbs of nitrogen per acre seems very high. We applied the nitrogen available per acre in low, medium and high scenarios for other fertilizers to this subset of data.

6. Atmospheric Deposition: Nitrogen from the ambient air falls equally on all areas of the LYV GWMA. By only categorizing nitrogen that falls on non-agricultural areas as Atmospheric Deposition, the WSDA leaves the impression that Atmospheric Deposition is not significant. FOTC has revised the estimates and calculated the input from this source using 175,161 acres, the total GWMA area, and estimates of 1.53, 2.05 and 6.15 lbs/acre. (FOTC believes these estimates are too low). Corresponding amounts of nitrogen per acre were subtracted from irrigated agriculture and from animal agriculture.

7. Residential Fertilizer: It is unreasonable to suggest that all of the nitrogen from fertilizers applied to lawns and gardens is available for leaching. Plant uptake for a flower garden is not much different from uptake for hops. For simplicity FOTC has estimated that about half of the nitrogen from residential fertilizer is available for leaching. We have reduced the Yakima County estimates by 50%.

Note: There are ponds in the southeastern section of the GWMA target are that receive waste water from the City of Grandview. FOTC believes that there is likely discharge to groundwater from these ponds but we lack the resources and time to estimate the contribution to GWMA nitrogen balance from this source.

Here are the revised Table 1 and Table 2, based on the adjustments described above:

Table 1 Revised - Lbs per Year

Source		Scenario A	(Low)	Scenario B	(Medium)	Scenario C	(High)
		#/year	% total N	#/year	% total N	#/year	% total N
Irrigated Agriculture	Calculated for 15 major crops	464,764	34%	5,014,161	55%	14,376,484	71%

Irrigated Agriculture	Estimated for minor crops	54,184	4%	584,571	6%	1,676,069	8%
CAFO	Pens	137,225	10%	1,001,783	11%	1,856,742	8%
	Lagoons	273,953	20%	1,508,281	17%	2,741.857	9%
	Compost	35,026	3%	255,703	3%	473,930	2%
RCIM	All Septic (ROSS, LOSS, COSS)	94,000	7%	166,000	2%	270,000	1%
	Residential Fertilizer	10,000	1%	26,000	0%	41,000	0%
	Small Scale Farms	8,000	1%	22,000	0%	36,000	0%
	Bio-solids	10,350	1%	90,750	1%	260,700	1%
	Waste Spray fields	2,746	0%	24,079	0%	69,172	0%
Atmospheric Deposition		267,996	20%	359,080	4%	1,077,240	5%
Totals -#		1,358,244		9,052,408		20,140,079	

Table 1 Revised – Tons per Year

Source		Scenario A	(Low)	Scenario B	(Medium)	Scenario C	(High)
		Ton/year	% total N	Ton/year	% total N	Ton/year	% total N
Irrigated Agriculture	Calculated for 15 major crops	232.4	34%	2,507.1	55%	7,188.3	71%
Irrigated Agriculture	Estimated for minor crops	27.1	4%	292.3	6%	838	8%
CAFO	Pens	68.6	10%	500.9	11%	928.4	8%
	Lagoons	137	20%	754.1	17%	1,370.9	9%
	Compost	17.5	3%	127.9	3%	237	2%
RCIM	All Septic (ROSS, LOSS, COSS)	47	7%	83	2%	135	1%
	Residential Fertilizer	5	1%	13	0%	20.5	0%
	Small Scale Farms	4	1%	11	0%	18	0%
	Bio-solids	5.2	1%	45.4	1%	130.4	1%
	Waste Spray fields	1.4	0%	12	0%	34.6	0%
Atmospheric Deposition		134	20%	179.5	4%	538.6	5%
Totals -Tons		679.1		4,526.2		10,070.0	

Table 2 Revised

Source		Area (acres)	Scenario A (low) (lbs/acre-year)	Scenario B (medium) (lb/acre-year)	Scenario C (high) (lbs/acre-year)
Irrigated agriculture	Calculated Major Crops	85,775	0-58	0-148	0-284
	Estimated Minor Crops	10,000	6.9	60.5	173.8
CAFO	Pens	2,096	67	480	892
	Lagoons	203	1,354	7,448	13,542
	Compost	535	67	480	892
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential Fertilizer	4,281	2.35	5.85	9.3
	Small Scale Farms	2,096	4.3	10.7	17.1
	Bio-solids	1,500*	6.9	60.5	173.8
	Waste Spray Fields	398	6.9	60.5	173.8
Atmospheric Deposition		175,161	1.53	2.05	6.15

In the Medium Scenario the FOTC calculations give the following contributions to nitrogen availability by source:

Irrigated Agriculture: 61% (**55**% + 6%)

Lagoons: 17%

Pens: 11%

Atmospheric Deposition: 4%

Compost 3%

Septics: 2%

Bio-solids: 1%

This is somewhat different from the Contributions described in *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area*

Irrigated Agriculture: 64%

Lagoons: 19%

Pens: 12%

Septics: 2%

Atmospheric Deposition: 2%

Residential Fertilizer: 1%

August 25, 2018

Hello GWAC,

The Friends of Toppenish Creek remain dissatisfied with the GWMA Alternative Solutions. The costs of the alternatives were not adequately discussed by the GWAC, in our opinion.

With this in mind we took a closer look at the projected costs from the spreadsheet the GWAC received in May, 2018. Here are the costs for the selected alternatives according to that spreadsheet.

Alternative	Low Annual Coat	High Annual Cost	Low One Time	High One Time	Funding Source
ADM 1	100,000	100,000			Legislature
ADM 2	50,000	125,000			EPA
ADM 2	50,000	125,000			Ecology
PHS 1			50,000	100,000	Legislature
RCIM 1			5,000,000	5,000,000	Congress
RCIM 2			100,000	100,000	Legislature
RCIM 3			30,000	30,000	Legislature
RCIM 4					Ecology
RCIM 5			70,000	500,000	Permit Applicant/Subsidized
RCIM 6			10,000,000	10,000,000	Congress
RCIM 7	30,000	50,000			Legislature
RCIM 8					DOH Operating Budget
IA 1	100,000	100,000			WSU Operating Budget
IA 2			25,000	25,000	WSDA Operating Budget
IA 3			200,000	200,000	WCC Operating Budget
IA 3			200,000	200,000	WSU Operating Budget
IA 4			12,500,000	18,000,000	Identify local, state & federal programs like EQIP
IA 4			12,500,000	18,000,000	Producers/Growers
IA 5			500,000	500,000	Congress (Farm Bill)
IA 5			500,000	500,000	Ecology Capital Budget
IA 6			1,000,000	1,000,000	Ecology Capital Budget
IA 6			500,000	500,000	WSDA Capital Budget
LC 1			20,000	20,000	WSDA Operating Budget
LC 2			11,750,000	14,000,000	WSDA Capital Budget
LC 3			25,000	25,000	WSDA Operating Budget
LC 4			5,000,000	5,000,000	Legislature
LC 4			5,000,000	5,000,000	Industry
LC 5			250,000	250,000	WSU Operating Budget
LC 6			125,000	125,000	WSU Operating Budget

LC 6			125,000	125,000	Industry
LC 7					Congress
LC 8			50,000	250,000	WSDA Operating Budget
LC 8			50,000	250,000	WSU Operating Budget
LC 9			1,000,000	1,000,000	WCC Capital Budget
LC 10			250,000	250,000	Legislature
LC 10			250,000	250,000	Industry
IALC 1			50,000	60,000	Ecology Operating Budget
IALC 1			50,000	60,000	WSU Operating Budget
IALC 1			50,000	60,000	WSDA Operating Budget
IALC 1			50,000	60,000	Yakima County Operating Budget
IALC 1			50,000	60,000	SYCD Operating Budget
IALC 1			50,000	60,000	Industry
IALC 2					Operating Budgets Above in IALC 1
IALC 3					Operating Budgets Above in IALC 1
IALC 4					Operating Budgets Above in IALC 1
IALC 5					Operating Budgets Above in IALC 1
IALC 6					None
Data 1	250,000	250,000			Ecology
Data 2			75,000	75,000	WCC Operating Budget
Data 2			75,000	75,000	WSDA Operating Budget
Data 3	100,000	100,000			Legislature
Data 4			1,250,000	1,250,000	WCC Operating Budget
Data 5					NA
Data 6	100,000	125,000			Ecology Operating Budget
Data 6	100,000	125,000			DOH Operating Budget
Data 7					Ecology Operating Budget
Data 8	20,000	20,000			Ecology Operating Budget
Data 9	30,000	30,000			Ecology Grant
Data 10			300,000	300,000	Unknown
Data 11			50,000	50,000	Legislature
Data 12			625,000	625,000	WSDA Operating Budget
Data 12			625,000	625,000	Ecology Operating Budget
Reg 1	100,000	400,000			Legislature
Reg 2					NA
Reg 3					NA
Reg 4					NA
Reg 5			50,000	50,000	WSDA DNMP Operating Budget
Reg 6			10,000	10,000	Legislature
Reg 7					Developer
Reg 8					Developer/Purchaser/Permit Applicant

Reg 9			200,000	200,000	WCC Operating Budget
Reg 10	200,000	200,000			WSDA Operating Budget
Totals	1,230,000	1,750,000	70,630,000	84,820,000	

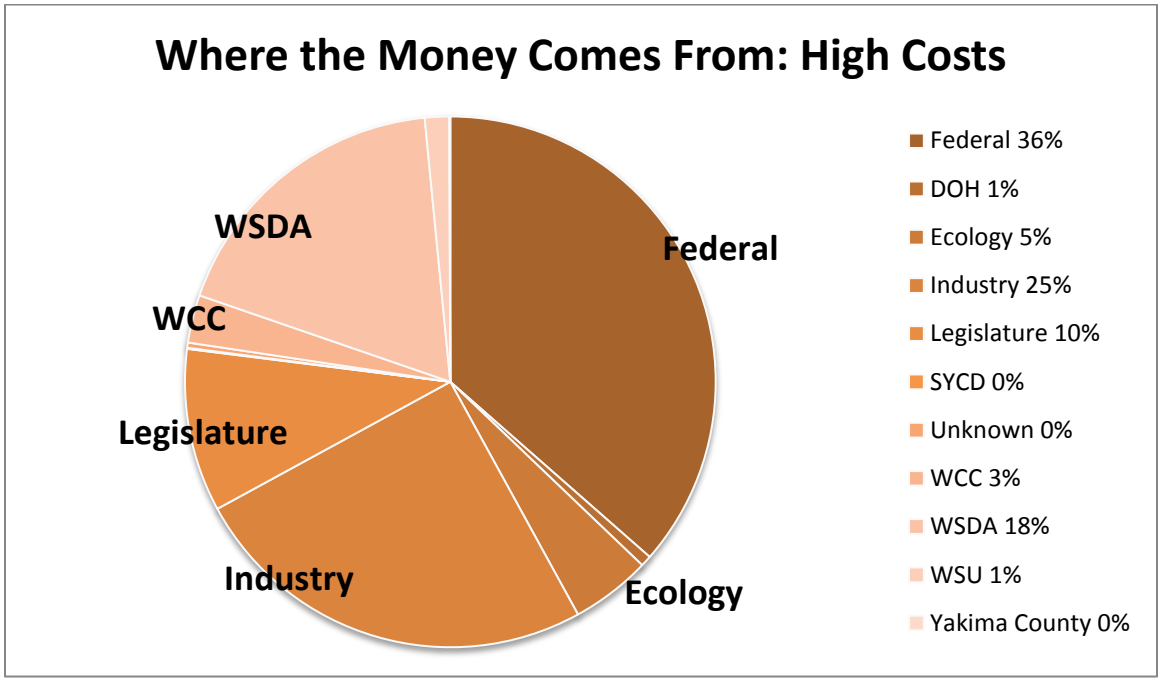
There were two types of cost estimates: annual costs and one-time costs. To estimate total costs over five years we multiplied low and high annual costs times five and added them to low and high one-time costs.

Total five year costs for the proposed plan are between $76,780,000 and $93,570,000.

We broke down the costs by funding source. Where there were several funding sources we divided the total cost equally. Where there was cost share we divided the total 50:50

Two Alternatives 52 & 53 assigned costs to Developers/Purchasers. We did not include these costs in the total analysis since we could not predict the number of future developments. Estimated fees are $25,000 to $50,000 per development and $10,000 to $50,000 per development. These costs will increase the RCIM category of spending.

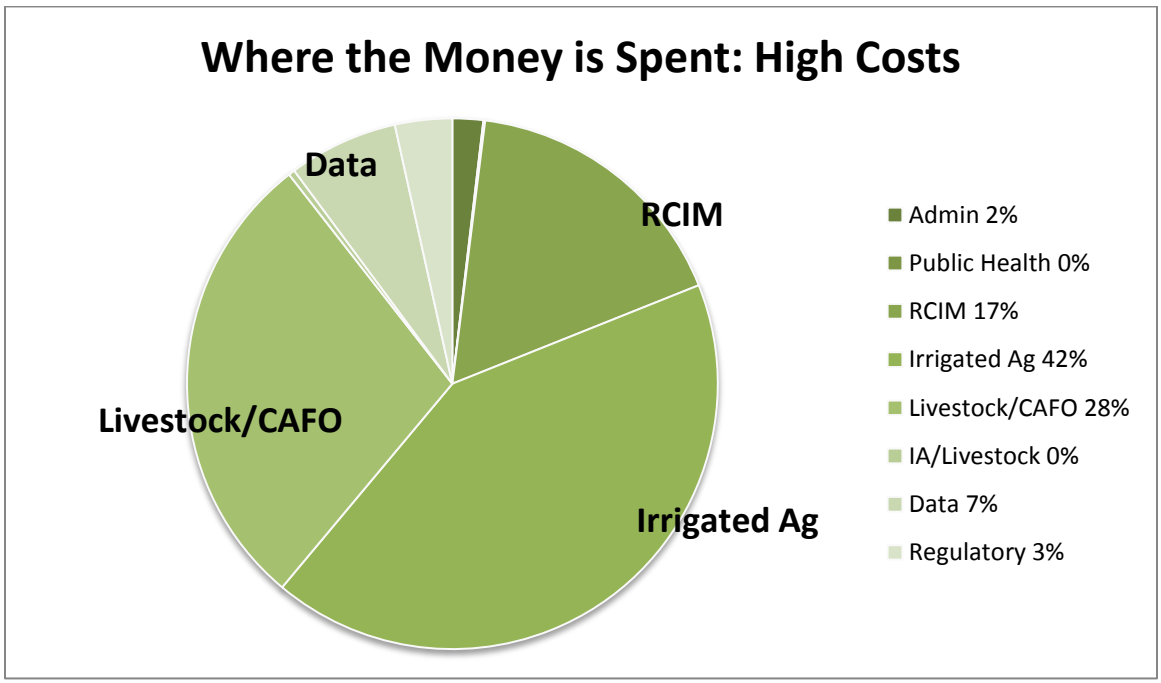
Here is a breakdown by funding source – where the money comes from for the maximum funding:



Total Costs by Funding Source for Five Years of the GWMA Plan

	Five Year Low	Five Year High	% Low	% High
Federal	28,250,000	34,125,000	37%	36%
DOH	500,000	625,000	1%	1%
Ecology	4,050,000	4,560,000	5%	5%
Industry	17,925,000	23,435,000	23%	25%
Legislature	7,210,000	9,290,000	9%	10%
SYCD	50,000	60,000	0%	0%
Unknown	300,000	300,000	0%	0%
WCC	2,725,000	2,725,000	4%	3%
WSDA	14,545,000	17,005,000	19%	18%
WSU	1,175,000	1,385,000	2%	1%
Yakima County	50,000	60,000	0%	0%
Total	76,780,000	93,570,000	100%	100%

And here is how the money would be spent at the high level:



Breakdown of cost using the categories in the GWM Alternative Solutions list

	Five Year Low	Five Year High	% Low	% High
ADM	1,000,000	1,750,000	1%	2%
PHS	50,000	100,000	0%	0%
RCIM	15,350,000	15,880,000	20%	17%
IA	28,425,000	39,425,000	37%	42%
LC	23,895,000	26,545,000	31%	28%
IA/LC	300,000	360,000	0%	0%
DATA	6,000,000	6,250,000	8%	7%
REG	1,760,000	3,260,000	2%	3%
Total	76,780,000	93,570,000	100%	100%

Here are the most expensive one-time Alternative Solutions:

South Yakima Conservation District, WA Department of Agriculture, and WSU Extension Service should collaboratively:

IA 4: Encourage advanced irrigation management. Integrate management of synthetic /organic fertilizers and application of water. (31 points received)
Recognizing that there is significant cost involved in changing an irrigation system, look for strategic opportunities where the use of more advanced irrigation management systems could have the greatest benefit for reducing nitrogen impacts to groundwater. One example of advanced irrigation management is electronic sensor irrigation water management (IWM). Identify federal, state and local incentive programs (like EQIP), such as grants, and low interest loans, to facilitate a transition to more advanced irrigation management in those areas. Provide financial assistance for 1) conversions from rill irrigation to sprinkler or drip irrigation, 2) installation of flow meters and moisture meters to reflect over-irrigation, high water table, drought conditions, 3) the cost of hiring third party sampling, measuring equipment, personnel or self-test kits, 4) management of sprinkler systems so they do not drive nutrients past the root system. Establish a voluntary irrigation management cost-share program from which data may be shared with the public.

$12, 500,000 to $18,000,000 from programs such as EQIP

WA Department of Agriculture should:

LC 2: Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of fertilizers and manures, including separation of solid and liquid wastes. (17 points received)
WSDA construct LYVGWMA administrative program.

$11,750,000 to $14,000,000 from the WSDA Capital Budget

Municipalities should:
RCIM 6: Provide funding for municipalities to replace aging sewer system infrastructure and ensure proper system maintenance to reduce nitrate leaching. (11 points received)
Municipalities need to estimate costs and system integration.

$10,000,000 from Congress – the Infrastructure Bill

Yakima County should:
RCIM 1: Encourage municipalities within the GWMA to extend municipal sewer systems within urban growth areas and retire ROSS and LOSS., alternatively extend public water systems. Encourage connection of residences within urban growth zones to sewer systems extended by municipalities. (26 points received)

$5,000,000 from Congress – the Infrastructure Bill

Producers should:
LC 4: Make capital improvements. (2 points received)
Install liners in liquid waste storage lagoons. Install impervious surfaces beneath silage storage.

$5,000,000 from the Legislature, $5,000,000 from industry

South Yakima Conservation District should:

DATA 4: Establish a multi-year Deep Soil Sampling Program where farmers subscribe for a duration with pre-determined fiscal remuneration for completed sampling. Cost share with farmer. Farmer to provide checklist indicating performance with BMPs. Test throughout growing year, in order to observe effects of fertilization throughout year. Share data with public. (25 points received)
Farmers would subscribe for a duration with pre-determined fiscal remuneration for completed sampling. Cost share with farmer. Farmer would provide checklist indicating performance with BMPs. Testing would occur throughout growing year, in order to observe effects of fertilization throughout year. Data grossly accumulated would be shared with public without attribution to individual farmers. Anecdotal results of deep soil sampling carried out by SYCD with farmers with pre-existing relationship with SYCD were informative. Word-of-mouth reporting within farmer community greatly increased acres sampled.

$1,250,000 from the WA Conservation Commission Operating Budget

Department of Ecology and WA Department of Agriculture should collaboratively:
IA 6: Make grants and allocate cost share funding or other funding assistance to people implementing environmental protection measures affecting groundwater quality. (17 points received)
Assign personnel to investigate which environmental protection measures utilized by irrigated agriculturalists and livestock/dairy producers have positive influence on groundwater quality and explore means to share costs of implementing such measures. (Coordinated DOE, WSDA, Conservation District program). See NRCS Environmental Stewardship Program (2012). Also WCC, Voluntary Stewardship Program (Bill Isler), USDA Rural Community Assistance Group environmental program.

$1,000,000 from the Ecology Capital Budget

Washington Conservation Commission should:
LC 9: Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of

fertilizers and manures, including separation of solid and liquid wastes. (26 points received)

$1,000,000 from the WA Conservation Commission Capital Budget

Here is a spreadsheet for funding from highest to lowest:

Alternative	Low Annual	High Annual	Low One Time	High One Time	Funding Source	Five Year Low	Five Year High
IA 4			12,500,000	18,000,000	Local, State & Federal such as EQIP	12,500,000	18,000,000
IA 4			12,500,000	18,000,000	Producers/Growers	12,500,000	18,000,000
LC 2			11,750,000	14,000,000	WSDA Capital Budget	11,750,000	14,000,000
RCIM 6			10,000,000	10,000,000	Congress	10,000,000	10,000,000
RCIM 1			5,000,000	5,000,000	Congress	5,000,000	5,000,000
LC 4			5,000,000	5,000,000	Legislature	5,000,000	5,000,000
LC 4			5,000,000	5,000,000	Industry	5,000,000	5,000,000
Data 1	250,000	250,000			Ecology	1,250,000	1,250,000
Data 4			1,250,000	1,250,000	WCC Operating Budget	1,250,000	1,250,000
IA 6			1,000,000	1,000,000	Ecology Capital Budget	1,000,000	1,000,000
LC 9			1,000,000	1,000,000	WCC Capital Budget	1,000,000	1,000,000
Data 12			1,000,000	1,000,000	WSDA Operating Budget	1,000,000	1,000,000
Reg 10	200,000	200,000			WSDA Operating Budget	1,000,000	1,000,000
ADM 1	100,000	100,000			Legislature	500,000	500,000
IA 1	100,000	100,000			WSU Operating Budget	500,000	500,000
IA 5			500,000	500,000	Congress (Farm Bill)	500,000	500,000
IA 5			500,000	500,000	Ecology Capital Budget	500,000	500,000
IA 6			500,000	500,000	WSDA Capital Budget	500,000	500,000
Data 3	100,000	100,000			Legislature	500,000	500,000
Data 6	100,000	125,000			Ecology Operating Budget	500,000	625,000
Data 6	100,000	125,000			DOH Operating Budget	500,000	625,000
Reg 1	100,000	400,000			Legislature	500,000	2,000,000
Data 10			300,000	300,000	Unknown	300,000	300,000
ADM 2	50,000	125,000			EPA	250,000	625,000
ADM 2	50,000	125,000			Ecology	250,000	625,000
LC 5			250,000	250,000	WSU Operating Budget	250,000	250,000
LC 10			250,000	250,000	Legislature	250,000	250,000
LC 10			250,000	250,000	Industry	250,000	250,000
Data 12			250,000	250,000	Ecology Operating	250,000	250,000

					Budget			
IA 3			200,000	200,000	WCC Operating Budget		200,000	200,000
IA 3			200,000	200,000	WSU Operating Budget		200,000	200,000
Reg 9			200,000	200,000	WCC Operating Budget		200,000	200,000
RCIM 7	30,000	50,000			Legislature		150,000	250,000
Data 9	30,000	30,000			Ecology Grant		150,000	150,000
LC 6			125,000	125,000	WSU Operating Budget		125,000	125,000
LC 6			125,000	125,000	Industry		125,000	125,000
RCIM 2			100,000	100,000	Legislature		100,000	100,000
Data 8	20,000	20,000			Ecology Operating Budget		100,000	100,000
Data 2			75,000	75,000	WCC Operating Budget		75,000	75,000
Data 2			75,000	75,000	WSDA Operating Budget		75,000	75,000
RCIM 5			70,000	500,000	Permit Applicant		70,000	500,000
PHS 1			50,000	100,000	Legislature	Ecology	50,000	100,000
LC 8			50,000	250,000	WSDA Operating Budget		50,000	250,000
LC 8			50,000	250,000	WSU Operating Budget		50,000	250,000
IALC 1			50,000	60,000	Ecology Operating Budget		50,000	60,000
IALC 1			50,000	60,000	WSU Operating Budget		50,000	60,000
IALC 1			50,000	60,000	WSDA Operating Budget		50,000	60,000
IALC 1			50,000	60,000	Yakima County Operating Budget		50,000	60,000
IALC 1			50,000	60,000	SYCD Operating Budget		50,000	60,000
IALC 1			50,000	60,000	Industry		50,000	60,000
Data 11			50,000	50,000	Legislature		50,000	50,000
Reg 5			50,000	50,000	WSDA DNMP Operating Budget		50,000	50,000
RCIM 3			30,000	30,000	Legislature		30,000	30,000
IA 2			25,000	25,000	WSDA Operating Budget		25,000	25,000
LC 3			25,000	25,000	WSDA Operating Budget		25,000	25,000
LC 1			20,000	20,000	WSDA Operating Budget		20,000	20,000
Reg 6			10,000	10,000	Legislature		10,000	10,000
RCIM 4					Ecology			
RCIM 8					DOH Operating Budget			
LC 7					Congress	Energy Bill		
IALC 2					Operating Budgets Above			
IALC 3					Operating Budgets Above			
IALC 4					Operating Budgets Above			
IALC 5					Operating Budgets Above			
IALC 6					None			
Data 5					NA			
Data 7					Ecology	$500,000 to $700,000 remaining in		

					Operating Budget	GWMA		
Reg 2					NA			
Reg 3					NA			
Reg 4					NA			
Reg 7					Developer	Purchaser		
Reg 8					Developer/Purchaser/Permit Applicant			
Totals	1,230,000	1,750,000	76,130,000	84,820,000			76,780,000	93,570,000

Thanks for Reading

Friends of Toppenish Creek

Last updated August 25, 2018

Concerns Regarding Alternatives Solutions:

WA Department of Health, Yakima Health District, and Yakima County should collaboratively:
PHS 1: Develop a bilingual, health-risk education and outreach campaign. (28)

Establish a public education program regarding nitrate pollution and health risk over a 5-10-year period. Partner with UW Pediatric Environmental Health Specialty Unit (PEHSU) to continue training local healthcare providers to recognize and address Nitrate risk in their patients (pregnant women and infants up to six months).

This is not the alternative solution that the GWAC voted on. That document reads:

Develop a health-risk education and outreach campaign

Establish a public education program regarding nitrate pollution and health risk over a 5-10-year period. Broaden the pool of people GWMA is educating or communicating with. Provide all materials distributed to the public in English and Spanish. Provide education about concepts that people can understand. Billboard campaign – urging well testing. Partner with UW Pediatric Environmental Health Specialty Unit (PEHSU) to continue training local healthcare providers to recognize and address Nitrate risk in their patients (pregnant women and infants up to six months)

The Cost Description reads:

$50K; $100K (5 Year plan) with funding coming from Ecology, Legislature

Questions:

- The changes to the alternative solution are significant. Why were they made and by whom?
- Is $50,000 to $100,000 the total appropriation? Does this mean $10,000 to $20,000 per year?
- Who will design the campaign and what are their qualifications?
- Why does the funding come through Ecology but implementation comes through DOH and Yakima County?

- The Yakima Health District never sent a representative to the GMW Education and Public Outreach Work Group. They have not conducted information and outreach campaigns regarding nitrates in the past. Does this agency have the capacity or desire to make an impact in this area?
- In 2014 – 2015 Yakima County returned $150,000 in state funds designated for treatment of contaminated water from domestic wells in the LYV. Does this agency have the capacity or desire to make a difference in peoples' lives?
- Why is there only one Alternative Solution to help the people who live in the LYV and pay out approximately $1 million per year for bottled water?

Yakima Health District should:

RCIM 5: Study potential nitrate contamination attributable to improperly operated septic systems. (32) Consider restoration/retrofit of older septic systems through incentives or county property tax breaks. Require nitrogen reducing technologies for onsite septic systems where appropriate. Assist hobby farmers to locate ROSS drain fields on their property so as to avoid animal farming over the drain field.

The Cost Description reads:

$700 per applicant for system repair permit application fee. 100 applicants subsidized = $70K; subsidize cost of reconstruction = $500K

Questions:

- Is this a study or just a project to fix individual failing septic systems?
- Will there be a campaign to inform the public and how will that be financed?
- What do people get for $700?
- The description says the costs will be subsidized. Where will the subsidies come from? (In the FOTC analyses we assigned the subsidies to the legislature)

South Yakima Conservation District and WA Department of Agriculture should collaboratively:
DATA 2: Monitor changes occurring in agricultural operations. Evaluate whether those changes positively affect improvement in groundwater quality. (25)

Requires cooperation of producers & landowners, multi-year effort to account for crop rotation, dry vs. wet years, changing technology, decades to monitor groundwater quality change. WSDA: prepare report to Legislature and Department of Ecology.

The Cost Description reads:

$100 K at SYCD; $50 K at WSDA

Question:

- Monitoring is a long term process. What does a one-time expenditure of $150,000 buy?
- How will costs in later years be covered?
- Who will design the monitoring system? What are their qualifications?
- What are the evaluation criteria for this proposed project?
- SYCD and WSDA had difficulties engaging farmers during the Deep Soil Sampling study and the Nitrogen Availability Assessment. How will they address this problem?

Department of Ecology and WA Department of Health should collaboratively:

DATA 6: Establish time-based performance objectives against which well-monitoring data can be compared. (16) E.g., number of at risk wells, BMP implementation, funding success, reduction in number of underperforming farming practices. Use both method-based measurement and performance-based measurement.

The Cost Description reads:

DB: $200-250K / Yr; GS 25 K, 1/4 FTE. DOE, DOH Operating Budget

Questions:

- This is not very clear. What exactly will DOH and Ecology do for ¼ million dollars?
- Why only ¼ FTE ?
- What are the qualifications for the people who will do the work?

- Why is this an annual cost? Is this an ongoing evaluation program?
- How will DOH and Ecology evaluate underperforming farming practices?
- What are the criteria for underperforming farming practices?
- How will DOH and Ecology collect the data?
- What is method based measurement?
- Will DOH and Ecology do a formative evaluation?
- Why is there no outcome evaluation?
- When did the GWAC select a performance based evaluation?
- There needs to be objective measurement of nitrate levels and a correlation with performance objectives. We cannot just assume that implementation of BMPs will make a difference.
- Why is there no evaluation of the impact that elevated nitrates have on the people who live in the LYV?

Yakima County should:
DATA 11: Contract with USGS to do particle tracking model study to indicate where groundwater moves faster (permeability). (9)
USGS Particle Tracking Model Overview--potentially combined with MT3D MODFLOW application to the vadose zone.

Question:

- Where will the funds come from to pay for this?
- Will this clarify what happens in the vadose zone?

Yakima County should:
DATA 3: Adopt and Implement an Adaptive Management Plan. (22)

Utilizing data collected, progress made, or lack of progress, to inform the community on adjustments that need to be implemented. Plan would incorporate necessary adjustments to availability of technology, education and outreach, tracking exports, land use regulations, treatment systems, and other changes to inform decision makers regarding management changes necessary for a successful Program.

Cost $100,000 per year from the legislature

It appears that the success of an Adaptive Management Plan depends on data collection and that the potential data is:

- Data 8: Well monitoring - $20,000 per year
- Data 2: Changes in agricultural operations - $150,000 (one time?)
- Data 4: Deep soil sampling - $250,000 per year x 5 years
- Data 5: Trends from reports – NPDES and SWD (already being done)
- Data 6: Time based performance objectives - $200,000 to $250,000 per year
- Data 9: Nitrate concentrations at head gates - $30,000 (one time?)
- Data 10: Domestic well testing - $300,000 (one time?)
- Data 11: USGS particle tracking - $50,000 (one time?)
- Data 12: Nitrogen Loading Assessment - $1,250,000
    - Hire a consultant for literature review of most relevant information and accurate factors
    - Periodically repeat grower survey
    - Data on how much commercial fertilizer, how much manure
    - Percentage of acreage in various crops
    - Triticale acreage
    - Commercial fertilizer tonnage
    - Nitrogen leaching from wasteways and drains
    - Study atmospheric deposition

Questions:

- Who was involved in the formative discussions regarding an Adaptive Management Plan?
- What happens to the plan if one or two pieces are not funded?
- How will the plan go about informing the community? Who is the community?
- Who are the decision makers who need to know about management changes?
- Which decisions might potentially be influenced?
- Why is there no data for public health?
- Why is there no data for adverse side effects/costs to the community?
- WSDA and Yakima County struggled with access to information during the GWMA Nitrogen Availability Assessment. How will the people who develop this project address those problems?
- What are the qualifications for the people who will implement this project?
- Are there opportunities for public oversight?

WA Department of Agriculture should:
IA 2: Design and implement pilot studies focusing on innovative farm techniques which reduce nitrogen loading to crops and monitor results. (34)
Cost $25,000 from the WSDA Operating Budget:

Question:

- In her comments, the Director for the WSDA Dairy Nutrient Management Program suggested that this is more appropriate for WSU. What do you think?
- What exactly would such a pilot study look like?
- How do you define innovative farm techniques?
- Don't think you can do more than one pilot study for $25,000

Producers should:
LC 4: Make capital improvements. (2)
Install liners in liquid waste storage lagoons. Install impervious surfaces beneath silage storage.

The Cost Description reads:

$10 million Cost-share/ producers & WSDA (Legislature)

Questions:

- Does this mean that representatives from the GWMA will go to the legislature and ask for millions of dollars to make improvements on dairies?
- Isn't it illegal for government to give money to private individuals or corporations?

Environmental Protection Agency, WA Department of Agriculture and Department of Ecology should collaboratively:
REG 1: Streamline current regulatory enforcement activities. (25)
Improve customer service and protocols, increase clarity of process, escalate enforcement for facilities not following management practices, identify methods to discourage repeatedly unfounded complaints, and improve overall transparency.

The Cost Description reads:

$ 0 - $ 300 K / yr, WSDA $100 K from the legislature

Questions:

- The WA Legislature cannot pay the EPA to streamline procedures. Where will the money come from to streamline procedures at the EPA?
- Which specific regulations do you have in mind?
- Could this address the concerns that people had in 2008-2010 regarding a bureaucratic runaround when they asked for help with nitrates in their wells?

WA Department of Agriculture should:
REG 5: Document and publish regulatory compliance for dairies within the GWMA that are completing and implementing Dairy Nutrient Management Plans (DNMP). (7) Explore the possibility of disclosing non-proprietary data produced through the DNMP process. Summarize the DNMP reporting and provide information that would disclose the amount of manure the CAFO's in the GWMA create and where it is distributed.

The Cost Description reads:

$50,000 WSDA / DNMP operating budget

Question:

- Is this a one-time expenditure or an annual expenditure?

Yakima Health District should:
REG 6: Issue permits for agricultural composting operations, to appropriately inspect composting operations and to enforce regulations that protect public health and the environment, per WAC 173.350.040. (4)

The Cost Description reads:

$10,000 depends upon number of composting facilities. Funded by the legislature, balance funded by permit applicant.

Questions:

- Is this a one-time expenditure or an annual expenditure?

Yakima Health District should:
REG 7: Require new developments outside towns to address potential impacts on groundwater quality. (19)
Work with Yakima County Planning and Building Divisions' permit program to identify methods of permitting while reducing impacts to groundwater
Requires BOCC approval

The Cost Description reads:

Approx. $25-50 K Costly for developer & purchaser.

Questions:

- Have we documented that new developments cause increased nitrates in groundwater?
- Is this a function of sewer density?
- What is BOCC?
- Is this $25,000 to $50,000 per new development?

There are three Alternative Solutions that are very similar:

Environmental Protection Agency and WA Department of Ecology should collaboratively:
ADM 2: Identify and support opportunities, including educational research institutions, for private, public, and industry investment in technology specific to addressing nitrate contamination in groundwater. (20)

WA Department of Agriculture should:
LC 2: Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of fertilizers and manures, including separation of solid and liquid wastes. (17)
WSDA construct LYVGWMA administrative program.

Washington Conservation Commission should:
LC 9: Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of fertilizers and manures, including separation of solid and liquid wastes. (26)

The wording has changed since the GWAC screened alternative solutions in May, 2018. That screening required Ecology and EPA to "construct a LYVGWMA Program for coordinated implementation". This component has now been deleted.

These are the solutions the GWAC voted on:

EPA & Ecology: Identify and support opportunities, including educational research institutions, for private, public, and industry investment in technology specific to addressing nitrate contamination in groundwater.
EPA & DOE construct a LYVGWMA Program for coordinated implementation.
Cost: $100,000 to $250,000. Agency Budgets

WSDA: Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of fertilizers and manures, including separation of solid and liquid wastes.
WSDA construct LYVGWMA administrative program.
Cost: $1.75-$4 million, WSDA $10 million. WSDA Capital Budget

WCC: Identify and support opportunities, including education research institutions for private, public and industry investment in technology and management of fertilizers and manures, including separation of solid and liquid wastes.
Cost $1 million WCC Capital Budget

Questions:

- Why isn't LC2 categorized under Administration since it authorizes the WSDA to construct LYVGWMA administrative program?
- Why did you remove the statement that EPA and Ecology would construct a LYVGWMA Program for coordinated implementation?
- Why is there such a huge discrepancy in proposed funding for the four agencies?
- It is inappropriate to inter-mingle alternatives that "identify and support opportunities, including education research institutions for private, public and industry investment in technology" with "construction of LYVGWMA programs". These are completely separate endeavors that require different skill sets and resources. Why was this done?

- Please explain how WSDA has the expertise to construct the LYVGWMA administrative program.
- Can the GWMA tap into the WSDA Capital Budget? How?

Thanks for Reading.

Friends of Toppenish Creek

Last updated August 24, 2018 by Jean Mendoza

Small towns, big bills: Cities look to utility taxes to plug budget holes

- **Phil Ferolito**
  pferolito@yakimaherald.com

- Aug 26, 2018

YAKIMA, Wash. -- In the early 2000s, small cities across Yakima County began taxing water, sewer and garbage services to generate enough revenue to operate.

Then, significant losses in state revenue led to shortfalls in city budgets. City administrators were left scratching their heads over how to afford police, fire and even park services. Utility taxes, allowed under state law, seemed a viable fix.

City's across Washington have turned to utility taxes to help plug budget holes, leaving residents in small towns facing big utility bills. Click here to see how much your city taxes your utilities, and how that compares with other towns in the Yakima Valley.

Now more than 15 years later, the taxes, which have helped drive up average monthly water, sewer and garbage bills in many small cities to anywhere from $150 to $200 a month, still aren't enough to address all needs.

And there's nothing keeping monthly bills from rising even more as inflation drives up the cost of needed maintenance to city facilities to keep up with standards.

The city of Selah is discussing possible rate increases — which are separate from the tax — on water and sewer to help fund needed sewer line upgrades, said City Administrator Don Wayman.

"The costs of finished goods are going up faster than the revenue we receive," he said. "The consequences of that is that cities, we're going to have to ask residents to pay more for their sewer, water and streets. We're going to have to do that in order to keep our infrastructure from crumbling."

Unable to retain police officers in Mabton, the city is having the Yakima County Sheriff's Office take over its police department under a contract. Officials in Toppenish are considering contracting out police dispatch services — last year the city closed its jail and court and entered into a contract with Sunnyside to provide those services.

"These are all vital services to every community," said Toppenish City Manager Lance Hoyt. "Every community likes to have their own because you seem to do it better when it's yours, but with the current revenue situations, this is what cities have to do."

This year Wapato closed its jail, saying the operation was too expensive to operate, and the century-old structure was outdated and unsafe. The city now houses its inmates elsewhere under contracts.

This trend of contracting out services will continue to grow and may lead to regionalization of services as rising costs continue to outpace revenue, city officials across the county say.

“Regionalization of services is something that is going to happen,” said Sunnyside City Manager Don Day. “I’ve known that for many years. There’s got to be cooperation between cities. We all can’t afford to buy a million dollar firetruck every year, but a few cities together can.”

Financially hamstrung

In the early 2000s, legislation sparked by a voter-approved initiative that leveled annual auto licensing fees at $30 eliminated a state fund that provided small cities with revenue.

Later came more legislation that capped annual property increases cities could impose without voter approval at 1 percent.

Cities began running into budget shortfalls of hundreds of thousands of dollars.

As a result, most small cities began assessing taxes on water, sewer and garbage services — revenue that could go directly into general fund budgets, which largely pay for police, fire and park services. Some of those taxes are as high as 20, 30 percent, anywhere from $20 to nearly $50 a month.

Although a strain on local utility bills, the tax helped keep services at current levels in most cities.

Now some cities like Mabton, where residents are paying the most for water, sewer and garbage services, are feeling more financial pressure.

The city has long struggled to offer police enough pay to keep them in the town of about 2,300 people for an extended period of time, said Mayor Laura Vazquez.

Earlier this year, the police chief retired, and one of the department’s two officers left for another job elsewhere. Since then, only one officer has been on duty, but sheriff’s deputies and officers from neighboring cities have assisted when needed.

“We know that it’s just been a cycle here and in other small cities that just can’t pay top dollar, which I wish we could,” Vasquez said.

Hiring new officers, sending them off to the academy and training only to see them leave a short time later gets expensive, she said.

“We bring in a new officer, we send him off to the academy, train him and then he moves on to a bigger community or closer to home,” she said.

Hoyt said he runs into a similar dilemma in Toppenish, which has more than 9,000 residents.

“We have a big crime rate here in Toppenish,” Hoyt said. “Multiple calls a night, it’s a training ground (for officers). And by the time we get them ready to go on their own, they’re ready to go somewhere else where they get more pay.”

Hoyt says the cost of equipment, training, the academy and other requirements for a beginner officer can run as high as $57,000.

Having the sheriff’s office take over police services in Mabton under a contract equivalent to the department’s $600,000 budget will provide stable, quality policing, Vasquez said.

“We’re excited about that,” she said.

But the agreement won’t roll back the minimum monthly utility bill of more than $170 in Mabton, where the median income is $18,000 year.

Vasquez said her average monthly bill has shot up from about $115 three years ago to nearly $200 this year.

“Our water, sewer and garbage rates, they’ve really come up to almost double for some residents,” she said.

Much of that has been caused by the cost of a sewer plant overhaul and a new well and reservoir needed to provide an adequate water supply. Though federal and state grants covered much of the $10 million cost of those projects, the remaining $1 million in loans is being repaid by the rate hikes.

The upgrades have drastically improved the city’s water and sewer capacity, and now Vasquez is working with the county to get some land to the south eventually annexed into the city. A developer is interested in building a dental and medical clinic and some low income housing, projects that may improve the city’s profile that could lure additional development, resulting in improved revenue into city coffers, she said.

“I’m striving very hard to get some things done here in the city,” she said. “Yeah, we’re a small town, and we’re ready to grow and we’re ready to invite people in.”

Utility Rates for Yakima County Towns & Cities

* Grandview

- Water: $23.77 (1,000 gallons)
- Sewer: $33.29 (1,000 gallons)
- Garbage: $13.95, (90 gallon container)
- Taxes: Water, 24.2 percent; sewer, 6 percent; garbage, 38 percent
- Minimum bill: $84.06
- General fund budget: $6.6 million

* Granger

- Water: $39.05 (5,000 gallons)
- Sewer: $39.05 (5,000 gallons)
- Garbage: $22.33 (90 gallon container)
- Mosquito control: 50 cents
- Tax: water, sewer, 36 percent
- Minimum bill: $100.93
- General fund: $1.3 million

* Harrah

- Water: $28.50 (600 cubic feet)
- Sewer: $50.90 (flat rate)
- Garbage: (contracted by Yakima Waste)
- Taxes: Water, sewer, 8 percent
- Minimum bill: $85.75
- General fund: $670,000

* Mabton

- Water: $57.85 (536 cubic feet)
- Sewer: $65 (536 cubic feet)
- Garbage: $19.37 (92 gallon container)
- Tax: 20 percent
- Minimum bill: $170.62.
- General fund: $937,500

* Moxee

- Water: $19.50 (300 cubic feet)
- Sewer: $35 (flat rate)

- Garbage: $12.15 (64 gallon container), $14.95 (96 gallon container)
- Tax: Water, sewer, garbage, 6 percent
- Minimum bill: $58.50
- General fund: $1.8 million

* Naches

- Water: $31.12 (400 cubic feet)
- Sewer: $48.76 (400 cubic feet)
- Garbage: $12.77 (96 gallon container)
- Tax: Water, 6 percent; sewer, garbage, 3 percent
- State refuse tax: 6.5 percent
- Minimum bill:$100.60
- General fund: $623,910

* Selah

- Water: $16.58 (300 cubic feet)
- Sewer: $40.52 (flat rate)
- Garbage: $12 (64 gallon container)
- Tax: Water, sewer, garbage, 29.5 percent
- Minimum bill: $90.37
- General fund: $5 million

* Sunnyside

- Water: $17.73 (300 cubic feet)
- Sewer: $40.65 (300 cubic feet)
- Garbage: $12.09 (96 gallon container)
- Tax: Water, sewer, garbage, 19 percent
- State surcharge: 3.6 percent
- Minimum bill: $96.33
- General fund: $13.7 million

* Tieton

- Water: $37.68 (400 cubic feet)
- Sewer: $50.87 (1,000 cubic feet)
- Garbage: $14.51 (96 gallon container)
- Taxes: Water, sewer, garbage, 6 percent
- General fund: $639,687

* Toppenish

- Water: $33.04 (6,000 cubic feet)
- Sewer: $65.18 (6,000 cubic feet)
- Garbage: $16.77 (90 gallon container)
- Tax: Water, sewer, garbage, 33 percent
- Minimum bill: $152.93
- General fund: $5.3 million

* Wapato

- Water: $40.29 (1,000 cubic feet)
- Sewer: $55.86 (1,000 cubic feet)
- Garbage: $24.41 (96 gallon container)
- Taxes: (information wasn't available by deadline)
- Minimum bill: $120.56
- General fund: (information wasn't available by deadline)

* Yakima

- Water: $10.60 (500 cubic feet) includes a daily 34-cent service charge
- Sewer: $21.60 (500 cubic feet) includes a daily 72-cent service charge
- Garbage: $17.60 (32 gallon container), $20.10 (96 gallon container)
- Taxes: Water, sewer, 20 percent; garbage, 15 percent
- Minimum bill: $81.50
- General fund: $78 million

* Zillah

- Water: $14.76 plus a $9 improvement fee (300 cubic feet)
- Sewer: $30.50 plus a $7 improvement fee (300 cubic feet)
- Garbage: $14.81 (64 gallon container)
- Tax: Water, 26.3 percent; sewer, garbage, 32 percent
- Minimum bill: $94.45
- General fund: $2.4 million

Note: A typical family uses about 460 gallons of water a day, or 13,800 gallons a month, which translates into about 1,845 cubic feet of water, according to the U.S. Geological Survey.

SECOND SUPPLEMENTAL EXPERT REPORT
OF
DAVID J. ERICKSON

Community Association for Restoration of the Environment, Inc. and Center for Food Safety, Inc.
v.
George & Margaret, LLC, George DeRuyter & Son Dairy, LLC, D & A Dairy, and D & A Dairy, LLC.

Docket No. 2:13-cv-3017-TOR
&
Community Association for Restoration of the Environment, Inc. and Center for Food Safety, Inc.
v.
Cow Palace, LLC, The Dolsen Companies, and Three D Properties, LLC

Docket No. 2:13-cv-3016-TOR
&
Community Association for Restoration of the Environment, Inc. and Center for Food Safety, Inc.
v.
Henry Bosma Dairy, Liberty Dairy, LLC, Arizona Acres, LP, Liberty Acres, LLC, and Henry Bosma.

Docket No. 2:13-cv-3019-TOR

Prepared for:

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1. I, David J. Erickson, have been retained by Plaintiffs in the above-captioned matter to provide expert testimony about the manure management and storage practices of the aforementioned Defendants, including whether these activities have caused contamination of soils and groundwater.

2. As with my initial and prior supplemental reports, all opinions expressed herein are to a reasonable degree of scientific certainty, unless specified otherwise. I reserve the right to modify or supplement this report based on information obtained by Plaintiffs after the date of this report.

3. I have reviewed all new data provided to Plaintiffs by Defendants, including productions from January, 2015 forward. The most recent production was provided on April 24, 2015. These documents include recent soil sampling records, 2014Q4 and 2015Q1 groundwater monitoring data, and AOC-related documentation and correspondence from 2015. I also visited the DeRuyter facilities, obtaining Geoprobe samples from that Defendants' composting area on April 9, 2015. Overall, the new information I have reviewed further confirms my opinions outlined in my prior expert reports.

4. Plaintiffs finally received hydrometer and deep soil sampling analysis for the Cow Palace and Bosma facilities. The hydrometer analysis for Cow Palace, dated August 22, 2012 shows that the sampled field and location

(Field 2, 4-5 foot depth) was predominantly silt with 20% sand and 15% clay and had sufficient moisture (25.4%) to be conducive to the downward movement of water in the unsaturated zone and, correspondingly, nitrate deeper into the soil profile well beyond the reach of plant uptake. DAIRIES028837.

5. The same is true for the Bosma sampling, with more silt and only minor concentrations of sand (5%) and clay (12%). The Bosma hydrometer analysis also shows an in-situ moisture content of 28.1%. Both samples indicate that the silt zone is approaching saturated flow conditions. DAIRIES028838.

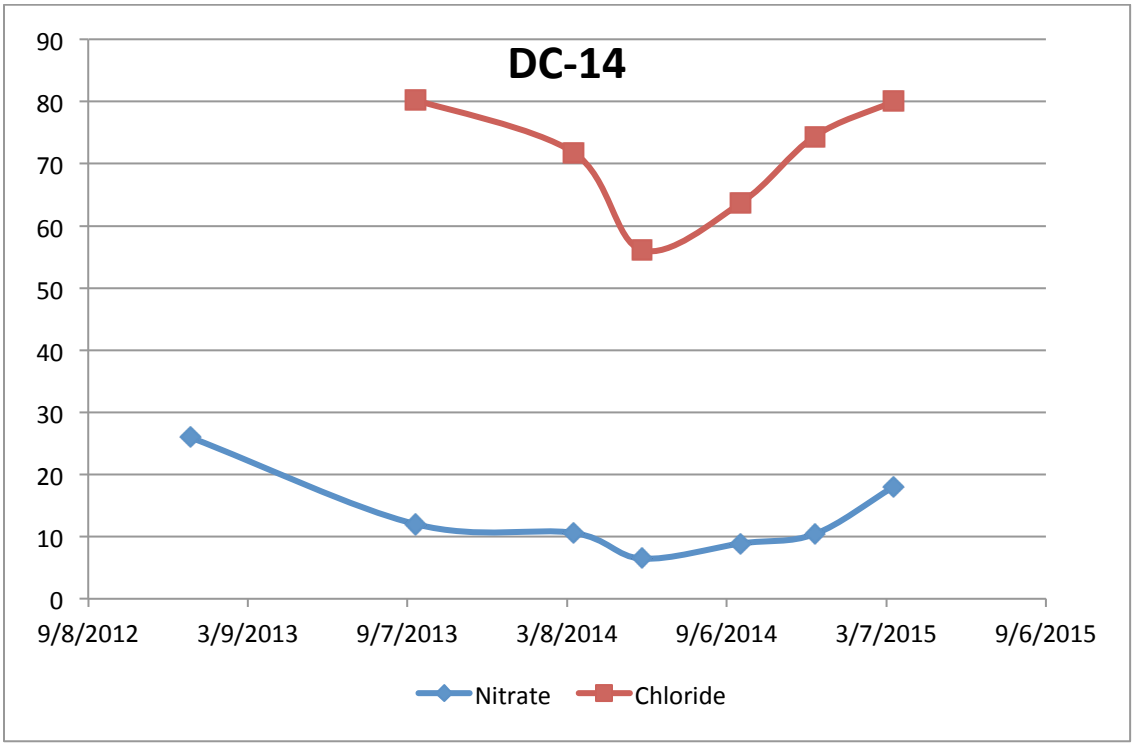
6. The Bosma deep soil samples were collected in August or 2012, DAIRIES028836, and received by the Plaintiffs in April of 2015. The analysis shows high concentrations of nitrate throughout the soil column, but more significantly in the deeper portions of the soil column. For instance, at 15 feet below ground surface, results of 44.1, 130, 161, 87.2, 37, and 143 mg/kg nitrate were recorded in fields 1-6, respectively. In addition, the deep samples indicate the sources are animal waste, per the nitrogen isotope analysis performed by Arcadis. Moisture content was predominantly between 18 and 22%. In my opinion, this further indicates that the Bosma

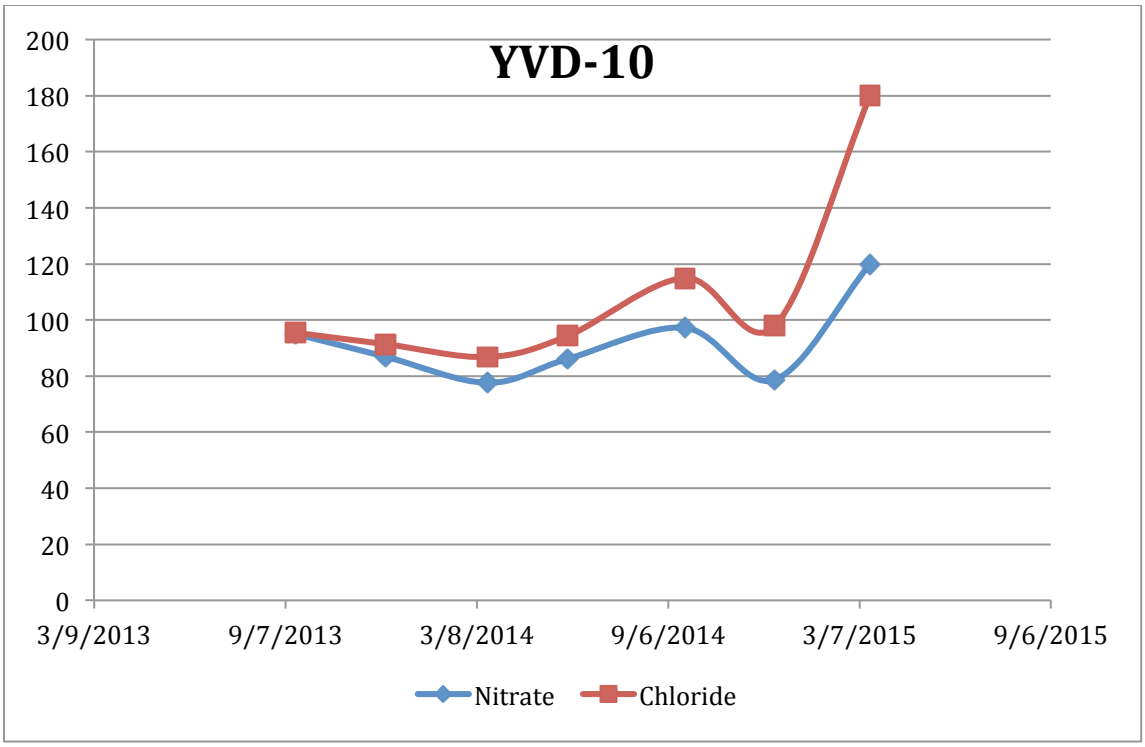
dairies were depositing large amounts of manure onto their fields – far more than crops could uptake as fertilizer.

7. I have also reviewed records showing that Cow Palace Dairy had an off site manure spill on to the Butler property in January, 2015. DAIRIES029864. No soil samples were taken from the field to which manure was applied. DAIRIES029867. That Cow Palace is still incapable of applying manure in compliance with its DNMP and with the AOC shows just how important it is that the recommendations of Dr. Shaw for future field management are adopted with enforceable capabilities.

8. The most recent soil sampling from Defendants show that nutrient levels are still very high – in many instances, much higher than the AOC's 45 mg/kg (aka ppm) nitrate level of concern. For Liberty/Bosma, a summary table at DAIRES031078 shows that Fields 2, 6, 7, and 8 have very high residual nitrate concentrations, with Fields 7 and 8 both exceeding 100 mg/kg nitrate. Cow Palace Field 6 exceeded the AOC 45 ppm nitrate level of concern. DAIRES033022. The fields at the DeRuyter facilities remain the highest in terms of residual nitrate concentrations, with GDS-SU4 and GDS-SU5 being very high (GDS-SU5 had results in excess of 200 mg/kg nitrate). Many fields remain in violation of the AOC's 45 ppm level of concern. DAIRIES032050.

9. Additional groundwater monitoring results obtained pursuant to the AOC show that the dairies are still the major contributor to the nitrate contamination observed in the wells. In the data usability reports from 4Q2014 and 1Q2015, nitrate levels continue to remain high in downgradient wells, with results fluctuating between one sampling event to the next. This provides further additional support that surface activities are influencing groundwater on a relatively short timeframe. The histograms below show the temporal nitrate and chloride results from monitoring wells along the centerline of the contaminant plume emanating from Dairy operations.




YVD-10
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180
160
140
120
100
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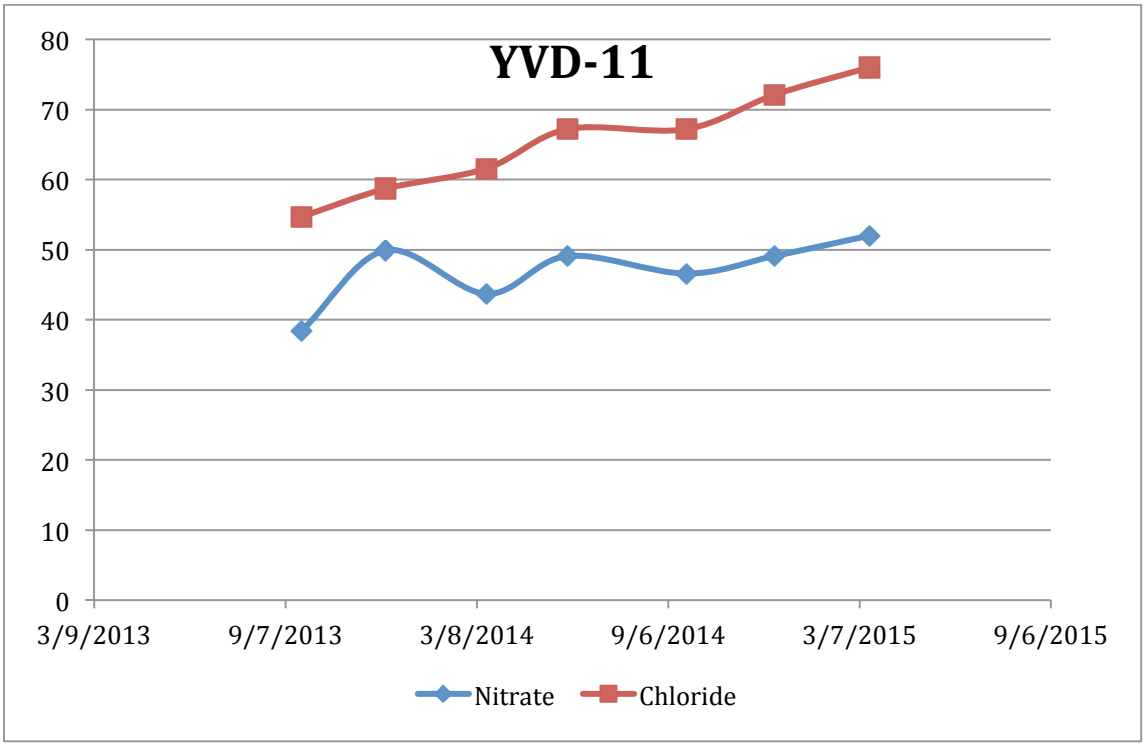
9/6/2015
Nitrate
Chloride


YVD-11
80
70
60
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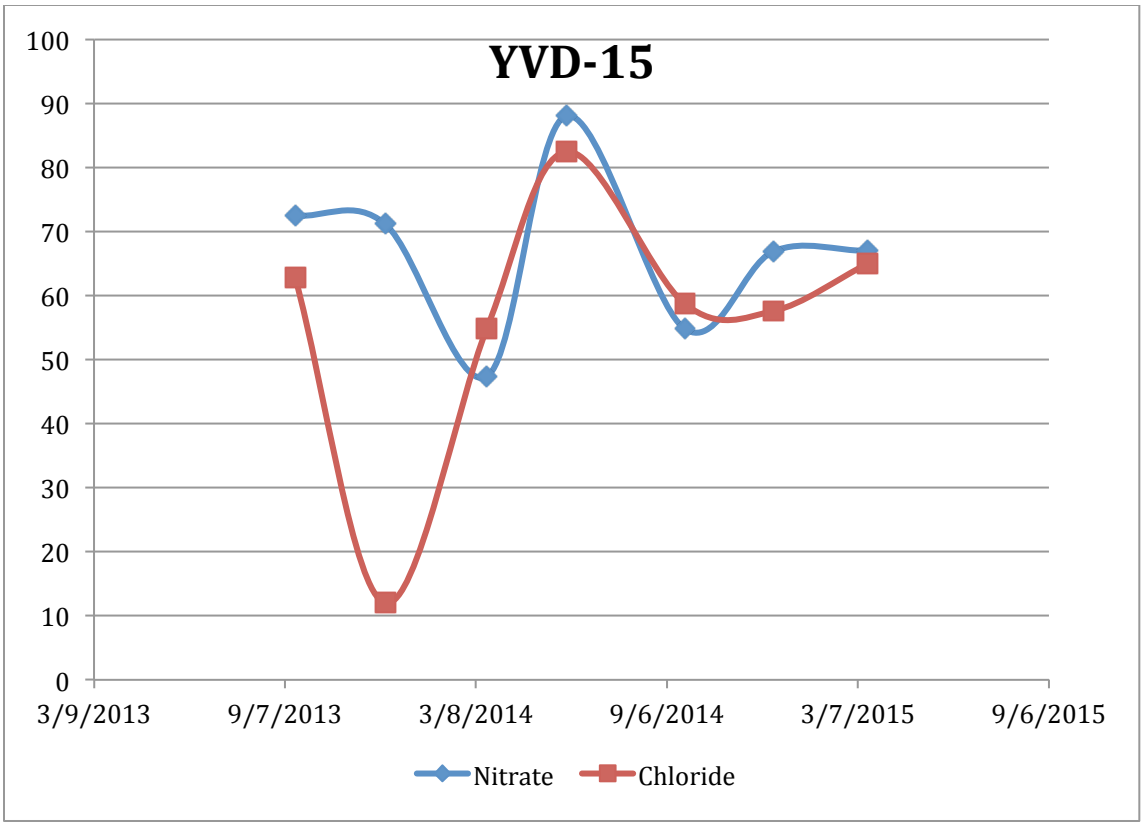
9/6/2015
Nitrate
Chloride



The histograms above provide concentrations versus time for the wells referenced. The concentration trends show increasing, decreasing and stable trends; consistent with contamination from multiple sources or source terms impacting an alluvial aquifer.

10. I have also reviewed the new lagoon work plans submitted by Defendants to EPA. The double lined system proposed is consistent with what has been recommended in my earlier reports, as long as some additional issues are properly addressed. In those documents, Defendants propose lining their lagoons with a hybrid double lined system with one glaring shortfall; if construction quality control is not excellent, there is a

good chance the lagoon will have a leak with no means of detecting the location or magnitude of the leak. By incorporating leak detection into the liner system, the Dairies can remove future leak concerns. Given the liner system proposed, leak detection should be required and could easily be added to the construction drawings.

11. Additionally, in the work plans the Defendants' representative states that gas venting will be required because of deposited organic material in the soil underlying the lagoons. Despite repeated denials, this is a further statement from Defendants indicating their knowledge that the existing lagoons as designed leak.

12. With respect to the DeRuyter facilities, on April 9, 2015, I oversaw the use of the Geoprobe sampler at both of DeRuyter's composting facilities. One composting facility is located at the D&A Dairy site, and I understand from conversations with Mr. DeRuyter during the inspection that it has been in operation for more than 15 years. The other composting operation is located northeast of the George DeRuyter & Son Dairy, above the Roza Canal. I understand this composting facility to be relatively newer, with our sampling location in an area that has had a composting operation for about three years.

13. Samples were collected in the DeRuyter compost areas to determine subsurface soil types, moisture content, and nutrient concentrations. In addition, continuous core samples were collected to allow analysis on 1 foot intervals. This detailed analysis was performed to allow precise characterization of subsurface migration pathways and a detailed description of chemical processes in the subsurface. The yellow highlighted columns in the following table (see below) summarizes all the data collected during this investigation. The brown shading highlights soil intervals with concentrations greater than 100 mg/kg with darker brown representing concentrations greater than 200 mg/kg.

Photo. Geoprobe in D&A Compost Area



14. Given the nitrate concentrations in the subsurface and the laboratory moisture content, nitrate concentrations in the soil moisture (pore water) can be calculated using a reference partitioning coefficient for the nitrate contaminant.[1] The last column in the table provides the nitrate concentration in pore water migrating down to ground water. With pore water concentrations as high as 3,000 mg/l, it is readily apparent that ground water

[1] Cantrell K.J., R.J. Serne and G.V. Last, 2003, Hanford Contaminant Distribution Coefficient Database and Users Guide, PNNL-13895 Rev. 1.

concentrations in the 200 mg/l range could originate from the composting operation. Also, under unsaturated flow conditions, the decreasing soil concentrations do not represent the lack of migration, but rather the decrease in soil moisture typical with coarser grained soils.

15. Data from the table are presented in the following graphs. The correlation between soil moisture and nitrate is a direct indication that the soil moisture is transporting the nitrate into the subsurface. While the soil descriptions show that the silt is retaining moisture to saturated or near saturated conditions, until the liquid breaks through the coarser grained material, most likely under finger flow conditions.

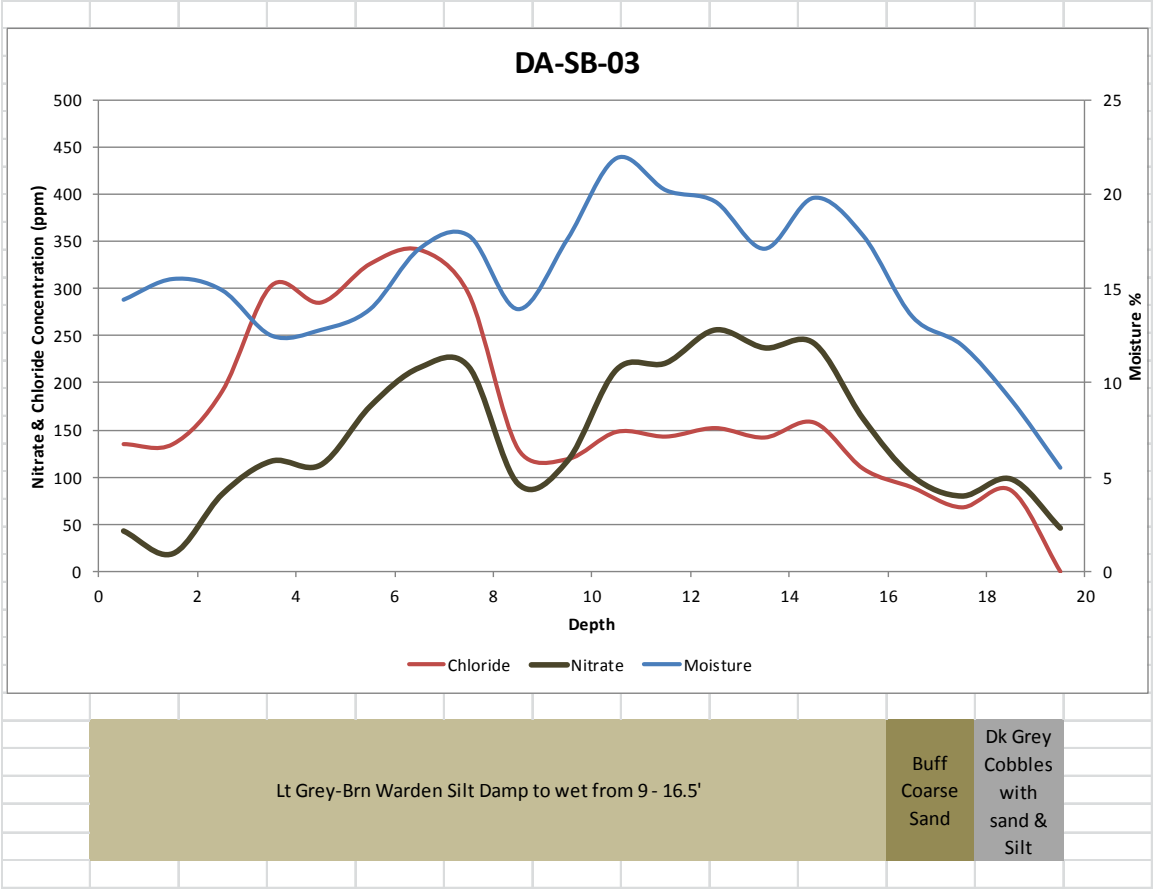
Photo Wet Silt. Note free water on soil core liner



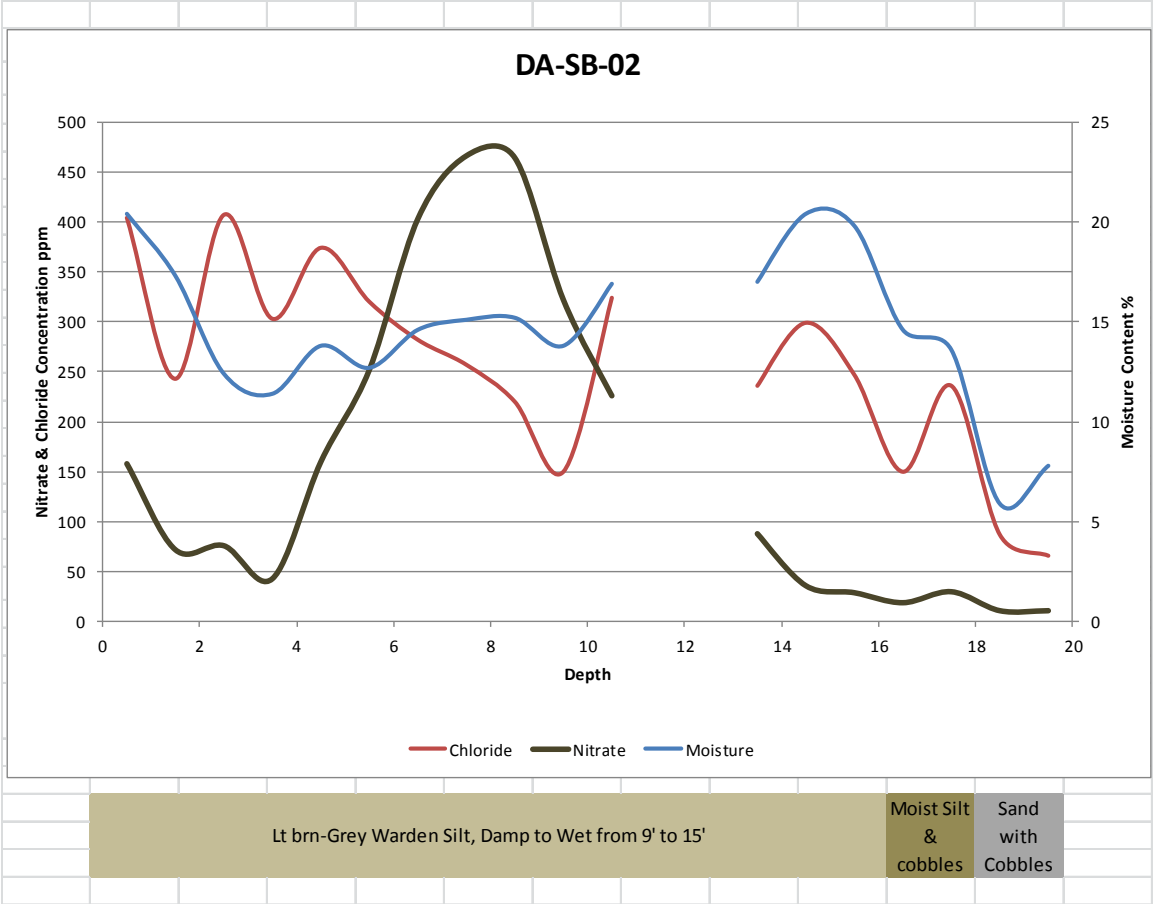
Photo. Wet Silt on top of Gravel. DS-SB-03 @ 15’



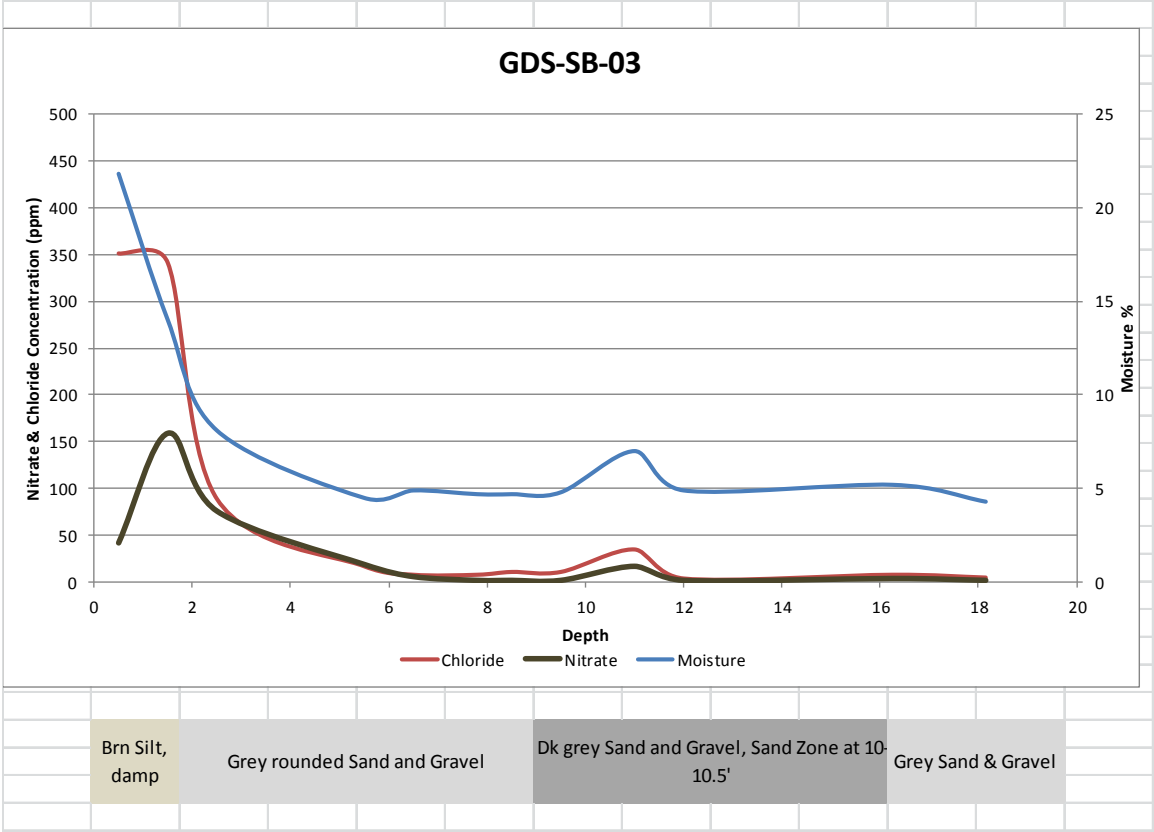
Boring ID		Soil							Pore water Concentration (C_w)
		Moisture content		Concentration (C_t)					
	Interval (ft)	Weight (%)	θ_w (-)	Chloride (mg/kg)	Phos (mg/kg)	Ammonia (mg/kg)	Nitrate (mg/kg)	TKN (mg/kg)	Nitrate (mg/L)
DA-SB-02	0-1	20.4	0.388	404	95	12	158	896	775
	1-2	17.3	0.329	243	58	21	72	560	416
	2-3	12.4	0.236	407	14	13	76	448	613
	3-4	11.4	0.217	303	4	8	43	280	377
	4-5	13.8	0.262	374	4	11	160	224	1,159
	5-6	12.7	0.241	320	2	9	252	56	1,984
	6-7	14.6	0.277	282	3	104	403	112	2,760
	7-8	15.1	0.287	257	4	6	466	112	3,086
	8-9	15.2	0.289	220	3	5	464	112	3,053
	9-10	13.8	0.262	150	3	5	322	112	2,333
	10-11	16.9	0.321	324	47	8	226	672	1,337
	13-14	17	0.323	236	3	5	88	224	518
	14-15	20.4	0.388	299	4	4	36	168	176
	15-16	19.8	0.376	247	4	5	29	168	146
	16-17	14.6	0.277	150	8	5	19	336	130
	17-18	13.6	0.258	236	14	5	30	336	221
	18-19	5.9	0.112	87	3	4	11	112	186
	19-20	7.8	0.148	66	2	4	11	168	141
DA-SB-03	0-1	14.4	0.274	135	97	8	43	168	299
	1-2	15.5	0.295	135	31	4	19	560	123
	2-3	14.9	0.283	191	21	4	82	336	550
	3-4	12.5	0.238	303	34	3	117	504	936
	4-5	12.8	0.243	285	2	3	113	224	883
	5-6	13.9	0.264	326	8	3	175	224	1,259
	6-7	17.1	0.325	341	7	4	216	224	1,263
	7-8	17.8	0.338	294	15	4	217	280	1,219
	8-9	13.9	0.264	130	5	4	93	224	669
	9-10	17.6	0.334	119	3	5	117	672	665
	10-11	21.9	0.416	148	4	5	214	168	977
	11-12	20.2	0.384	143	4	2	221	168	1,094
	12-13	19.6	0.372	152	3	4	256	168	1,306
	13-14	17.1	0.325	142	3	7	237	168	1,386
	14-15	19.8	0.376	158	3	5	242	168	1,222
	15-16	17.8	0.338	109	4	4	162	112	910
	16-17	13.5	0.257	89	4	4	101	112	748
	17-18	12	0.228	68	11	5	80	224	667
	18-19	9.1	0.173	86	7	5	98	224	1,077
	19-20	5.5	0.105	0	2	5	46	112	836
GDS-SB-02	0-1	13	0.247	1580	79	9	288	896	2,215
	1-2	12.3	0.234	1040	13	5	210	672	1,707
	2-3	6.2	0.118	174	8	5	49	336	790
GDS-SB-03	0-1	21.8	0.414	351	510	18	42	3530	193
	1-2	14	0.266	341	120	4	159	728	1,136
	2-3	8.1	0.154	89	23	5	76	336	938
	5-6	4.5	0.086	17	26	4	19	168	422
	6-7	4.9	0.093	8	5	5	6	56	122
	7-8	4.7	0.089	8	4	4	2	56	43
	8-9	4.7	0.089	11	4	4	2	0	43
	9-10	4.8	0.091	11	3	4	2	0	42
	10-12	7	0.133	35	150	6	17	616	243
	13-15	4.9	0.093	4	4	2	2	56	41
	15-17.5	5.2	0.099	8	33	3	4	112	77
	17.5-18.8	4.3	0.082	5	3	3	2	0	47



16. DA-SB-03 was completed in the older compost area on D&A Dairy. The nitrate had infiltrated the complete sample depth at concentrations as high as 1300 mg/l in the pore water and 256 mg/kg in the soil. The nitrate occurs in the soil moisture below any root depth, although there are no plants at the surface to uptake the nutrients. As a result, this contamination will continue to migrate down to the ground water under the force of gravity along preferential flow paths.



17. DA-SB-02 was completed in the D&A Dairy compost area. Nitrate concentrations in the soil are as high as 466 mg/kg and over 3,000 mg/l in the pore water. These data indicate that the compost areas are a major source of nitrate contamination, even more so than previous data from Cow Palace and Bosma indicated.



18. Two additional borings were done at the George DeRuyter & Sons facility, one encountered refusal at 5 feet and the second was completed to 18.8 feet. The area of the second boring had been used for composting operations for about 3 years. These data are significant because they show a good correlation with moisture, but more importantly, show nitrate infiltration to 5 feet with an increase in concentration in a sand zone at 10' below ground surface. Again, this data indicates nitrate impacts from the composting operation are present, migrate in soil moisture and occur relatively quickly.

19. The different lengths of time that DeRuyter has composted at the D&A and GDS facilities indicate the cumulative effect of leaching from compost facilities that are on permeable surfaces will cause or contribute to groundwater contamination. It is just a matter of time before the cumulative nitrate migrates to preferential flowpaths. The D&A facility has been used long enough to show the serious cumulative effects of the nitrogen loading, while the GDS compost area shows that the area will continue to be a contributing source.

20. The high concentrations released from compost operations dictate the need for corrective measures. All compost operations should be completed on impermeable surfaces, as I have indicated in my past expert reports. In addition to those measures, Defendants could also use vacuum pipes in their compost piles, and by controlling the moisture, the composting process could be shortened and the odor controlled with biofilters. All leachate and liquid from the manure piles would need to be contained and applied to the compost piles, as needed.

21. In conclusion, the newest information and data I have seen provides further support for the opinions expressed in my earlier expert reports. The mass of nutrients discharged to the ground by the lagoons, application fields compost operations, and animal pens reinforces the need for corrective

measures at the facilities. Unfortunately, source control may not be sufficient to decrease the ground water impacts in a reasonable time frame, given the mass of contaminants in the soil column. Additional active ground water remediation, such as hydraulic control of the plume and removal of nitrates from the water table, may be required to decrease the extent or magnitude of the plume within a time frame that would benefit the residences that rely on the aquifer for drinking water.

Dated: April 30, 2015

David J. Erickson PG CPG
President and Hydrogeologist
Water & Environmental Technologies, PC

Soil Survey Data for the LYV GWMA Target Area

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Summary of NRCS Soil Testing in the LYV

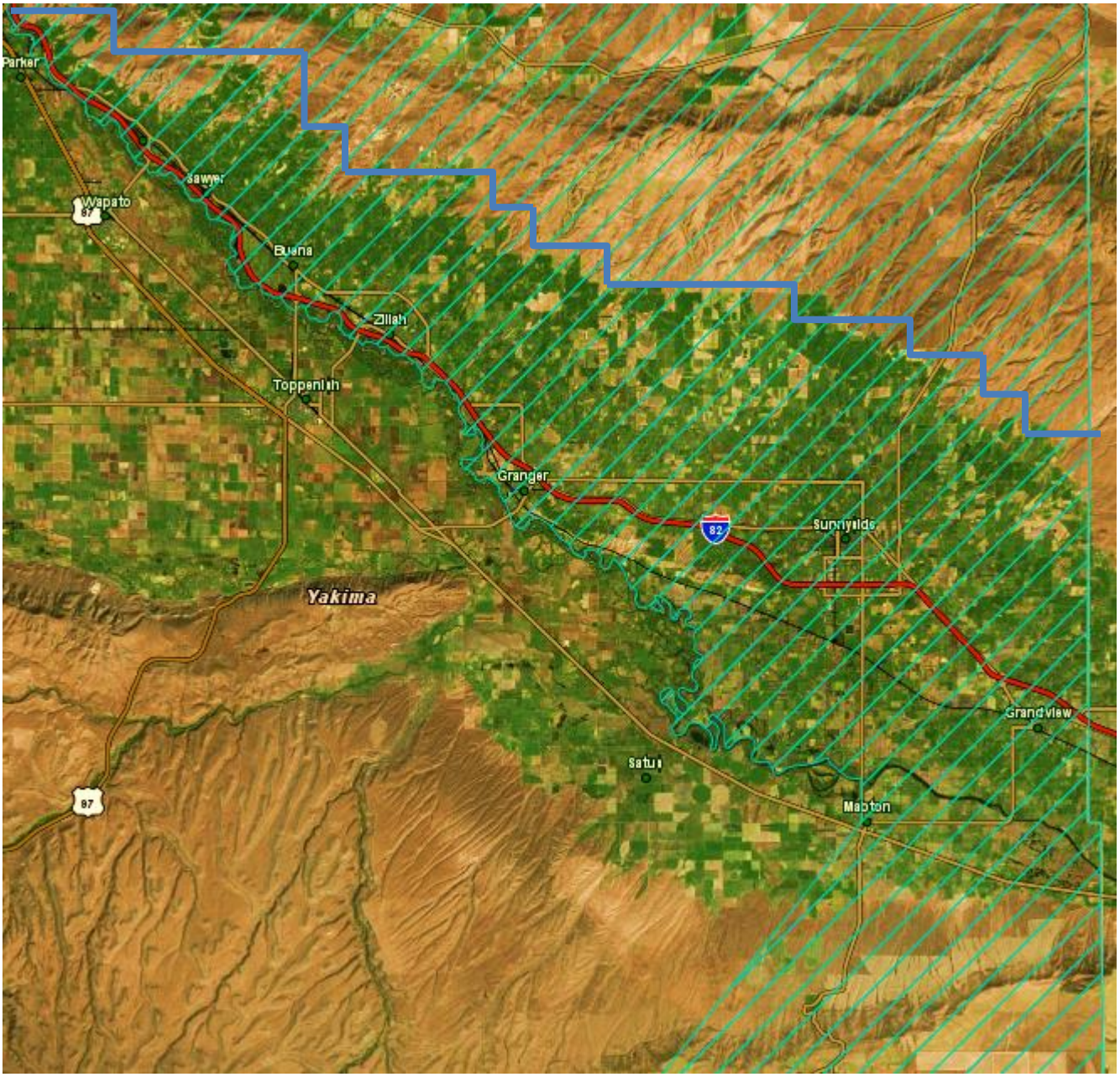
This information has been gathered from the Natural Resources Conservation Services Soil Survey website at https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/

We have copied some of the most important maps for the GWMA target area in order to explain and display the characteristic of the land and water regarding: nitrate leaching, application of manures and food processing wastes, disposal of wastewater by irrigation, calcium carbonate levels, cation exchange capacity, electrical conductivity, soil pH, available water capacity, available water storage, available water supply, % organic matter, % clay, % sand, % silt, saturated hydraulic conductivity, water content, depth to any soil restrictive area, drainage class, hydrologic soil group, depth to water table and compaction potential.

The NRCS definitions for these parameters and descriptions of the soils found in the LYV GWMA target area follow.

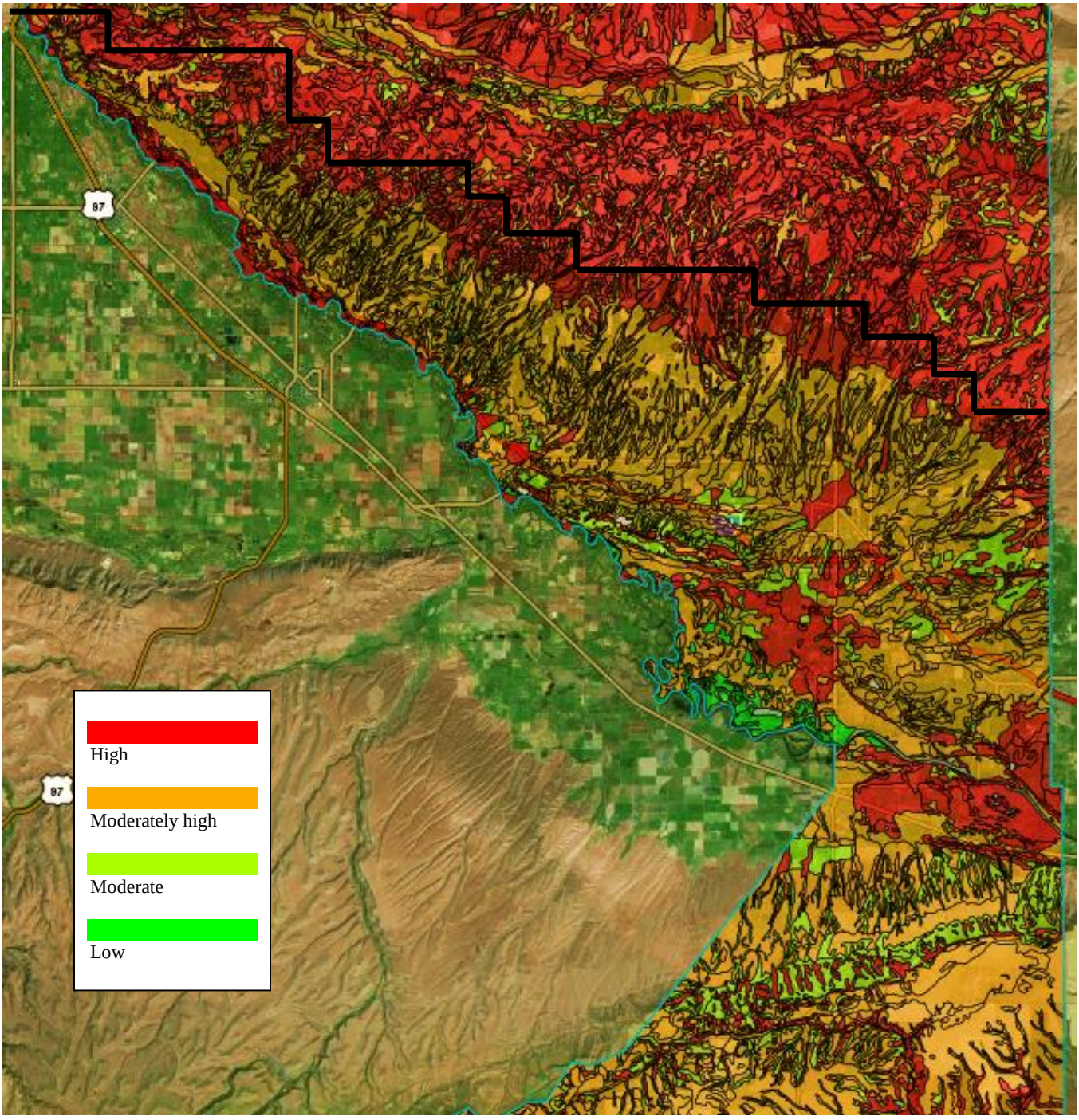
Map of the Area

GWMA



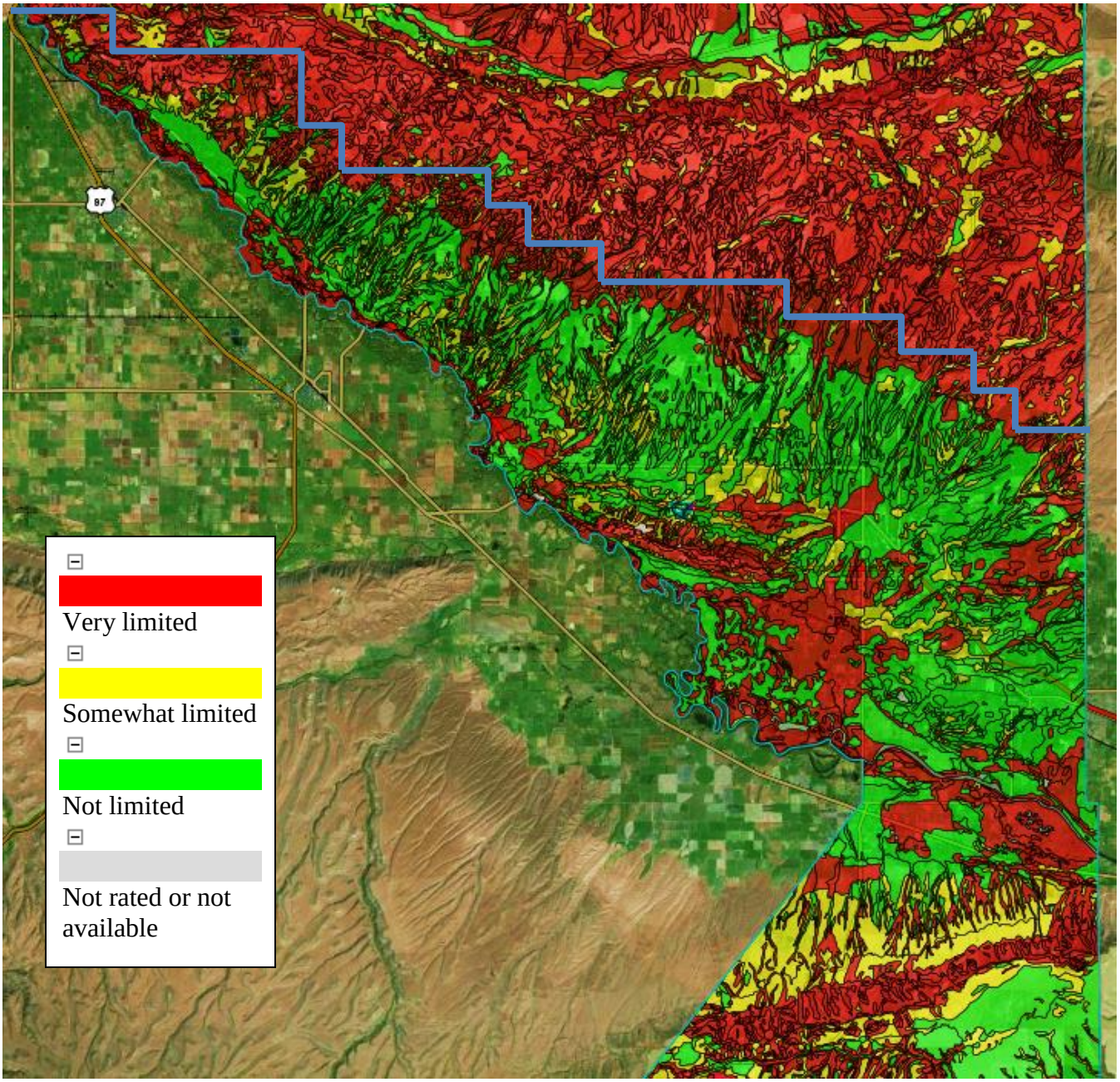
Nitrate Leaching Potential

GWMA



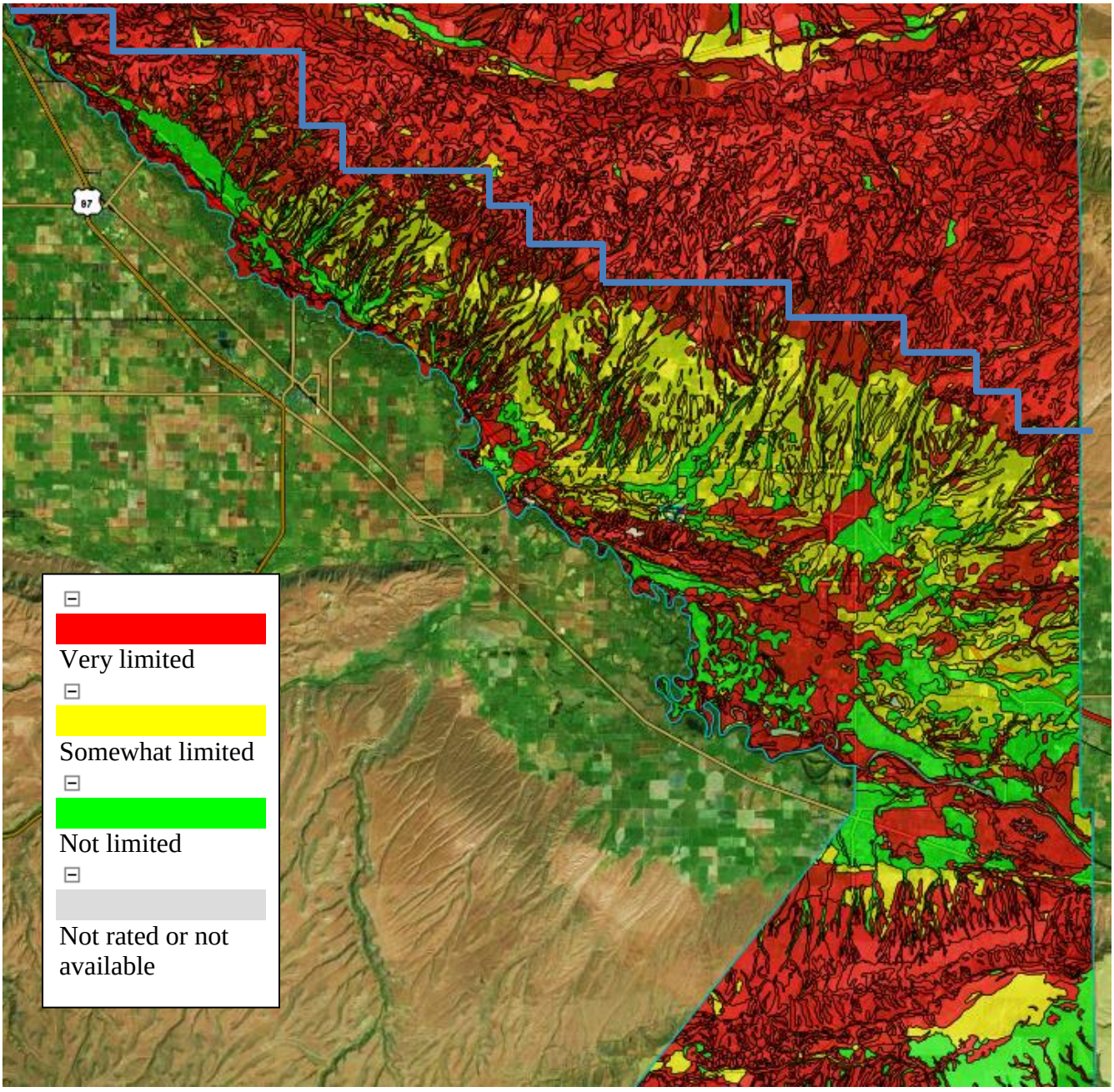
Manure & Food Processing Waste

GWMA



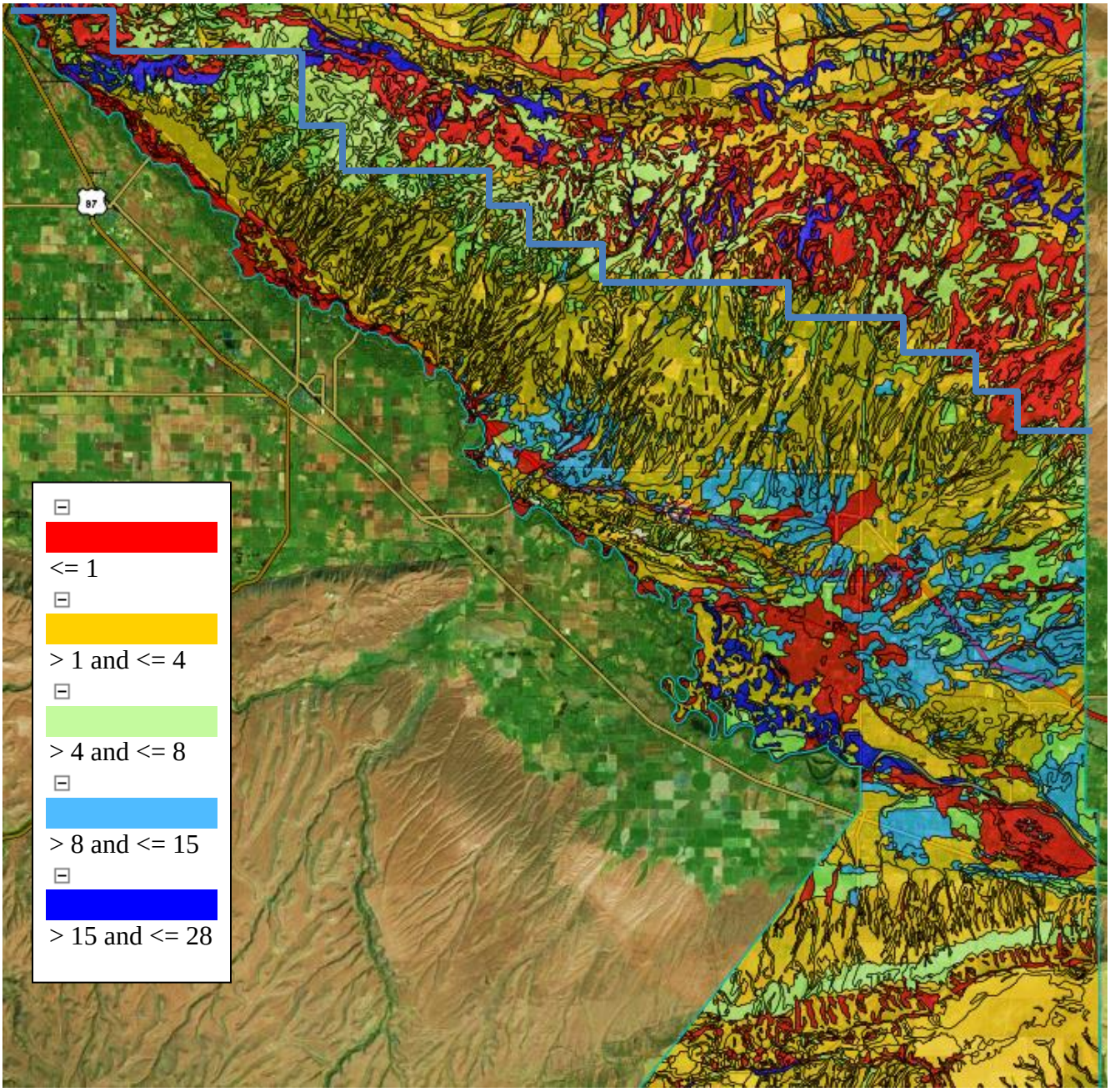
Disposal of Wastewater by Irrigation

GWMA



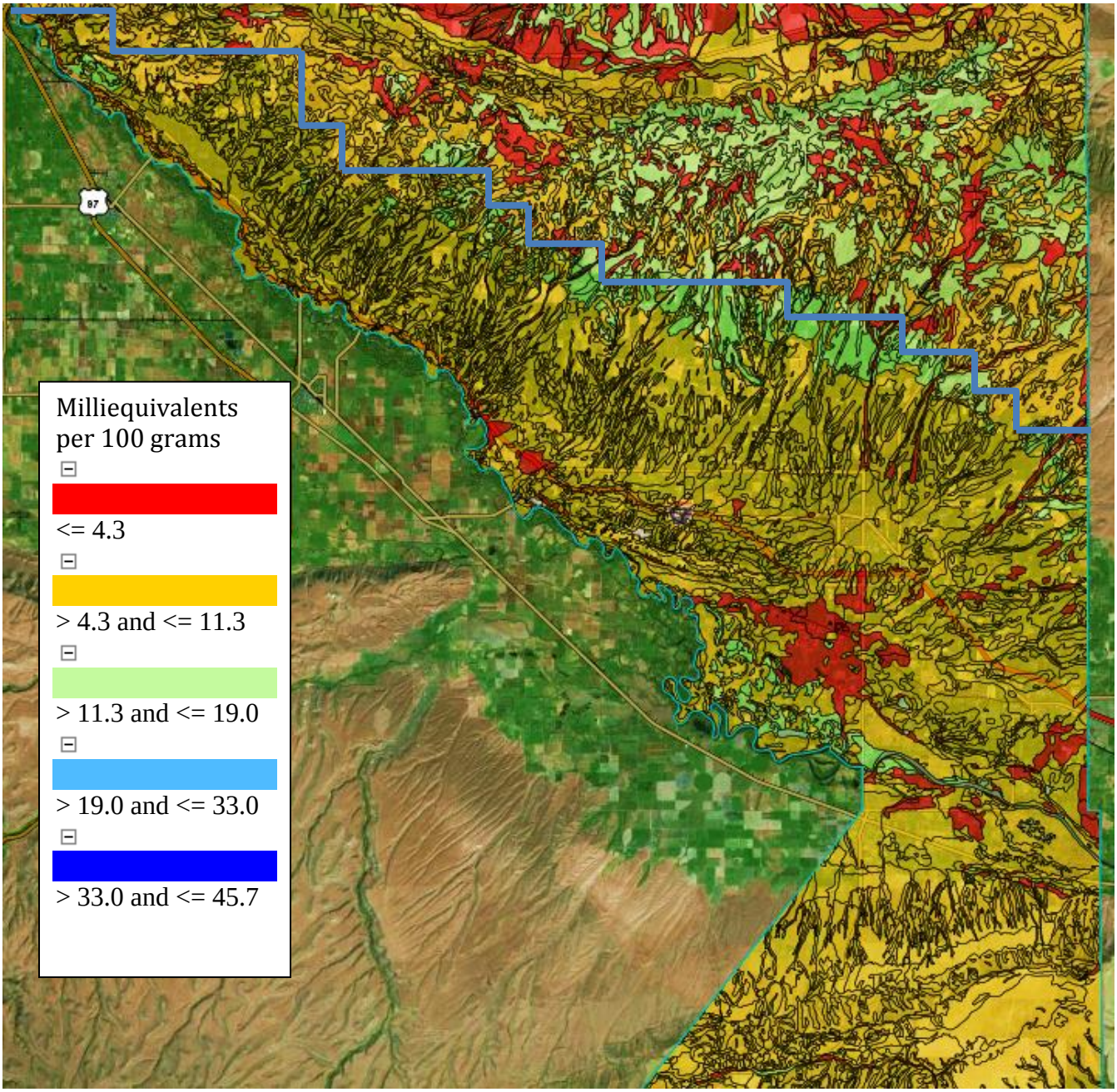
Calcium Carbonate

GWMA



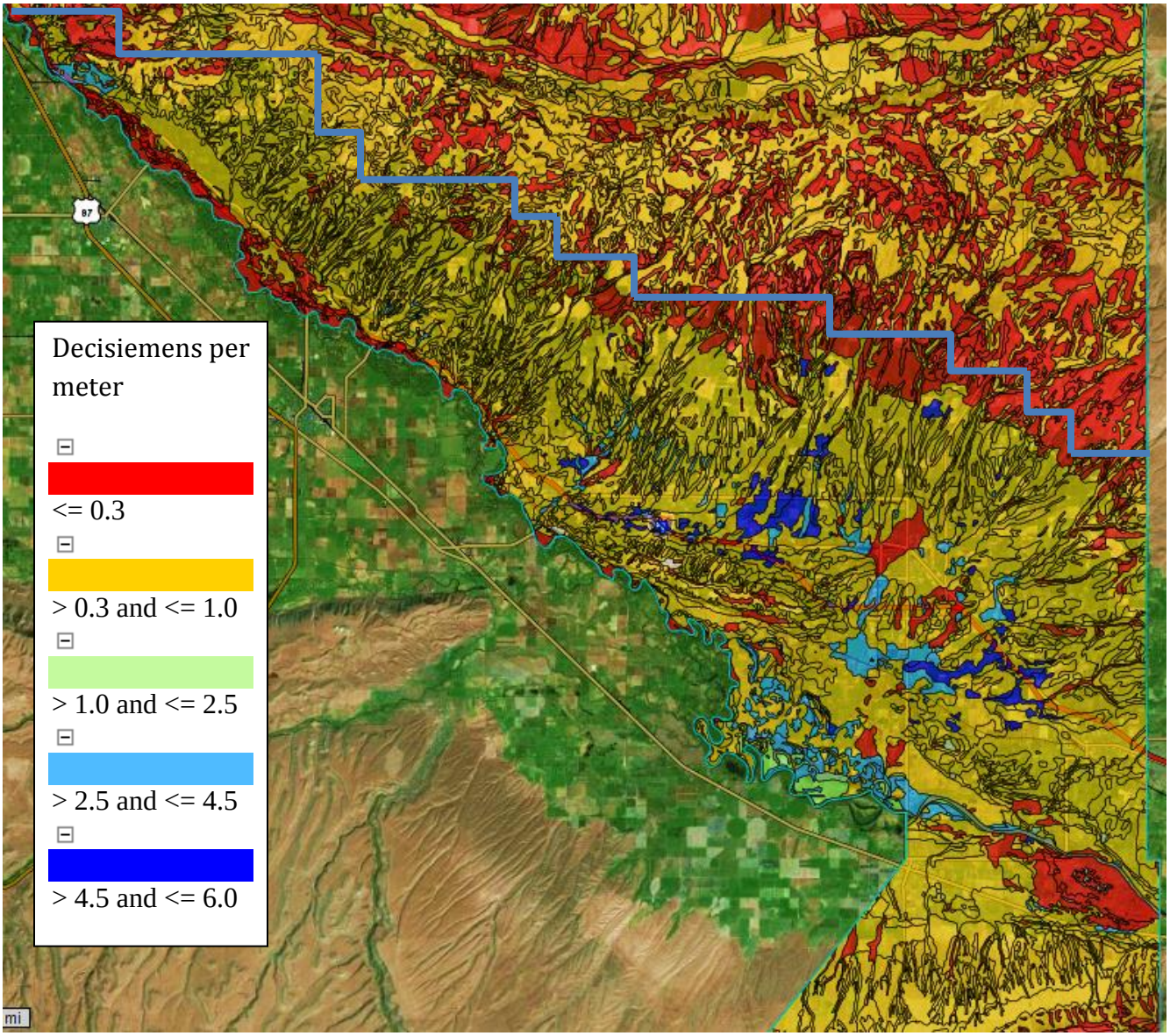
Cation Exchange Capacity

GWMA



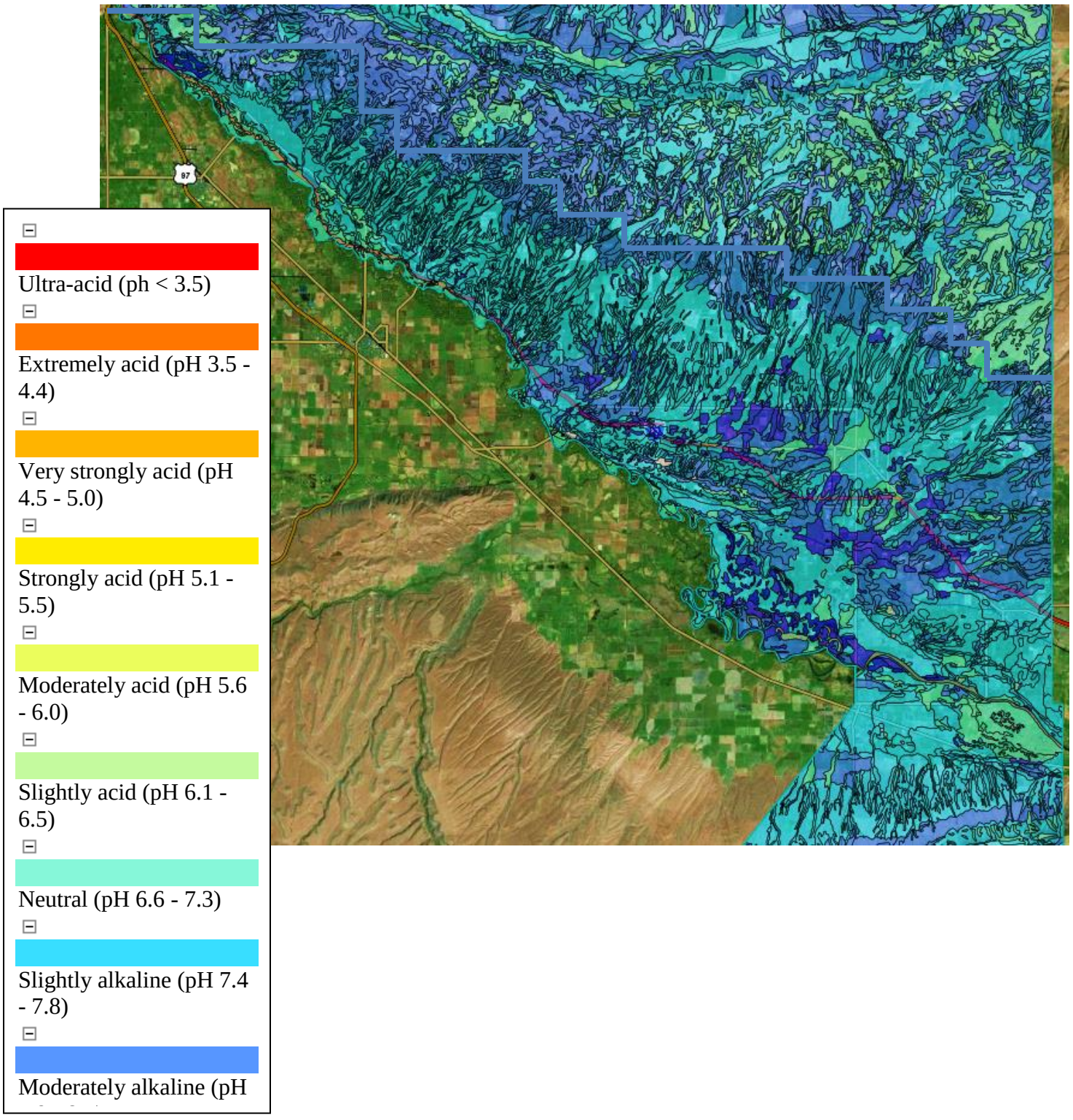
Electrical Conductivity

GWMA



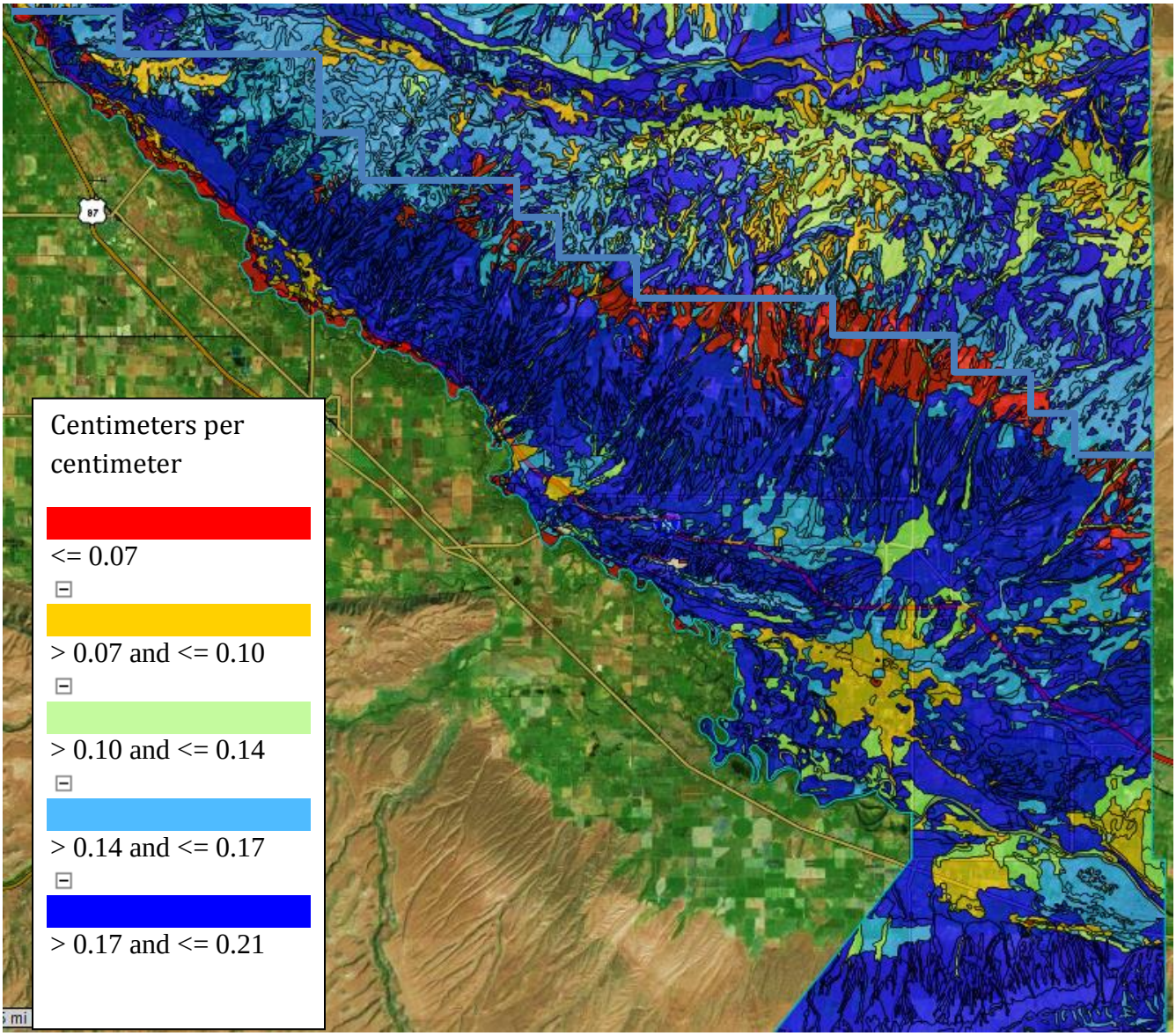
pH

GWMA


87
Ultra-acid (ph < 3.5)
Extremely acid (pH 3.5 - 4.4)
Very strongly acid (pH 4.5 - 5.0)
Strongly acid (pH 5.1 - 5.5)
Moderately acid (pH 5.6 - 6.0)
Slightly acid (pH 6.1 - 6.5)
Neutral (pH 6.6 - 7.3)
Slightly alkaline (pH 7.4 - 7.8)
Moderately alkaline (pH

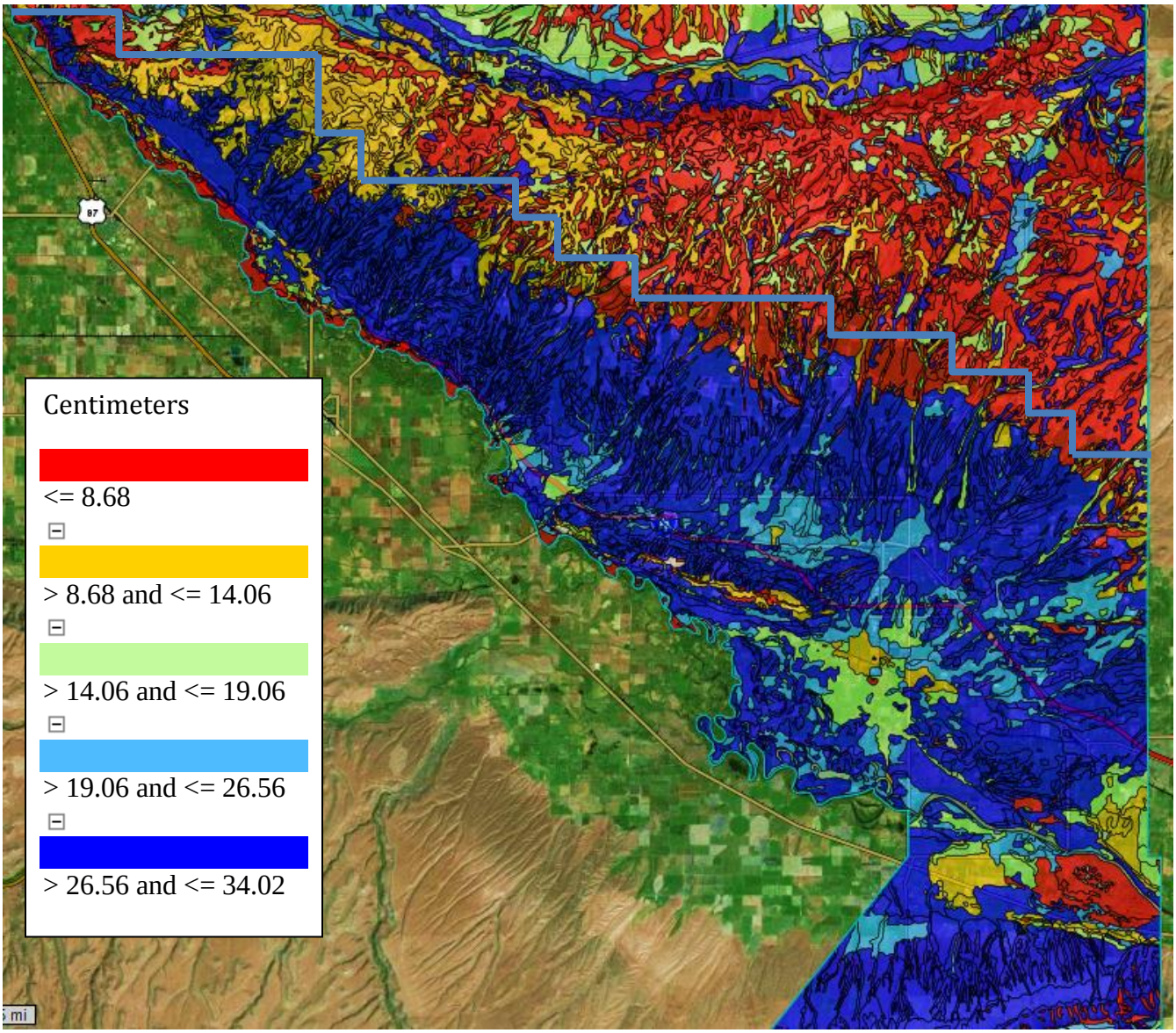
Available Water Capacity

GWMA



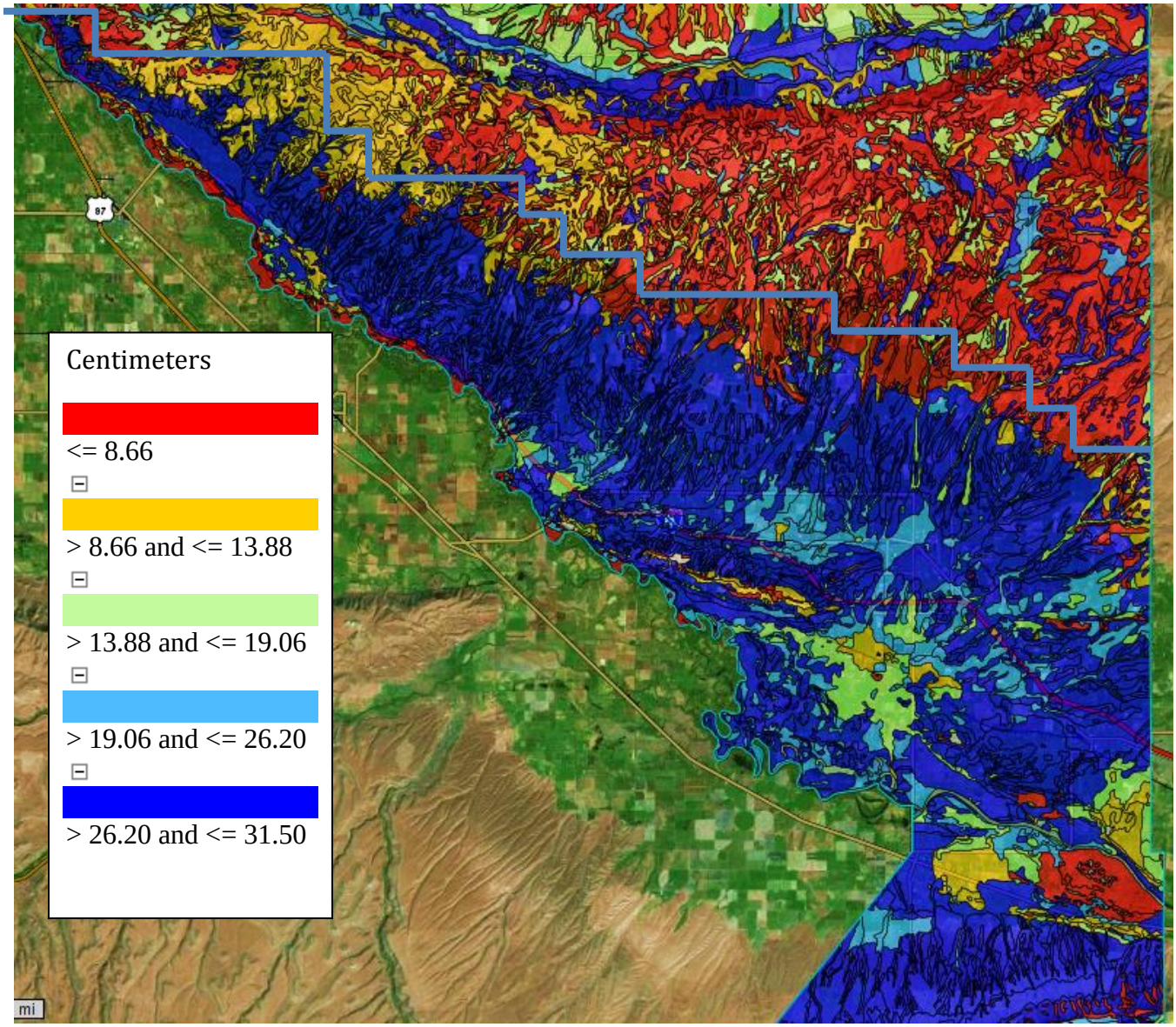
Available Water Storage

GWMA



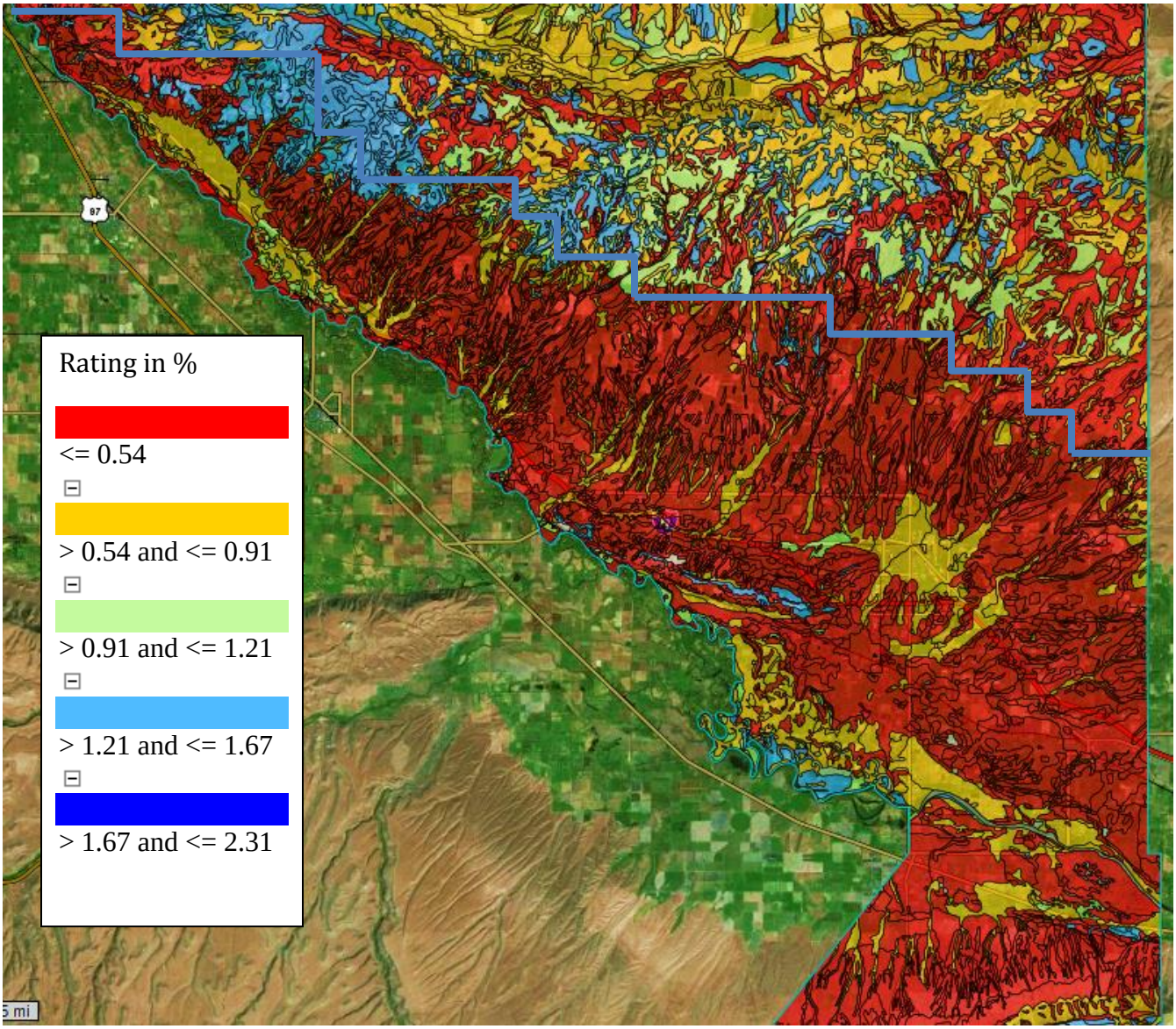
Available Water Supply – 0 to 150 cm

GWMA



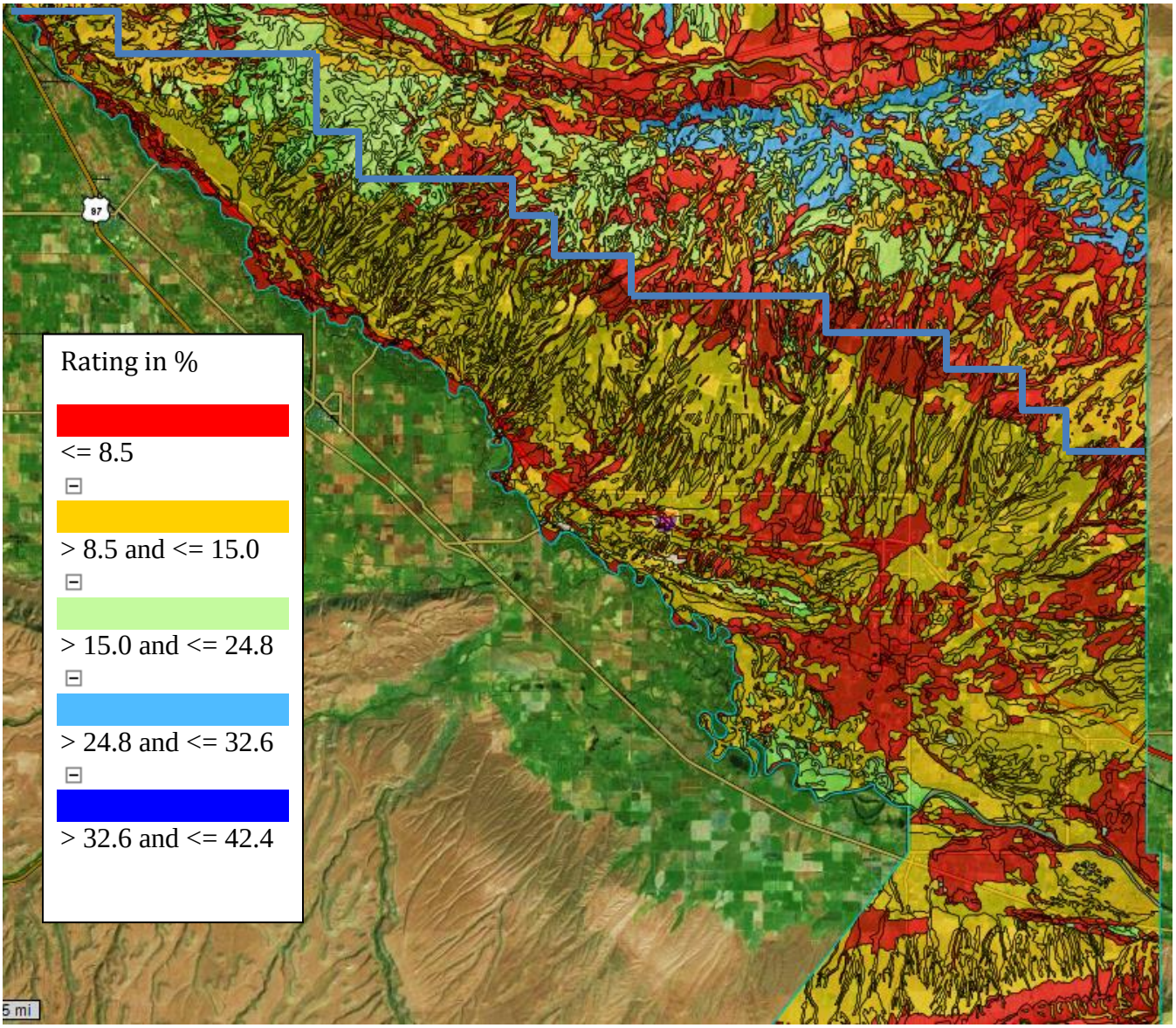
Organic Matter

GWMA



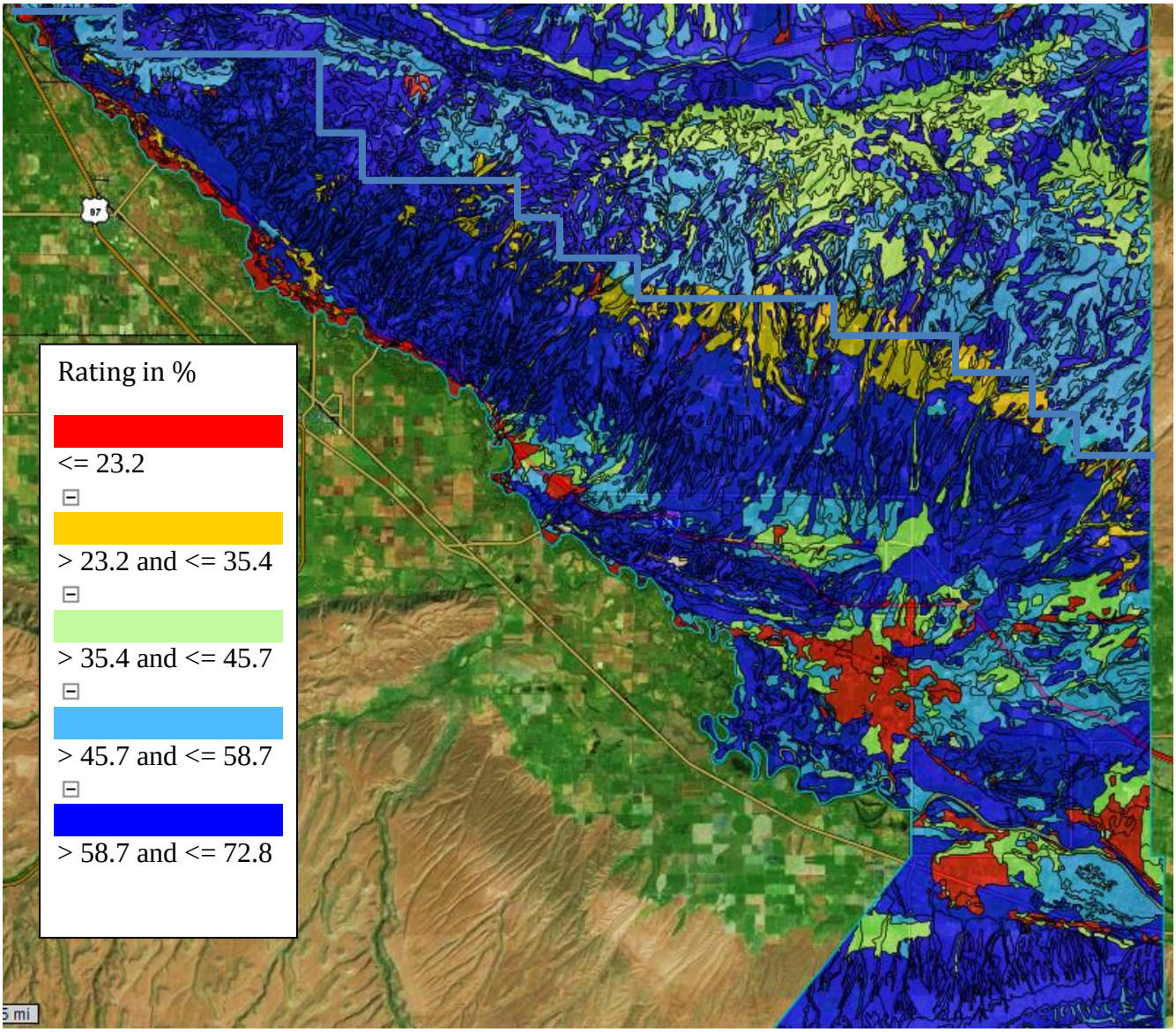
Percent Clay

GWMA



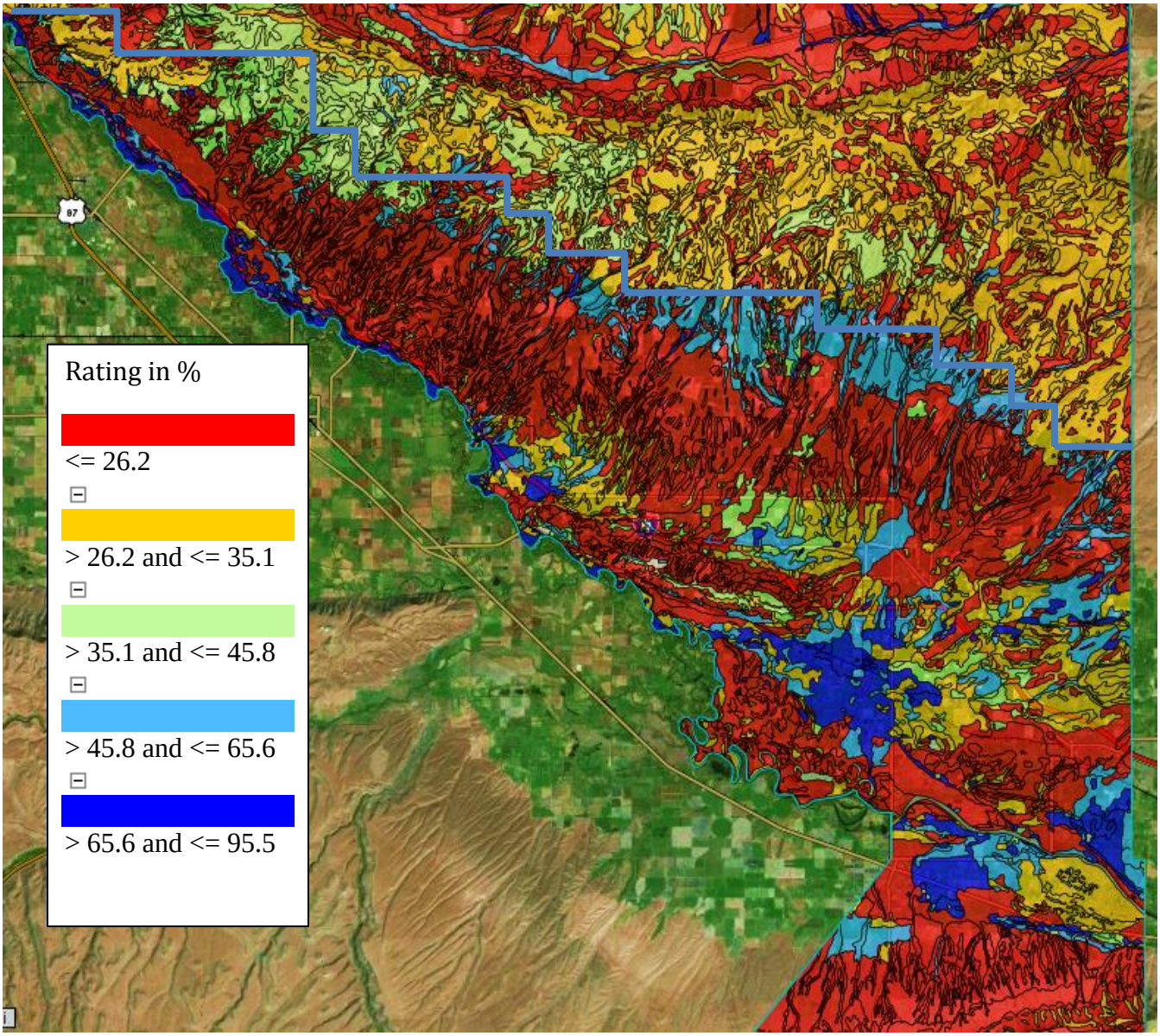
Percent Silt

GWMA



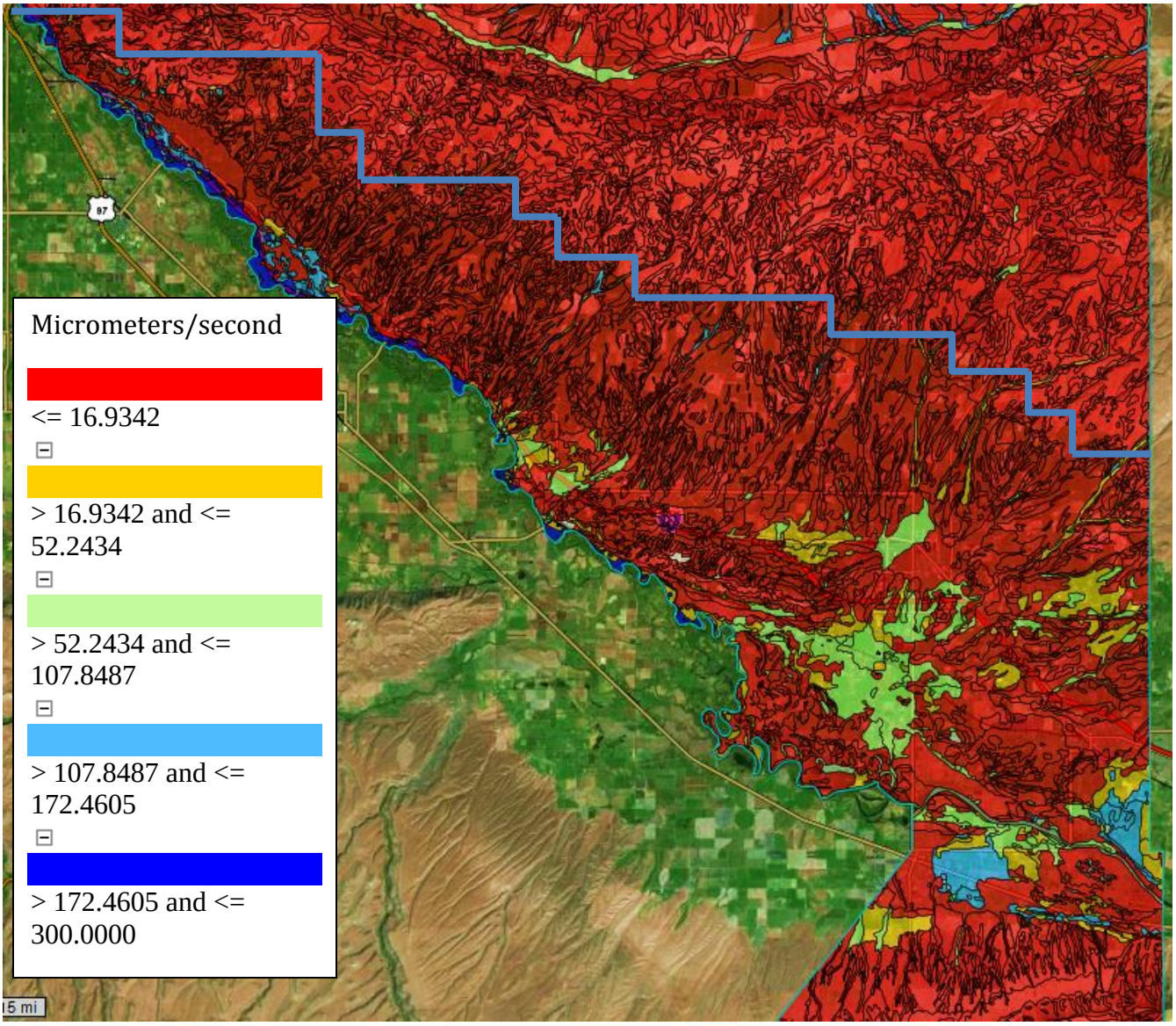
% Sand

GWMA



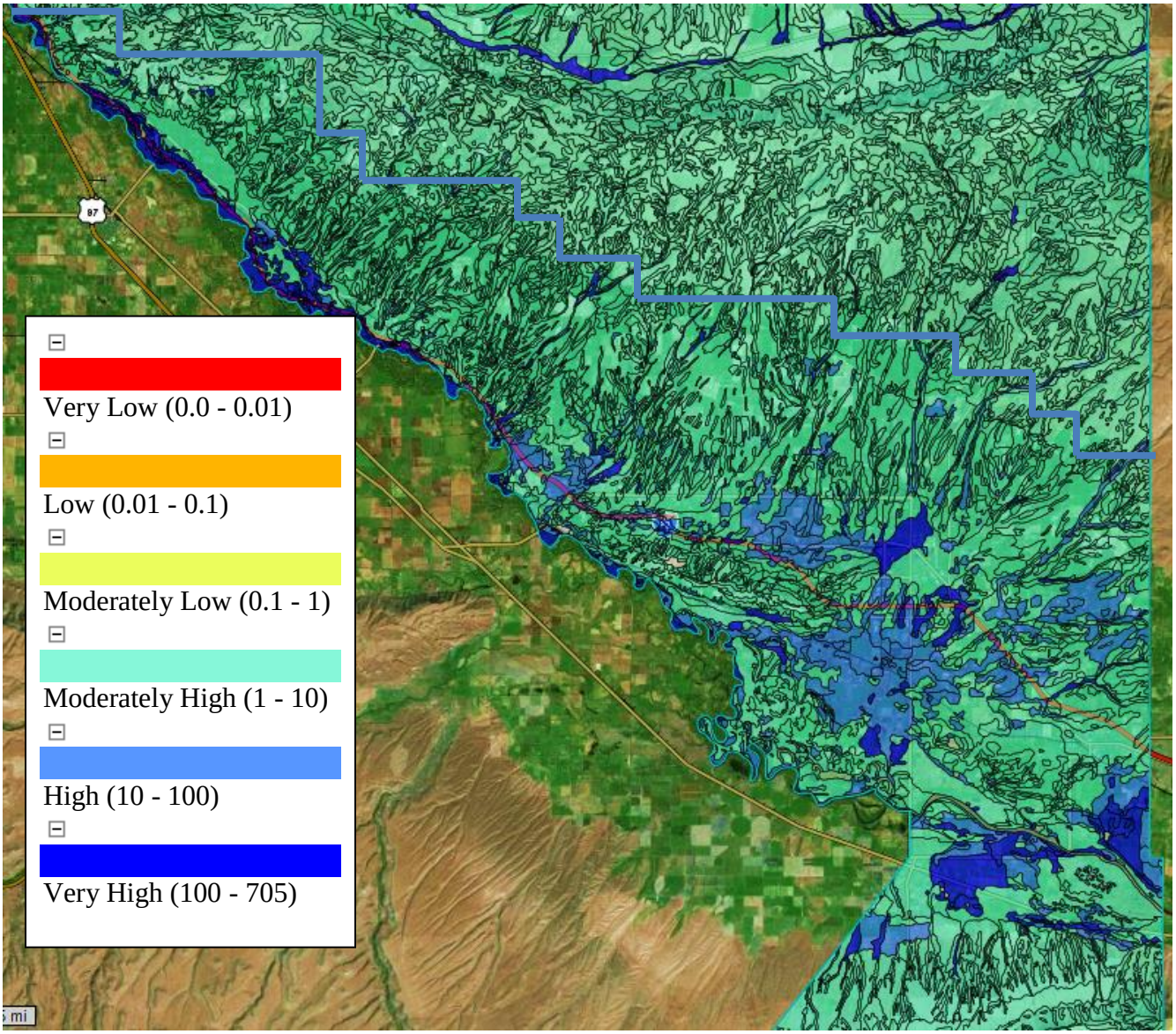
Saturated Hydraulic Conductivity - Ksat

GWMA



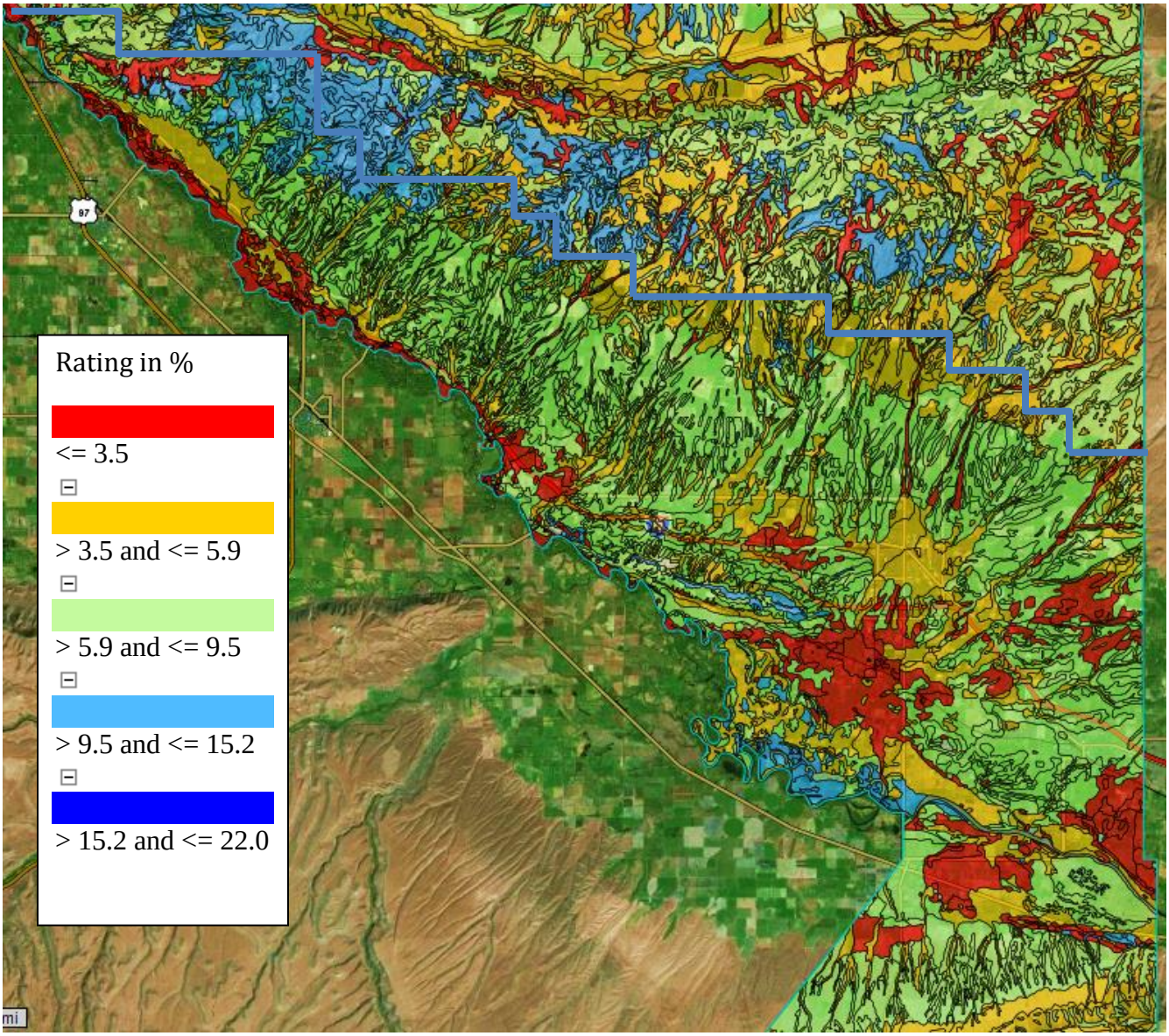
Ksat Classes

GWMA



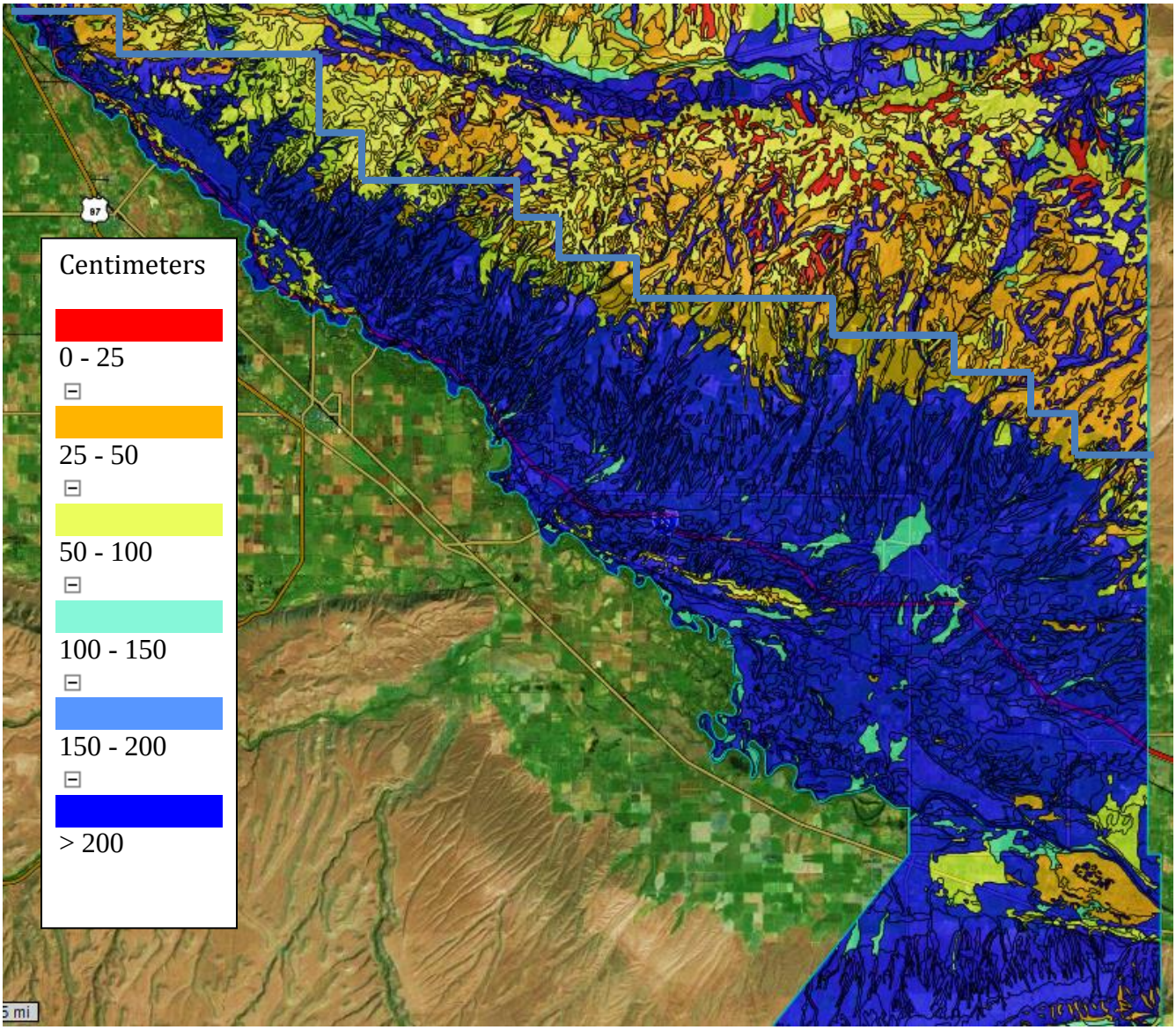
Water Content – 15 Bar

GWMA



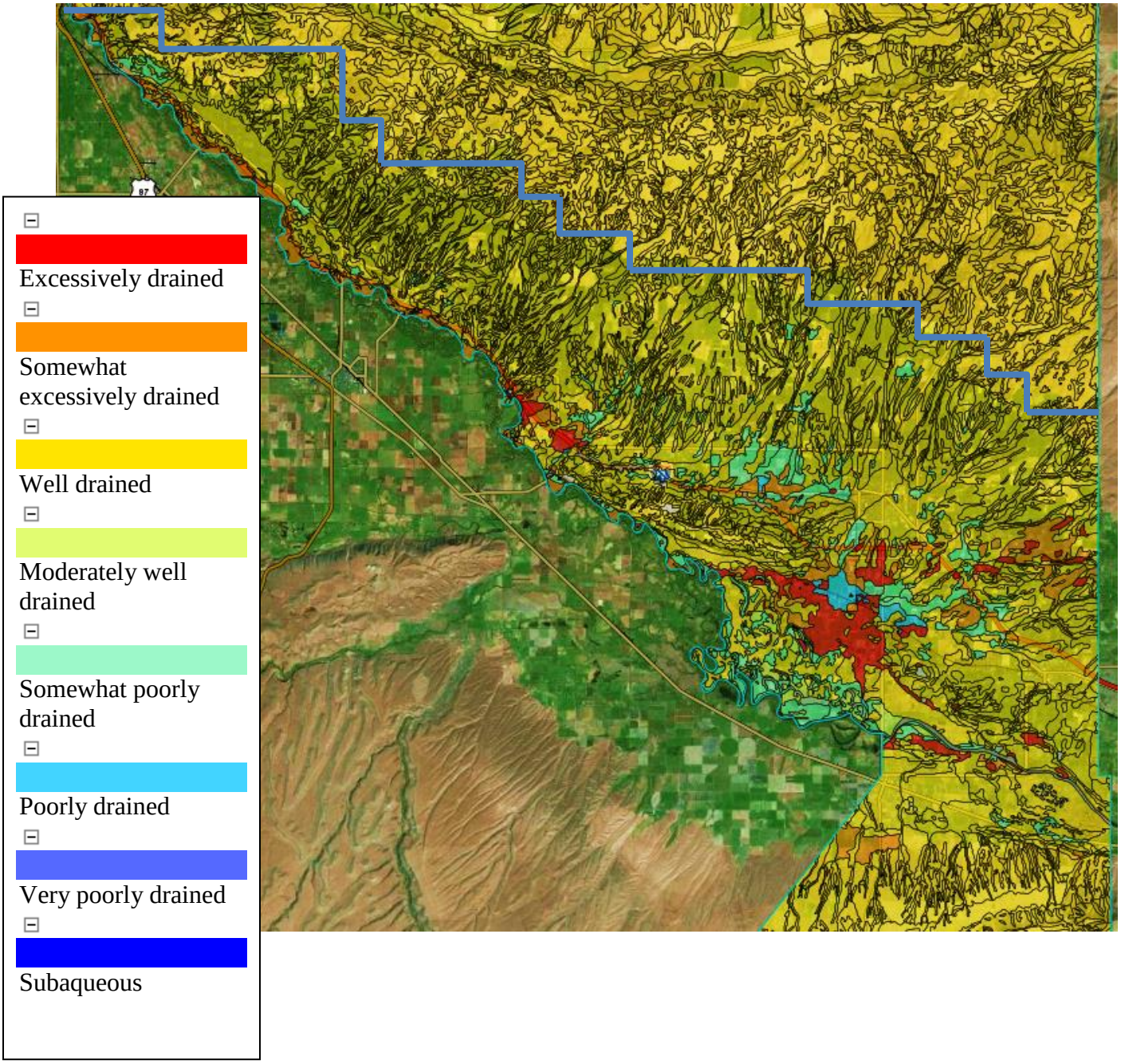
Depth to Any Soil Restrictive Layer

GWMA



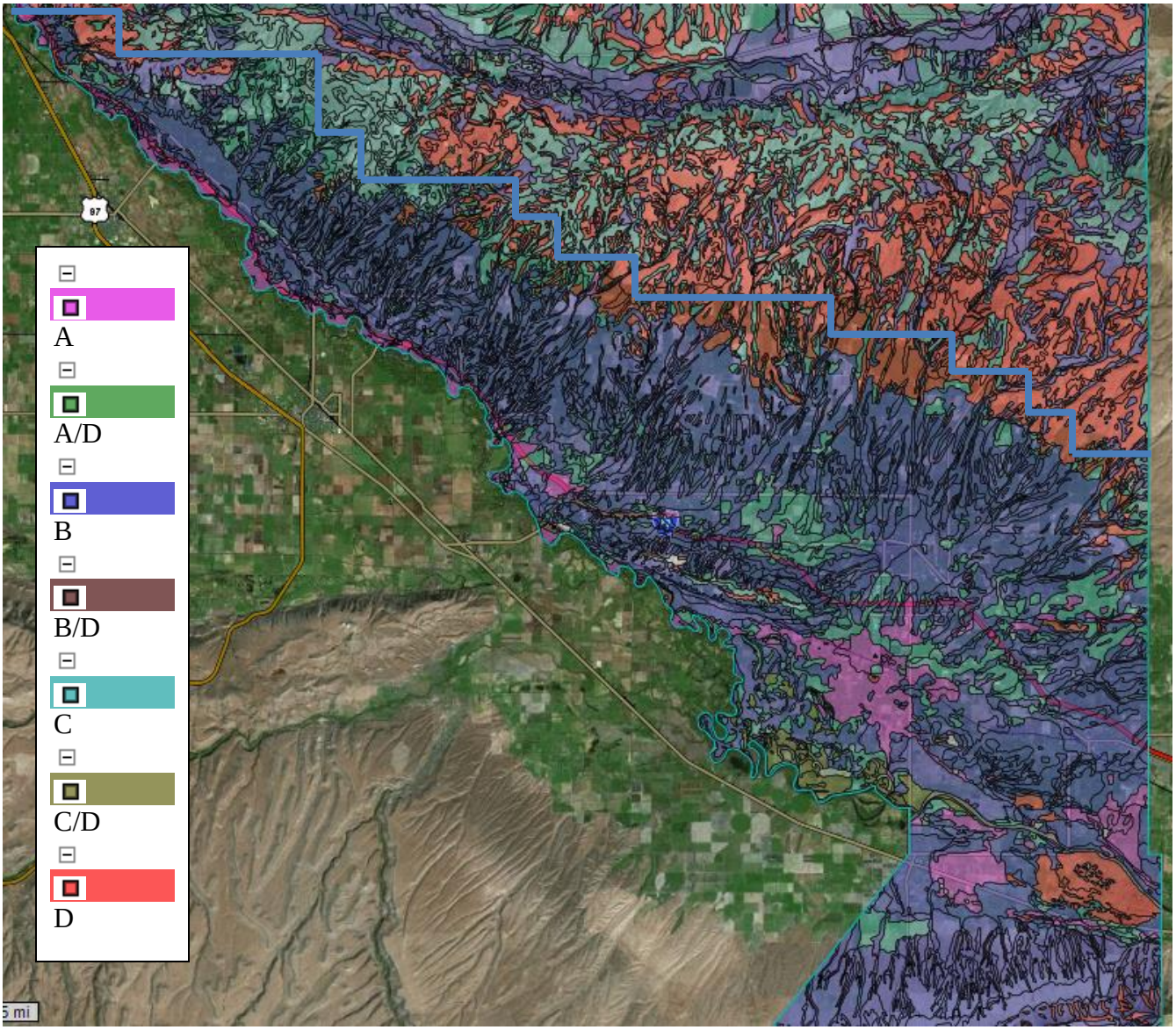
Drainage Class

GWMA



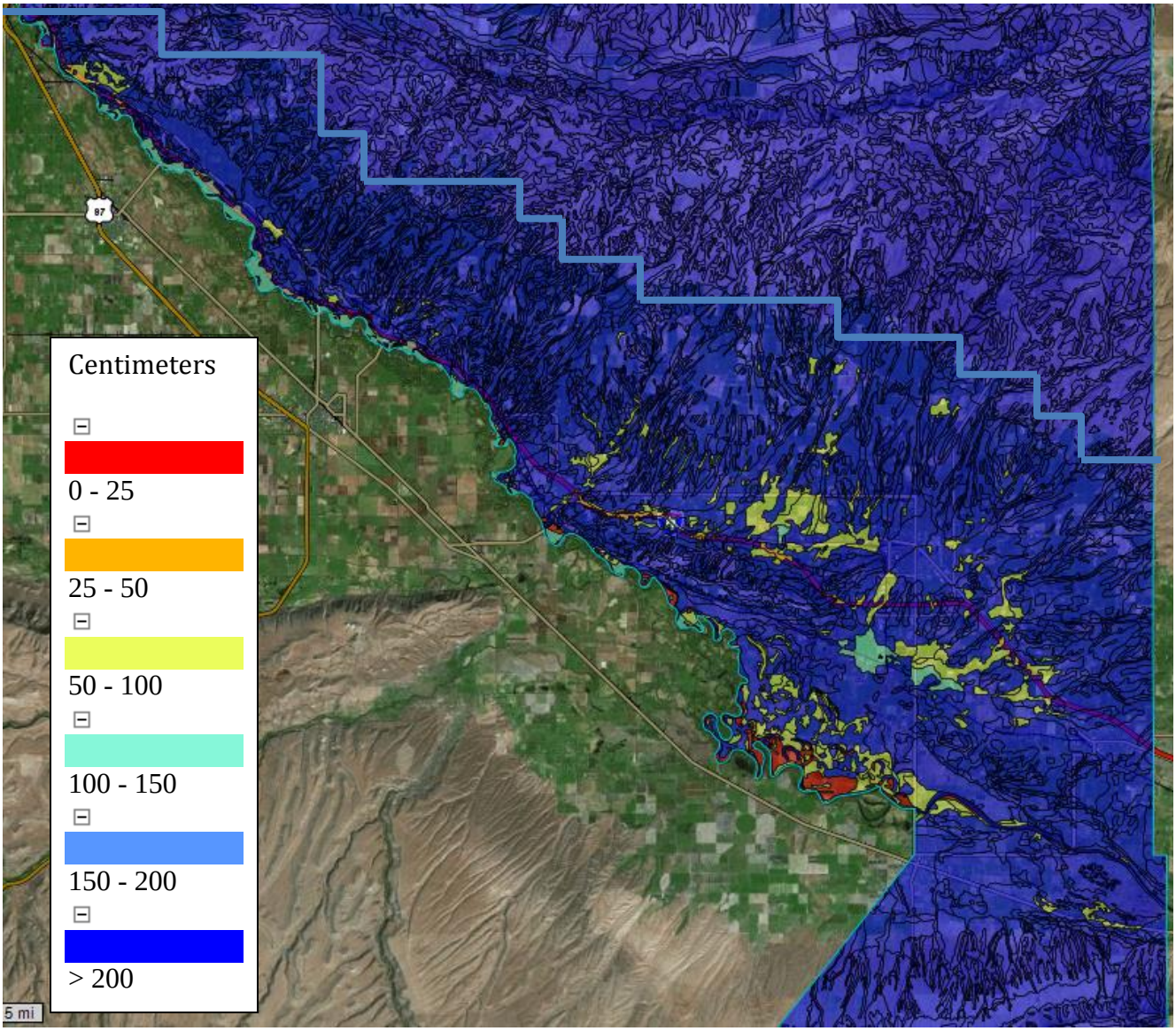
Hydrologic Soil Group

GWMA



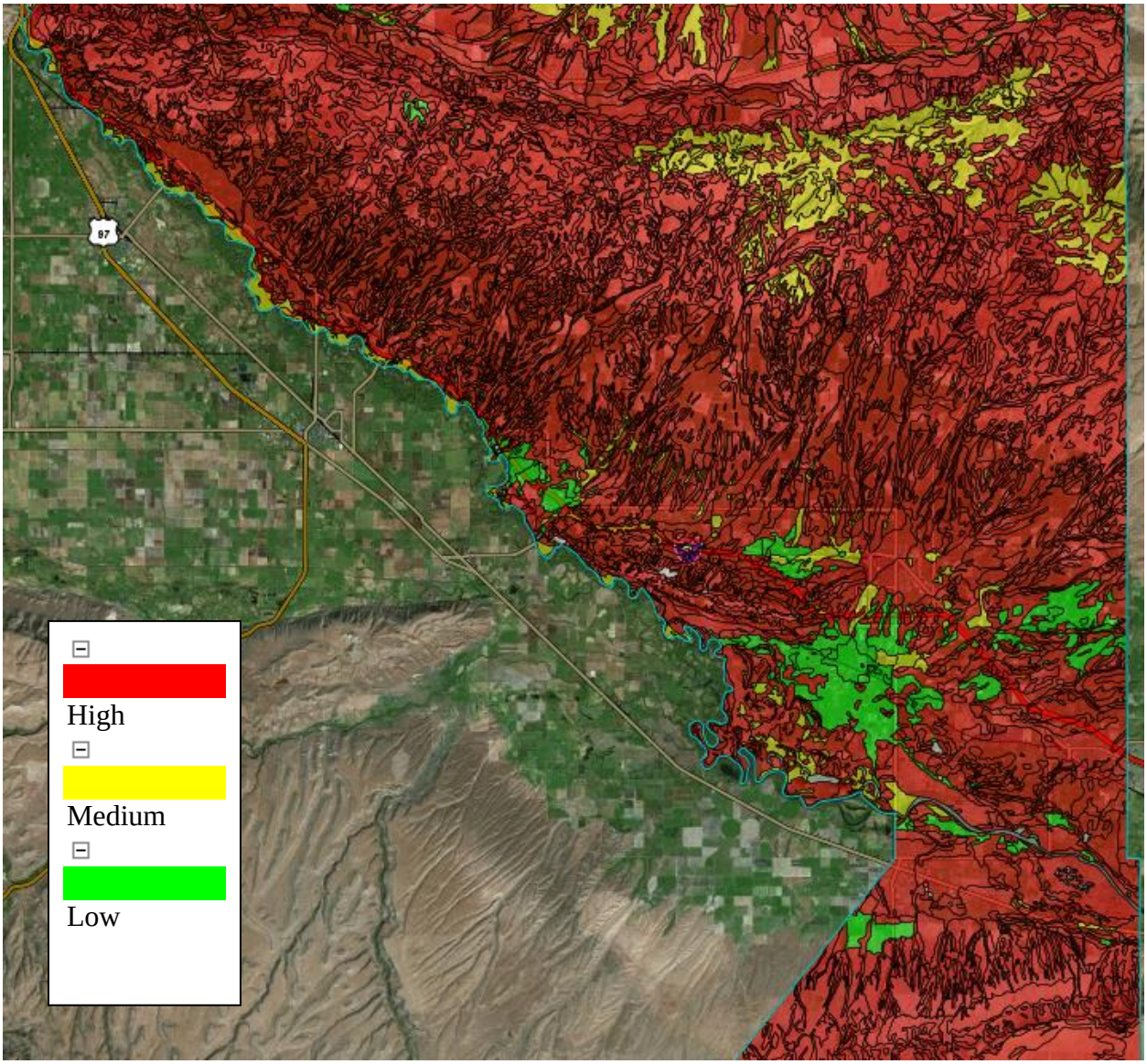
Depth to Water Table

GWMA



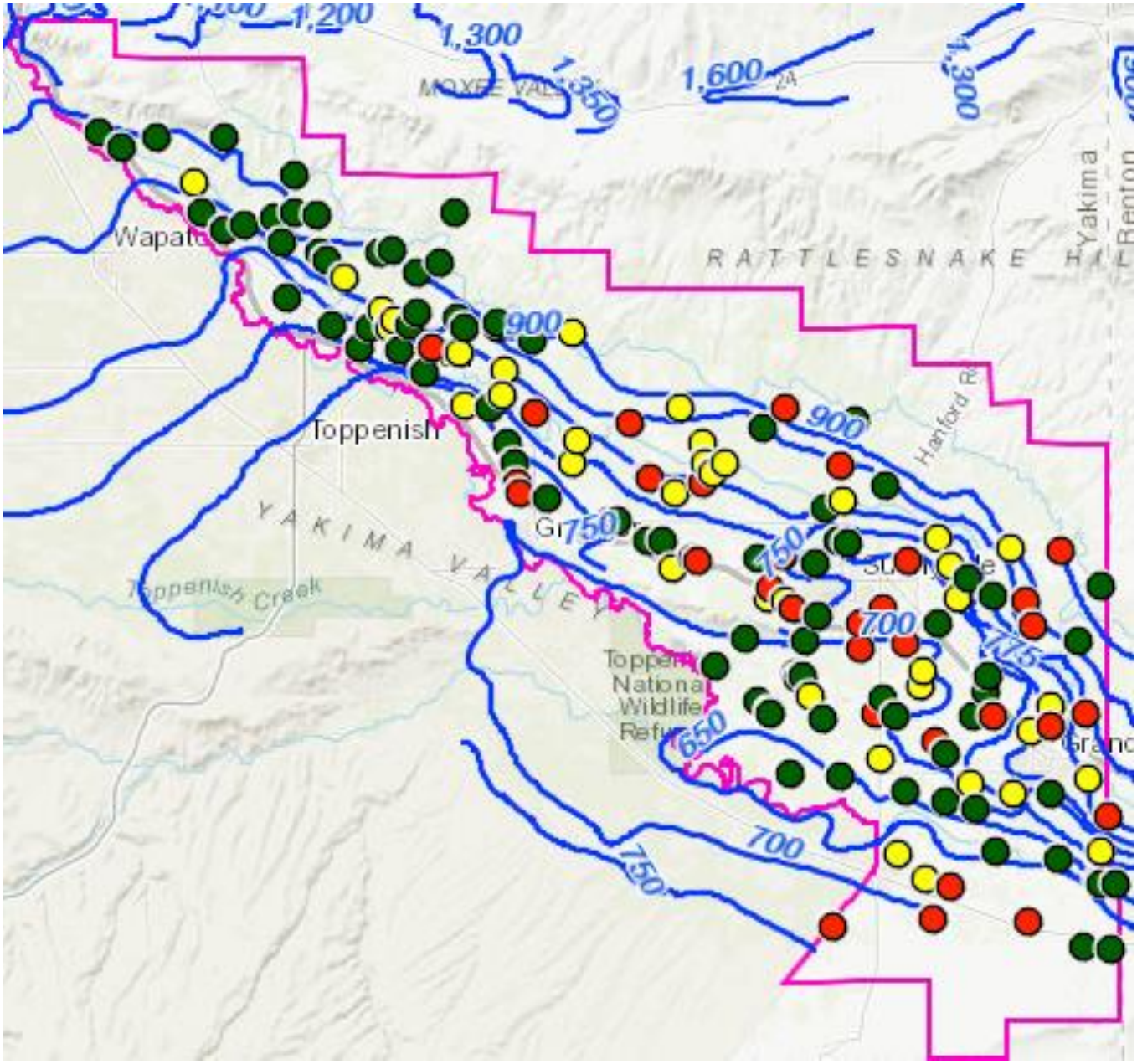
Compaction Potential

GWMA

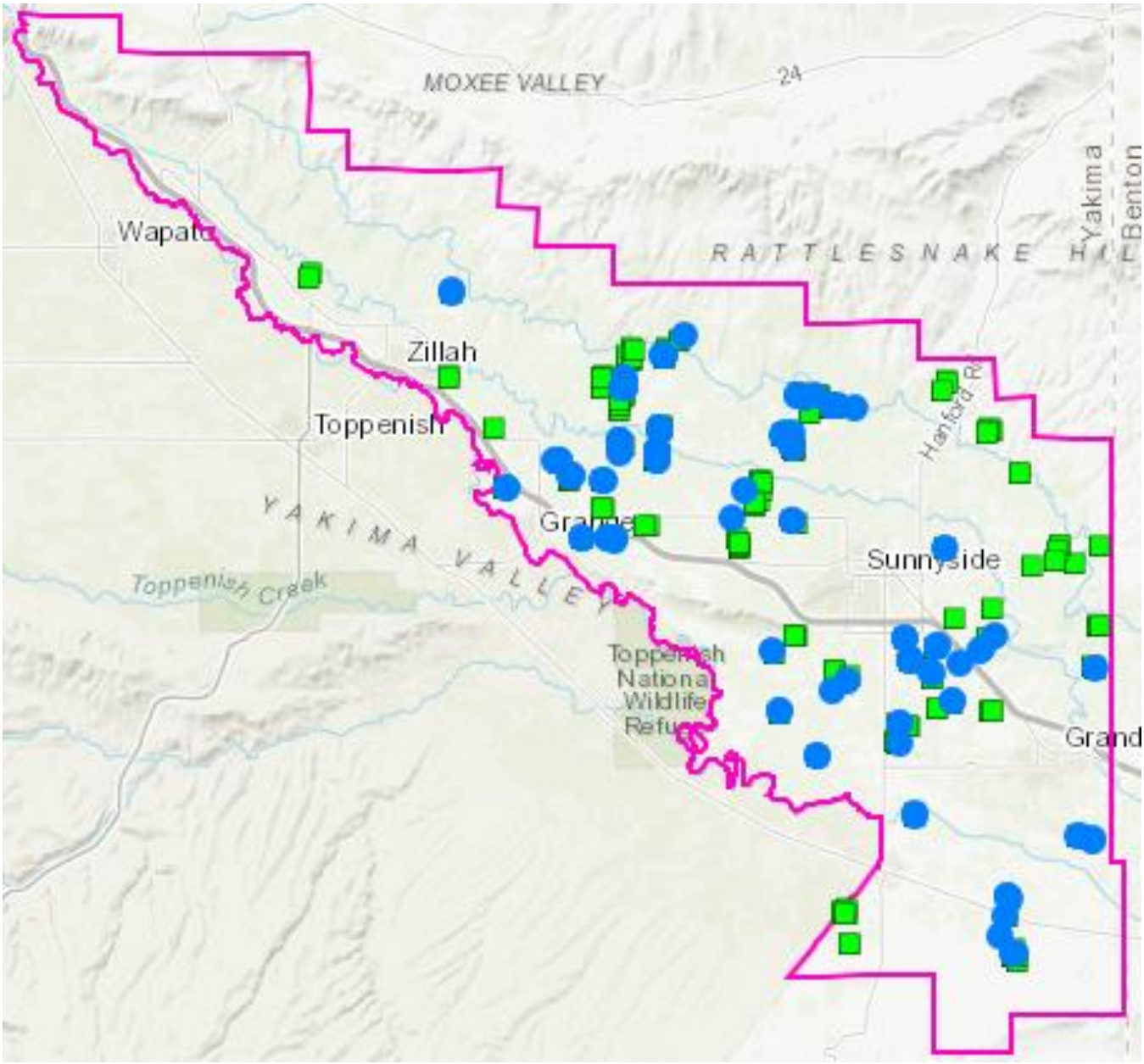


From GWMA GIS - http://arcg.is/1ie9mP

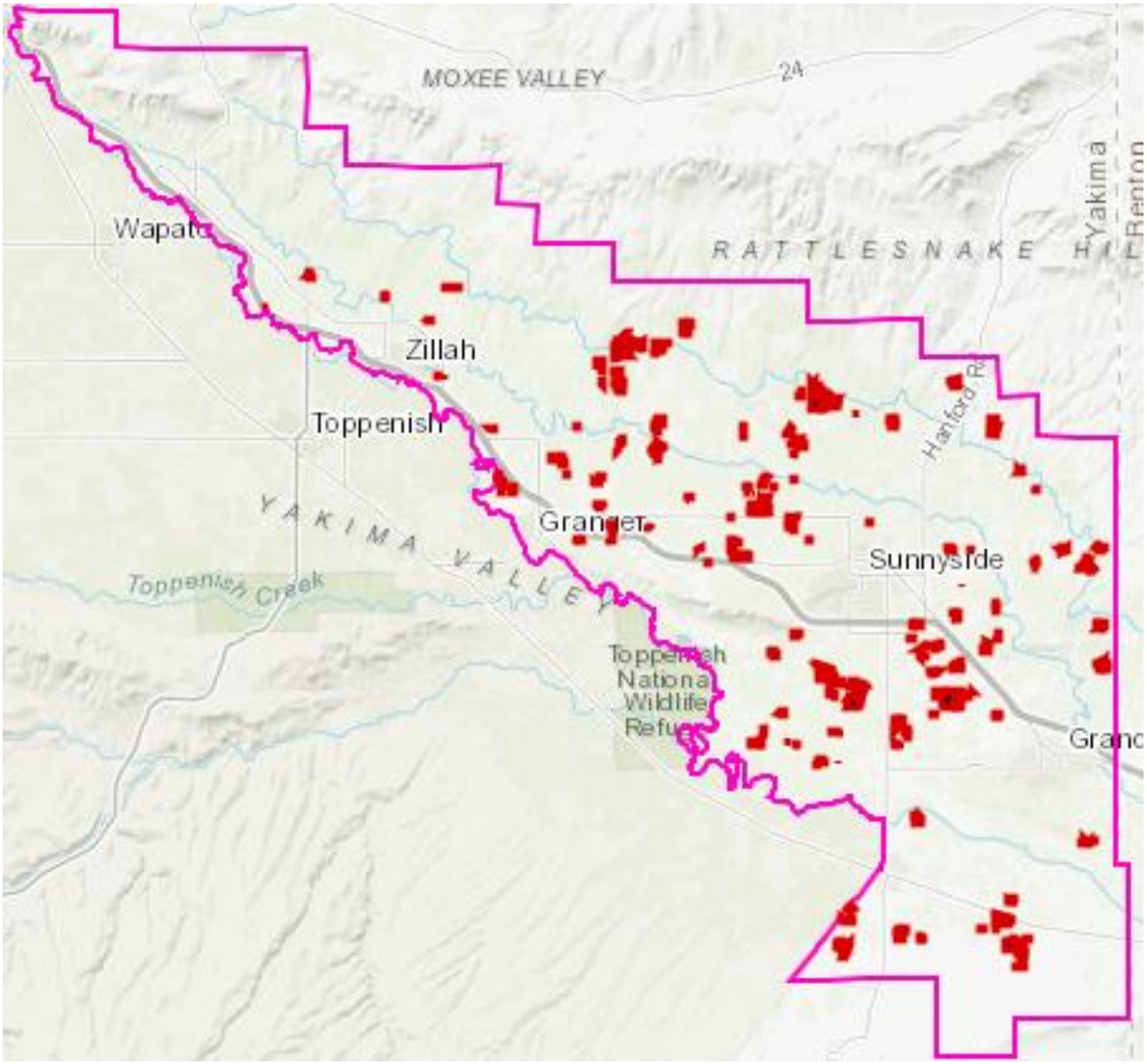
2017 USGS Well Testing



Lagoons & Ponds



CAFO Pens, Corrals & Compost



Here are descriptions of the NRCS soil parameters:

Nitrate Leaching

This interpretation is designed to evaluate the potential for nitrate-nitrogen to be transmitted through the soil profile below the root zone by percolating water under irrigated conditions. Leaching nitrates have the potential to contaminate shallow and deep aquifers used for drinking water. The ratings are based on inherent soil and climate properties that affect nitrate leaching and do not account for management practices, such as crop rotation, rates and timing of nitrogen fertilizer applications, and management of irrigation water.

The following soil and climate factors are used in the interpretation criteria:

1. Mean annual precipitation minus potential evapotranspiration.-This factor provides an estimate of the amount of water that is available to move through the soil profile on an annual basis from precipitation. Potential evaporation is estimated from mean annual air temperature using an algorithm (developed by the National Soil Survey Center) that employs the Hamon potential evapotranspiration method.

2. Water travel time through the entire soil profile.-This factor uses the saturated hydraulic conductivity (Ksat) and thickness of each soil horizon to estimate the number of hours that would be required for a given volume of water to move through the entire soil profile. One advantage of this method for estimating the rate of water movement is that the properties and thickness of each soil horizon are accounted for instead of using an average saturated hydraulic conductivity for the entire profile. This method accounts for subtle differences between soils in texture, structure, horizon thickness, and depth to water-restricting layers.

3. Available water capacity.-This factor accounts for the cumulative amount of water available to plants that the entire soil profile can hold at field capacity to a depth of 150 cm. The more water the soil profile can hold, the less water is available for deep leaching.

4. Depth to and duration of a water table.-This factor uses a water table index based on the minimum average depth to a water table and the number of months that the water table is present during the period from April through October. The factor is used to account for the loss of nitrates to the atmosphere as nitrous oxide or nitrogen gas due to denitrification under anaerobic conditions caused by water saturation. The higher the water table and the longer its duration, the larger the quantity of nitrates that would potentially be lost to the atmosphere and therefore would not be available for deep leaching.

5. Slope gradient adjusted for hydrologic soil group.-The steeper the slope gradient, the higher the potential for surface runoff and the lower the amount of water available to move through the soil profile. The following adjustments are made to the slope gradient by hydrologic group to account for differences in potential for surface runoff:

Hydrologic group A-slope % x 0.75

Hydrologic group B-slope % x 0.85
Hydrologic group C-slope % x 0.95
Hydrologic group D-no adjustment

The ratings are both verbal and numerical. The ratings for Nitrate Leaching Potential, Irrigated Areas, are calculated as follows:

1. The Water Travel Time subrule is weighted by multiplying by 0.60.
2. The Available Water Capacity subrule is weighted by multiplying by 0.40.
3. The sum of these two weighted subrules results in a value between 0.00 and 1.00.
4. Adjustments are then made for water table depth and duration and for slope gradient adjusted for hydrologic group. The sum of the values from these subrules is subtracted from the sum in step 3 above. The maximum reduction is 0.50 for the water table index subrule and 0.30 for the slope gradient subrule.
5. A final positive adjustment is made for the Mean Annual Precipitation minus Potential Evapotranspiration subrule. The maximum addition is 0.60.

The ratings for Nitrate Leaching Potential, Nonirrigated Areas, are calculated with different weighting factors from those listed for the irrigated interpretation.

The following rating classes for Nitrate Leaching Potential, Irrigated Areas, are assigned based on the final calculation from the factors above:

Low: 0.00 to 0.25
Moderate: 0.26 to 0.50
Moderately high: 0.51 to 0.75
High: 0.76 to 1.00

The ratings indicate the potential for nitrate leaching below the root zone, based on inherent soil and climate properties and application of irrigation water. A "low" rating indicates a low potential for leaching of nitrates below the root zone. A "high" rating indicates a high potential for leaching of nitrates below the root zone. The "moderate" and "moderately high" ratings indicate intermediate potential.

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating

the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Application of Manure & Food Processing Waste

The application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include saturated hydraulic conductivity (Ksat), depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit.

The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Disposal of Waste Water by Irrigation

Wastewater includes municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. The effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, saturated hydraulic conductivity (Ksat), slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. "Not limited" indicates that the soil has features that are very favorable for the specified

use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Calcium Carbonate

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Cation Exchange Capacity

Cation-exchange capacity (CEC-7) is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Electrical Conductivity

Electrical conductivity (EC) is the electrolytic conductivity of an extract from saturated soil paste, expressed as decisiemens per meter at 25 degrees C. Electrical conductivity is a measure of the concentration of water-soluble salts in soils. It is used to indicate saline soils. High concentrations of neutral salts, such as sodium chloride and sodium sulfate, may interfere with the absorption of water by plants because the osmotic pressure in the soil solution is nearly as high as or higher than that in the plant cells.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

pH

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion. In general, soils that are either highly alkaline or highly acid are likely to be very corrosive to steel. The most common soil laboratory measurement of pH is the 1:1 water method. A crushed soil sample is mixed with an equal amount of water, and a measurement is made of the suspension.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Available Water Capacity

Available water capacity (AWC) refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in centimeters of water per centimeter of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure, with corrections for salinity and rock fragments. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. It is not an estimate of the quantity of water actually available to plants at any given time.

Available water supply (AWS) is computed as AWC times the thickness of the soil. For

example, if AWC is 0.15 cm/cm, the available water supply for 25 centimeters of soil would be 0.15 x 25, or 3.75 centimeters of water.

For each soil layer, AWC is recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Available Water Storage

Available water storage (AWS) is the total volume of water (in centimeters) that should be available to plants when the soil, inclusive of rock fragments, is at field capacity. It is commonly estimated as the amount of water held between field capacity and the wilting point, with corrections for salinity, rock fragments, and rooting depth. AWS is reported as a single value (in centimeters) of water for the specified depth of the soil. AWS is calculated as the available water capacity times the thickness of each soil horizon to a specified depth.

For each soil layer, available water capacity, used in the computation of AWS, is recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For the derivation of AWS, only the representative value for available water capacity is used.

The available water storage for each map unit component is computed as described above and then aggregated to a single value for the map unit by the process described below.

A map unit typically consists of one or more "components." A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated (e.g., available water storage), the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the process is to derive a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for the map units can be generated. Aggregation is needed because map units rather than components are delineated on the soil maps.

The composition of each component in a map unit is recorded as a percentage. A composition of 60 indicates that the component typically makes up approximately 60 percent of the map unit.

For the available water storage, when a weighted average of all component values is computed, percent composition is the weighting factor.

Available Water Supply

Available water supply (AWS) is the total volume of water (in centimeters) that should be available to plants when the soil, inclusive of rock fragments, is at field capacity. It is

commonly estimated as the amount of water held between field capacity and the wilting point, with corrections for salinity, rock fragments, and rooting depth. AWS is reported as a single value (in centimeters) of water for the specified depth of the soil. AWS is calculated as the available water capacity times the thickness of each soil horizon to a specified depth.

For each soil layer, available water capacity, used in the computation of AWS, is recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For the derivation of AWS, only the representative value for available water capacity is used.

The available water supply for each map unit component is computed as described above and then aggregated to a single value for the map unit by the process described below.

A map unit typically consists of one or more "components." A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated (e.g., available water supply), the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the process is to derive a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for the map units can be generated. Aggregation is needed because map units rather than components are delineated on the soil maps.

The composition of each component in a map unit is recorded as a percentage. A composition of 60 indicates that the component typically makes up approximately 60 percent of the map unit.

For the available water supply, when a weighted average of all component values is computed, percent composition is the weighting factor.

% Organic Matter

Organic matter is the plant and animal residue in the soil at various stages of decomposition. The estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms. An irregular distribution of organic carbon with depth may indicate different episodes of soil deposition or soil formation. Soils that are very high in organic matter have poor engineering properties and subside upon drying.

For each soil layer, this attribute is actually recorded as three separate values in the

database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

% Clay

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Most of the material is in one of three groups of clay minerals or a mixture of these clay minerals. The groups are kaolinite, smectite, and hydrous mica, the best known member of which is illite.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

% Sand

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In the database, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

% Silt

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In the database, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil

hydrologic qualities, and for soil classification

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Saturated Hydraulic Conductivity – Ksat

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01
Low: 0.01 to 0.1
Moderately low: 0.1 to 1.0
Moderately high: 1 to 10
High: 10 to 100
Very high: 100 to 705

Water Content – 15 Bar

Water content, 15 bar, is the amount of soil water retained at a tension of 15 bars, expressed as a volumetric percentage of the whole soil material. Water retained at 15 bars is significant in the determination of soil water-retention difference, which is used as the initial estimation of available water capacity for some soils. Water retained at 15 bars is an estimation of the wilting point.

Water content varies between soil types, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure.

For each soil layer, water content is recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A

"representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Depth to Any Soil Restrictive Area

A "restrictive layer" is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers.

This theme presents the depth to any type of restrictive layer that is described for each map unit. If more than one type of restrictive layer is described for an individual soil type, the depth to the shallowest one is presented. If no restrictive layer is described in a map unit, it is represented by the "> 200" depth class.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Drainage Class

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist

chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Compaction Potential

This interpretation is designed to predict the potential for soil compaction from operation of ground-based equipment for forest harvesting and site preparation activities when soils are moist. Soil compaction reduces porosity and increases bulk density by reducing the interaggregate pore space.

Compacted soils are less favorable for good plant growth because of high soil bulk density and hardness, reduced pore space, and poor aeration and drainage. Root penetration and growth is decreased in compacted soils because the hardness or strength of these soils prevents the expansion of roots. Supplies of air, water, and nutrients that roots need are also less favorable when compaction decreases soil porosity and drainage.

Interpretation ratings are based on soil properties in the upper 12 inches of the profile.

Factors considered are soil texture, soil structure, and rock fragment content. Initial ratings are based on the following soil texture groups:

Low compaction potential: loamy sand, loamy fine sand, loamy coarse sand, sand, fine sand, coarse sand

Moderate compaction potential: silty clay, clay, sandy clay, sandy clay loam, sandy loams with less than 15 percent clay

High compaction potential: loam, silt, silt loam, silty clay loam, very fine sandy loam, sandy loams with 15 percent or more clay.

Ratings are reduced by one class, such as from "high" to "medium" for strong soil structure grade. Ratings are reduced by one class for rock fragment content of 35 to 60 percent by volume, and are reduced by two classes for rock fragment content of greater than 60 percent.

The ratings are both verbal and numerical. Rating class terms indicate the soil compaction potential.

A "High" rating indicates that the potential for compaction is significant. The growth rate of seedlings will be reduced following compaction. After initial compaction, this soil is still able to support standard equipment, but will continue to compact with each subsequent pass. The soil is moisture sensitive, exhibiting large changes in density with changing moisture content.

A "Medium" rating indicates that the potential for compaction is significant. The growth rate of seedlings may be reduced following compaction. After the initial compaction (i.e., the first equipment pass), this soil is able to support standard equipment with only minimal increases in soil density. The soil is intermediate between moisture insensitive and moisture sensitive.

A "Low" rating indicates that the potential for compaction is insignificant. This soil is able to support standard equipment with minimal compaction. The soil is moisture insensitive, exhibiting only small changes in density with changing moisture content.

Numerical ratings indicate the soil compaction potential The ratings are shown in decimal fractions ranging from 1.00 to 0.00. They indicate gradations between the point where compaction potential is highest (1.00) and the point at which compaction potential is lowest (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map

unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Soils Common to the GWMA target area:

- Burke silt loam
- Cleman sandy loam
- Esquatzel silt loam
- Finley sandy loam
- Finley silt loam
- Harwood loan
- Harwood-Burke-Wiehl silt loam
- Hezel loamy find sand
- Outlook sandy loam
- Outlook silt loam
- Roza clay loam
- Scoon silt loam
- Scooteney silt loam
- Shano silt loam
- Simcoe silt loam
- Sinloc silt loam
- Starbuck silt loam
- Starbuck-Rock outcrop
- Toppenish silt loam
- Umapine silt loam
- Warden sandy loam
- Warden silt loam
- Weirman sandy loam
- Zillah silt loam
- Zillah sandy loam

Soil Descriptions

10—Burke silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29nz
- Elevation: 650 to 1,600 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Burke and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the map unit.

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

11—Burke silt loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29pb
- Elevation: 650 to 1,600 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Burke and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

12—Burke silt loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29pp
- Elevation: 650 to 1,600 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Burke and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

18—Cleman very fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29rt
- Elevation: 400 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Cleman and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cleman

Setting

- Landform: Alluvial fans, flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 10 inches: very fine sandy loam
- H2 - 10 to 40 inches: stratified loamy fine sand to silt loam
- H3 - 40 to 60 inches: stratified sand to loamy sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: B
- Ecological site: LOAMY BOTTOM 6-10 PZ (R007XY402WA)
- Hydric soil rating: No

19—Cleman very fine sandy loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29s5
- Elevation: 400 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Cleman and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cleman

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 10 inches: very fine sandy loam
- H2 - 10 to 40 inches: stratified loamy fine sand to silt loam
- H3 - 40 to 60 inches: stratified sand to loamy sand

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: B
- Ecological site: LOAMY BOTTOM 6-10 PZ (R007XY402WA)
- Hydric soil rating: No

20—Cleman very fine sandy loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29sc
- Elevation: 400 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Cleman and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cleman

Setting

- Landform: Alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 10 inches: very fine sandy loam
- H2 - 10 to 40 inches: stratified loamy fine sand to silt loam
- H3 - 40 to 60 inches: stratified sand to loamy sand

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: B
- Ecological site: LOAMY BOTTOM 6-10 PZ (R007XY402WA)
- Hydric soil rating: No

21—Cleman very fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29sd
- Elevation: 400 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches

- Mean annual air temperature: 48 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Cleman and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cleman

Setting

- Landform: Alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 10 inches: very fine sandy loam
- H2 - 10 to 40 inches: stratified loamy fine sand to silt loam
- H3 - 40 to 60 inches: stratified sand to loamy sand

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.8 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: B
- Ecological site: LOAMY BOTTOM 6-10 PZ (R007XY402WA)
- Hydric soil rating: No

32—Esquatzel silt loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29ss
- Elevation: 300 to 2,900 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 54 degrees F
- Frost-free period: 130 to 200 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Esquatzel and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Esquatzel

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 17 inches: silt loam
- H2 - 17 to 60 inches: silt loam
- H3 - 60 to 64 inches: stratified fine sandy loam to silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Very high (about 12.6 inches)

Interpretive groups

- Land capability classification (irrigated): 2c
- Land capability classification (nonirrigated): 3c
- Hydrologic Soil Group: B

- Hydric soil rating: No

33—Esquatzel silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29st
- Elevation: 300 to 2,900 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 54 degrees F
- Frost-free period: 130 to 200 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Esquatzel and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Esquatzel

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 17 inches: silt loam
- H2 - 17 to 60 inches: silt loam
- H3 - 60 to 64 inches: stratified fine sandy loam to silt loam

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Very high (about 12.6 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: B
- Hydric soil rating: No

34—Fiander silt loam

Map Unit Setting

- National map unit symbol: 29sv
- Elevation: 700 to 900 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 50 to 52 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Fiander, drained, and similar soils: 85 percent
- Minor components: 15 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fiander, Drained

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 2 inches: silt loam
- H2 - 2 to 25 inches: silty clay loam
- H3 - 25 to 50 inches: silt loam
- H4 - 50 to 60 inches: loamy very fine sand

Properties and qualities

- Slope: 0 to 3 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Moderately well drained

- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: About 6 to 36 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 35 percent
- Gypsum, maximum in profile: 5 percent
- Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 15.0
- Available water storage in profile: Moderate (about 8.2 inches)

Interpretive groups

- Land capability classification (irrigated): 4w
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C/D
- Ecological site: ALKALI BOTTOM 6-10 PZ (R007XY401WA)
- Hydric soil rating: Yes

Minor Components

Kittitas

- Percent of map unit: 5 percent
- Landform: Flood plains
- Hydric soil rating: Yes

Toppenish

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Fiander, undrained

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

35—Finley fine sandy loam, 0 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29sw

- Elevation: 300 to 1,800 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Finley and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finley

Setting

- Landform: Terraces, alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 4 inches: fine sandy loam
- H2 - 4 to 14 inches: fine sandy loam
- H3 - 14 to 30 inches: very gravelly loam
- H4 - 30 to 60 inches: extremely gravelly sand

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: A
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

36—Finley cobbly fine sandy loam, 0 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29sx
- Elevation: 300 to 1,500 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Finley, cobbly, and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finley, Cobbly

Setting

- Landform: Alluvial fans, terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 4 inches: cobbly fine sandy loam
- H2 - 4 to 14 inches: fine sandy loam
- H3 - 14 to 30 inches: very gravelly loam
- H4 - 30 to 60 inches: extremely gravelly loamy sand

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 3.2 inches)

Interpretive groups

- Land capability classification (irrigated): 4s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: A
- Ecological site: SANDY 6-10 PZ (R007XY501WA)
- Hydric soil rating: No

37—Finley silt loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29sy
- Elevation: 300 to 1,800 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Finley and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finley

Setting

- Landform: Terraces, alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: silt loam
- H2 - 12 to 30 inches: very gravelly loam
- H3 - 30 to 60 inches: extremely gravelly sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None

- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: A
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

38—Finley silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29sz
- Elevation: 300 to 1,800 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Finley and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finley

Setting

- Landform: Terraces, alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: silt loam
- H2 - 12 to 30 inches: very gravelly loam
- H3 - 30 to 60 inches: extremely gravelly sand

Properties and qualities

- Slope: 2 to 5 percent

- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: A
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

39—Finley silt loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29t0
- Elevation: 300 to 1,800 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Finley and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finley

Setting

- Landform: Terraces, alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: silt loam

- H2 - 12 to 30 inches: very gravelly loam
- H3 - 30 to 60 inches: extremely gravelly sand

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: A
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

40—Finley silt loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29t2
- Elevation: 300 to 1,800 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Finley and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Finley

Setting

- Landform: Terraces, alluvial fans
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: silt loam
- H2 - 12 to 30 inches: very gravelly loam
- H3 - 30 to 60 inches: extremely gravelly sand

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: A
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

46—Harwood loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29t8
- Elevation: 1,200 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 50 degrees F
- Frost-free period: 135 to 150 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Harwood and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 3s
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

47—Harwood loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29t9
- Elevation: 1,200 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 50 degrees F
- Frost-free period: 135 to 150 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Harwood and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

48—Harwood loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29tb
- Elevation: 1,200 to 2,000 feet

- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 50 degrees F
- Frost-free period: 135 to 150 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Harwood and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

49—Harwood loam, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29tc
- Elevation: 1,200 to 2,000 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 50 degrees F
- Frost-free period: 135 to 150 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Harwood and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 6e

- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

50—Harwood-Burke-Wiehl silt loams, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29tf
- Elevation: 400 to 6,200 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Harwood and similar soils: 30 percent
- Burke and similar soils: 30 percent
- Wiehl and similar soils: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None

- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 3s
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

Description of Wiehl

Setting

- Landform: Terraces
- Parent material: Eolian deposits over residuum weathered from sandstone and siltstone

Typical profile

- H1 - 0 to 3 inches: silt loam
- H2 - 3 to 21 inches: silt loam
- H3 - 21 to 27 inches: gravelly silt loam
- H4 - 27 to 37 inches: weathered bedrock

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

51—Harwood-Burke-Wiehl silt loams, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29tg
- Elevation: 400 to 6,200 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days

- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Harwood and similar soils: 30 percent
- Burke and similar soils: 30 percent
- Wiehl and similar soils: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

Description of Wiehl

Setting

- Landform: Terraces
- Parent material: Eolian deposits over residuum weathered from sandstone and siltstone

Typical profile

- H1 - 0 to 3 inches: silt loam
- H2 - 3 to 21 inches: silt loam
- H3 - 21 to 27 inches: gravelly silt loam
- H4 - 27 to 37 inches: weathered bedrock

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

52—Harwood-Burke-Wiehl silt loams, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29th
- Elevation: 400 to 6,200 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Harwood and similar soils: 30 percent
- Burke and similar soils: 30 percent
- Wiehl and similar soils: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained

- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

Description of Wiehl

Setting

- Landform: Terraces
- Parent material: Eolian deposits over residuum weathered from sandstone and siltstone

Typical profile

- H1 - 0 to 3 inches: silt loam
- H2 - 3 to 21 inches: silt loam
- H3 - 21 to 27 inches: gravelly silt loam
- H4 - 27 to 37 inches: weathered bedrock

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

53—Harwood-Burke-Wiehl silt loams, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29tj
- Elevation: 400 to 6,200 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Harwood and similar soils: 30 percent
- Burke and similar soils: 30 percent
- Wiehl and similar soils: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained

- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 6e

- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

Description of Wiehl

Setting

- Landform: Terraces
- Parent material: Eolian deposits over residuum weathered from sandstone and siltstone

Typical profile

- H1 - 0 to 3 inches: silt loam
- H2 - 3 to 21 inches: silt loam
- H3 - 21 to 27 inches: gravelly silt loam
- H4 - 27 to 37 inches: weathered bedrock

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

54—Harwood-Burke-Wiehl silt loams, 30 to 60 percent slopes

Map Unit Setting

- National map unit symbol: 29tk

- Elevation: 400 to 6,200 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 54 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Harwood and similar soils: 30 percent
- Burke and similar soils: 30 percent
- Wiehl and similar soils: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 30 to 60 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 7e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)

- Hydric soil rating: No

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 30 to 40 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 15 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

Description of Wiehl

Setting

- Landform: Terraces
- Parent material: Eolian deposits over residuum weathered from sandstone and siltstone

Typical profile

- H1 - 0 to 3 inches: silt loam

- H2 - 3 to 21 inches: silt loam
- H3 - 21 to 27 inches: gravelly silt loam
- H4 - 27 to 37 inches: weathered bedrock

Properties and qualities

- Slope: 30 to 60 percent
- Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 7e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

55—Harwood-Burke-Wiehl very stony silt loams, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29tl
- Elevation: 1,280 to 2,460 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 135 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Harwood and similar soils: 30 percent
- Burke and similar soils: 30 percent
- Wiehl and similar soils: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harwood

Setting

- Landform: Terraces
- Parent material: Loess and old alluvium

Typical profile

- H1 - 0 to 8 inches: loam
- H2 - 8 to 26 inches: loam
- H3 - 26 to 30 inches: gravelly loam
- H4 - 30 to 34 inches: cemented material

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

Description of Burke

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 25 inches: silt loam
- H3 - 25 to 29 inches: cemented material

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 5.0 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

Description of Wiehl

Setting

- Landform: Terraces
- Parent material: Eolian deposits over residuum weathered from sandstone and siltstone

Typical profile

- H1 - 0 to 3 inches: very stony silt loam
- H2 - 3 to 21 inches: silt loam
- H3 - 21 to 27 inches: gravelly silt loam
- H4 - 27 to 37 inches: weathered bedrock

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

57—Hezel loamy fine sand, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29tn
- Elevation: 400 to 2,500 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 52 to 54 degrees F
- Frost-free period: 150 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Hezel and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hezel

Setting

- Landform: Terraces
- Parent material: Eolian sands over silty lacustrine deposits

Typical profile

- H1 - 0 to 6 inches: loamy fine sand
- H2 - 6 to 22 inches: loamy fine sand
- H3 - 22 to 60 inches: stratified fine sandy loam to silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

58—Hezel loamy fine sand, 2 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29tp
- Elevation: 400 to 2,500 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 52 to 54 degrees F
- Frost-free period: 150 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Hezel and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hezel

Setting

- Landform: Terraces
- Parent material: Eolian sands over silty lacustrine deposits

Typical profile

- H1 - 0 to 6 inches: loamy fine sand
- H2 - 6 to 22 inches: loamy fine sand
- H3 - 22 to 60 inches: stratified fine sandy loam to silt loam

Properties and qualities

- Slope: 2 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Ecological site: SANDS 6-10 PZ (R007XY502WA)
- Hydric soil rating: No

91—Outlook fine sandy loam

Map Unit Setting

- National map unit symbol: 29vw
- Elevation: 300 to 2,000 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 52 degrees F
- Frost-free period: 130 to 160 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Outlook, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Outlook, Drained

Setting

- Landform: Flood plains

- Parent material: Alluvium

Typical profile

- H1 - 0 to 8 inches: fine sandy loam
- H2 - 8 to 60 inches: silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 12 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 25 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 5.0
- Available water storage in profile: High (about 10.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3w
- Land capability classification (nonirrigated): 4s
- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Sinloc

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Outlook, undrained

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

92—Outlook silt loam

Map Unit Setting

- National map unit symbol: 29vx
- Elevation: 300 to 2,000 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 50 to 52 degrees F
- Frost-free period: 130 to 160 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Outlook, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Outlook, Drained

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 8 inches: fine sandy loam
- H2 - 8 to 60 inches: silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 12 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 25 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 5.0
- Available water storage in profile: High (about 10.5 inches)

Interpretive groups

- Land capability classification (irrigated): 3w
- Land capability classification (nonirrigated): 4s

- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Sinloc

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Outlook, undrained

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

95—Quincy loamy fine sand, 0 to 10 percent slopes

Map Unit Setting

- National map unit symbol: 29w0
- Elevation: 200 to 4,500 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 46 to 54 degrees F
- Frost-free period: 100 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Quincy and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quincy

Setting

- Landform: Terraces
- Parent material: Eolian sands

Typical profile

- H1 - 0 to 20 inches: loamy fine sand
- H2 - 20 to 60 inches: sand

Properties and qualities

- Slope: 0 to 10 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 3 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: A
- Hydric soil rating: No

111—Roza clay loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29pd
- Elevation: 1,100 to 4,600 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 110 to 165 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Roza and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roza

Setting

- Parent material: Alluvium and/or residuum derived from fine textured sediments

Typical profile

- H1 - 0 to 2 inches: clay loam
- H2 - 2 to 19 inches: silty clay
- H3 - 19 to 60 inches: clay loam

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: CALCAREOUS LOAM 10-16" pz (R008XY701WA)
- Hydric soil rating: No

112—Roza clay loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29pf
- Elevation: 1,100 to 4,600 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 110 to 165 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Roza and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roza

Setting

- Parent material: Alluvium and/or residuum derived from fine textured sediments

Typical profile

- H1 - 0 to 2 inches: clay loam
- H2 - 2 to 19 inches: silty clay
- H3 - 19 to 60 inches: clay loam

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: CALCAREOUS LOAM 10-16" pz (R008XY701WA)
- Hydric soil rating: No

113—Roza clay loam, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29pg
- Elevation: 1,100 to 4,600 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 110 to 165 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Roza and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roza

Setting

- Parent material: Alluvium and/or residuum derived from fine textured sediments

Typical profile

- H1 - 0 to 2 inches: clay loam
- H2 - 2 to 19 inches: silty clay
- H3 - 19 to 60 inches: clay loam

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: C
- Ecological site: CALCAREOUS LOAM 10-16" pz (R008XY701WA)
- Hydric soil rating: No

114—Roza clay loam, 30 to 60 percent slopes

Map Unit Setting

- National map unit symbol: 29ph
- Elevation: 1,100 to 4,600 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 110 to 165 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Roza and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roza

Setting

- Parent material: Alluvium and/or residuum derived from fine textured sediments

Typical profile

- H1 - 0 to 2 inches: clay loam
- H2 - 2 to 19 inches: silty clay
- H3 - 19 to 60 inches: clay loam

Properties and qualities

- Slope: 30 to 60 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 7e
- Hydrologic Soil Group: C
- Ecological site: CALCAREOUS LOAM 10-16" pz (R008XY701WA)
- Hydric soil rating: No

120—Scoon silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29pq
- Elevation: 1,000 to 4,900 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 100 to 210 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Scoon and similar soils: 100 percent
- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scoon

Setting

- Landform: Alluvial fans, terraces
- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 16 inches: gravelly very fine sandy loam
- H3 - 16 to 60 inches: cemented material

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: 10 to 20 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

- Land capability classification (irrigated): 6s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

Collapse Report — Map Unit Description

Yakima County Area, Washington

121—Scoon silt loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29pr
- Elevation: 1,000 to 4,900 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 100 to 210 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Scoon and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scoon

Setting

- Landform: Alluvial fans, terraces
- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 16 inches: gravelly very fine sandy loam
- H3 - 16 to 60 inches: cemented material

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: 10 to 20 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

- Land capability classification (irrigated): 6s
- Land capability classification (nonirrigated): 6s

- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

122—Scoon silt loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29ps
- Elevation: 1,000 to 4,900 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 100 to 210 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Scoon and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scoon

Setting

- Landform: Alluvial fans, terraces
- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 16 inches: gravelly very fine sandy loam
- H3 - 16 to 60 inches: cemented material

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: 10 to 20 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None

- Calcium carbonate, maximum in profile: 5 percent
- Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

- Land capability classification (irrigated): 6s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No


Collapse Report — Map Unit Description

Yakima County Area, Washington

123—Scoon silt loam, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29pt
- Elevation: 1,000 to 4,900 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 100 to 210 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Scoon and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scoon

Setting

- Landform: Alluvial fans, terraces
- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 16 inches: gravelly very fine sandy loam

- H3 - 16 to 60 inches: cemented material

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 10 to 20 inches to duripan
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

- Land capability classification (irrigated): 6s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

124—Scooteney silt loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29pv
- Elevation: 400 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 170 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Scooteney and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scooteney

Setting

- Landform: Terraces

- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 22 inches: silt loam
- H3 - 22 to 33 inches: gravelly fine sandy loam
- H4 - 33 to 60 inches: very gravelly fine sandy loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 10 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

- Land capability classification (irrigated): 2s
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

125—Scooteney silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29pw
- Elevation: 400 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 170 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Scooteney and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scooteney

Setting

- Landform: Terraces
- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 22 inches: silt loam
- H3 - 22 to 33 inches: gravelly fine sandy loam
- H4 - 33 to 60 inches: very gravelly fine sandy loam

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 10 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

126—Scooteney silt loam, 5 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29px
- Elevation: 400 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches

- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 170 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Scooteney and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scooteney

Setting

- Landform: Terraces
- Parent material: Loess

Typical profile

- H1 - 0 to 6 inches: silt loam
- H2 - 6 to 22 inches: silt loam
- H3 - 22 to 33 inches: gravelly fine sandy loam
- H4 - 33 to 60 inches: very gravelly fine sandy loam

Properties and qualities

- Slope: 5 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 10 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

127—Scooteney cobbly silt loam, 0 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29py
- Elevation: 400 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 170 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Scooteney, cobbly, and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scooteney, Cobbly

Setting

- Landform: Terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 6 inches: cobbly silt loam
- H2 - 6 to 22 inches: silt loam
- H3 - 22 to 33 inches: gravelly fine sandy loam
- H4 - 33 to 60 inches: very gravelly sandy loam

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 10 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 7.4 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: B
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

133—Shano silt loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29q5
- Elevation: 500 to 2,300 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 46 to 54 degrees F
- Frost-free period: 125 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Shano and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shano

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 4 inches: silt loam
- H2 - 4 to 30 inches: silt loam
- H3 - 30 to 60 inches: silt loam

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None

- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

134—Shano silt loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29q6
- Elevation: 500 to 2,300 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 46 to 54 degrees F
- Frost-free period: 125 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Shano and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shano

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 4 inches: silt loam
- H2 - 4 to 30 inches: silt loam
- H3 - 30 to 60 inches: silt loam

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

135—Shano silt loam, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29q7
- Elevation: 500 to 2,300 feet
- Mean annual precipitation: 6 to 10 inches
- Mean annual air temperature: 46 to 54 degrees F
- Frost-free period: 125 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Shano and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Shano

Setting

- Landform: Hillslopes
- Parent material: Loess

Typical profile

- H1 - 0 to 4 inches: silt loam
- H2 - 4 to 30 inches: silt loam
- H3 - 30 to 60 inches: silt loam

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

136—Simcoe silt loam, 5 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29q8
- Elevation: 1,280 to 2,850 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 degrees F
- Frost-free period: 120 to 170 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Simcoe and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Simcoe

Setting

- Parent material: Loess and small amount volcanic ash and residuum weathered from basalt

Typical profile

- H1 - 0 to 8 inches: silt loam
- H2 - 8 to 37 inches: silty clay loam
- H3 - 37 to 41 inches: unweathered bedrock

Properties and qualities

- Slope: 5 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to lithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

136—Simcoe silt loam, 5 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29q8
- Elevation: 1,280 to 2,850 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 degrees F
- Frost-free period: 120 to 170 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Simcoe and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Simcoe

Setting

- Parent material: Loess and small amount volcanic ash and residuum weathered from basalt

Typical profile

- H1 - 0 to 8 inches: silt loam
- H2 - 8 to 37 inches: silty clay loam
- H3 - 37 to 41 inches: unweathered bedrock

Properties and qualities

- Slope: 5 to 15 percent
- Depth to restrictive feature: 20 to 40 inches to lithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

137—Simcoe silt loam, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29q9
- Elevation: 1,180 to 3,440 feet
- Mean annual precipitation: 8 to 12 inches
- Mean annual air temperature: 48 degrees F
- Frost-free period: 120 to 170 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Simcoe and similar soils: 100 percent
- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Simcoe

Setting

- Parent material: Loess and small amount volcanic ash and residuum weathered from basalt

Typical profile

- H1 - 0 to 8 inches: silt loam
- H2 - 8 to 37 inches: silty clay loam
- H3 - 37 to 41 inches: unweathered bedrock

Properties and qualities

- Slope: 15 to 30 percent
- Depth to restrictive feature: 20 to 40 inches to lithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: C
- Ecological site: LOAMY 10-16 PZ (R008XY102WA)
- Hydric soil rating: No

138—Sinloc fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29qb
- Elevation: 500 to 1,200 feet

- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 136 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Sinloc, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sinloc, Drained

Setting

- Landform: Terraces
- Parent material: Lacustrine deposits with a mantle of loess

Typical profile

- H1 - 0 to 3 inches: fine sandy loam
- H2 - 3 to 15 inches: silt loam
- H3 - 15 to 45 inches: silt loam
- H4 - 45 to 60 inches: loamy fine sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 12 to 42 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Gypsum, maximum in profile: 5 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 10.0
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3w
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C

- Hydric soil rating: Yes

Minor Components

Outlook

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

Sinloc, undrained

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

139—Sinloc silt loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29qc
- Elevation: 500 to 1,200 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 136 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Sinloc, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sinloc, Drained

Setting

- Landform: Terraces
- Parent material: Lacustrine deposits with a mantle of loess

Typical profile

- H1 - 0 to 3 inches: silt loam
- H2 - 3 to 15 inches: silt loam

- H3 - 15 to 45 inches: silt loam
- H4 - 45 to 60 inches: loamy fine sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 12 to 42 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Gypsum, maximum in profile: 5 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 10.0
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3w
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Outlook

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

Sinloc, undrained

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

140—Sinloc silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29qf

- Elevation: 500 to 1,200 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 136 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Sinloc, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sinloc, Drained

Setting

- Landform: Terraces
- Parent material: Lacustrine deposits with a mantle of loess

Typical profile

- H1 - 0 to 3 inches: silt loam
- H2 - 3 to 15 inches: silt loam
- H3 - 15 to 45 inches: silt loam
- H4 - 45 to 60 inches: loamy fine sand

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 12 to 42 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Gypsum, maximum in profile: 5 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 10.0
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3w
- Land capability classification (nonirrigated): 6s

- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Outlook

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

Sinloc, undrained

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

141—Sinloc silt loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29qg
- Elevation: 500 to 1,200 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 136 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Sinloc, drained, and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sinloc, Drained

Setting

- Landform: Terraces
- Parent material: Lacustrine deposits with a mantle of loess

Typical profile

- H1 - 0 to 3 inches: silt loam

- H2 - 3 to 15 inches: silt loam
- H3 - 15 to 45 inches: silt loam
- H4 - 45 to 60 inches: loamy fine sand

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 12 to 42 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 20 percent
- Gypsum, maximum in profile: 5 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 10.0
- Available water storage in profile: High (about 9.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6w
- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Sinloc, undrained

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

142—Starbuck silt loam, 2 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29qh
- Elevation: 400 to 2,700 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 115 to 210 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Starbuck and similar soils: 100 percent
- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Starbuck

Setting

- Landform: Structural benches, hillslopes
- Parent material: Loess and residuum derived from basalt

Typical profile

- H1 - 0 to 9 inches: silt loam
- H2 - 9 to 16 inches: gravelly silt loam
- H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

- Slope: 2 to 15 percent
- Depth to restrictive feature: 12 to 20 inches to lithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

- Land capability classification (irrigated): 6s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

143—Starbuck-Rock outcrop complex, 0 to 45 percent slopes

Map Unit Setting

- National map unit symbol: 29qj
- Elevation: 400 to 2,700 feet

- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 115 to 210 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Starbuck and similar soils: 50 percent
- Rock outcrop: 25 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Starbuck

Setting

- Landform: Hillslopes, structural benches
- Parent material: Loess and residuum derived from basalt

Typical profile

- H1 - 0 to 9 inches: silt loam
- H2 - 9 to 16 inches: gravelly silt loam
- H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

- Slope: 0 to 45 percent
- Depth to restrictive feature: 12 to 20 inches to lithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

- Land capability classification (irrigated): 7e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

- Slope: 0 to 45 percent
- Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 8
- Hydric soil rating: No

144—Starbuck-Rock outcrop complex, 45 to 60 percent slopes

Map Unit Setting

- National map unit symbol: 29qk
- Elevation: 400 to 2,700 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 115 to 210 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Starbuck and similar soils: 45 percent
- Rock outcrop: 35 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Starbuck

Setting

- Landform: Hillslopes, structural benches
- Parent material: Loess and residuum derived from basalt

Typical profile

- H1 - 0 to 9 inches: silt loam
- H2 - 9 to 16 inches: gravelly silt loam
- H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

- Slope: 45 to 60 percent

- Depth to restrictive feature: 12 to 20 inches to lithic bedrock
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 7e
- Hydrologic Soil Group: D
- Ecological site: STONY 6-10 PZ (R007XY202WA)
- Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

- Slope: 45 to 60 percent
- Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 8
- Hydric soil rating: No

163—Toppenish silt loam

Map Unit Setting

- National map unit symbol: 29r7
- Elevation: 700 to 1,800 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 50 to 52 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

- Toppenish, drained, and similar soils: 80 percent

- Minor components: 20 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Toppenish, Drained

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 4 inches: silt loam
- H2 - 4 to 50 inches: silt loam, silty clay loam
- H2 - 4 to 50 inches: extremely gravelly sand
- H3 - 50 to 60 inches:

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: 40 to 60 inches to strongly contrasting textural stratification
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: About 24 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 10.0
- Available water storage in profile: Very high (about 12.8 inches)

Interpretive groups

- Land capability classification (irrigated): 2w
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Wenas

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Track

- Percent of map unit: 5 percent
- Landform: Flood plains
- Hydric soil rating: Yes

Fiander

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Kittitas

- Percent of map unit: 3 percent
- Landform: Flood plains
- Hydric soil rating: Yes

Toppenish, undrained

- Percent of map unit: 2 percent
- Landform: Depressions
- Hydric soil rating: Yes

168—Umapine silt loam, 0 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29rd
- Elevation: 250 to 3,500 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 110 to 195 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Umapine and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Umapine

Setting

- Landform: Flood plains, terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 60 inches: silt loam

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 6 to 42 inches
- Frequency of flooding: Occasional
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 20.0
- Available water storage in profile: High (about 11.9 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Ecological site: ALKALI BOTTOM 6-10 PZ (R007XY401WA)
- Hydric soil rating: No

Minor Components

Toppenish

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

169—Umapine silt loam, drained, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29rf
- Elevation: 250 to 3,500 feet

- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 130 to 195 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Umapine, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Umapine, Drained

Setting

- Landform: Flood plains, terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 60 inches: silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 24 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 20.0
- Available water storage in profile: High (about 11.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Hydric soil rating: No

Minor Components

Toppenish

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Kittitas

- Percent of map unit: 5 percent
- Landform: Flood plains
- Hydric soil rating: Yes

170—Umapine silt loam, drained, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29rh
- Elevation: 250 to 3,500 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 130 to 195 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Umapine, drained, and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Umapine, Drained

Setting

- Landform: Flood plains, terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 7 inches: silt loam
- H2 - 7 to 60 inches: silt loam

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 24 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
- Sodium adsorption ratio, maximum in profile: 20.0
- Available water storage in profile: High (about 11.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: C
- Hydric soil rating: No

Minor Components

Toppenish

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

171—Wanser loamy fine sand

Map Unit Setting

- National map unit symbol: 29rj
- Elevation: 300 to 1,200 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 120 to 190 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Wanser, drained, and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wanser, Drained

Setting

- Landform: Terraces
- Parent material: Sandy alluvium and eolian sands

Typical profile

- H1 - 0 to 6 inches: loamy fine sand
- H2 - 6 to 60 inches: sand, fine sand, loamy fine sand
- H2 - 6 to 60 inches:
- H2 - 6 to 60 inches:

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
- Depth to water table: About 42 to 60 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
- Available water storage in profile: Very high (about 13.6 inches)

Interpretive groups

- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 6s
- Hydrologic Soil Group: A
- Hydric soil rating: Yes

Minor Components

Wanser, undrained

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

172—Warden fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29rk
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: fine sandy loam
- H2 - 5 to 19 inches: very fine sandy loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 2e

- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: SANDY 6-10 PZ (R007XY501WA)
- Hydric soil rating: No

173—Warden fine sandy loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29rl
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Warden and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: fine sandy loam
- H2 - 5 to 19 inches: very fine sandy loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None

- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: SANDY 6-10 PZ (R007XY501WA)
- Hydric soil rating: No

Minor Components

Outlook

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

174—Warden fine sandy loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29rm
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: fine sandy loam
- H2 - 5 to 19 inches: very fine sandy loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: SANDY 6-10 PZ (R007XY501WA)
- Hydric soil rating: No

175—Warden fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29rn
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: fine sandy loam
- H2 - 5 to 19 inches: very fine sandy loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 30 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.4 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: SANDY 6-10 PZ (R007XY501WA)
- Hydric soil rating: No

176—Warden silt loam, 0 to 2 percent slopes

Map Unit Setting

- National map unit symbol: 29rp
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Prime farmland if irrigated

Map Unit Composition

- Warden and similar soils: 100 percent
- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: silt loam
- H2 - 5 to 19 inches: silt loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.7 inches)

Interpretive groups

- Land capability classification (irrigated): 2c
- Land capability classification (nonirrigated): 6c
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

177—Warden silt loam, 2 to 5 percent slopes

Map Unit Setting

- National map unit symbol: 29rq
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: silt loam
- H2 - 5 to 19 inches: silt loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 2 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.7 inches)

Interpretive groups

- Land capability classification (irrigated): 2e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

178—Warden silt loam, 5 to 8 percent slopes

Map Unit Setting

- National map unit symbol: 29rr
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of statewide importance

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: silt loam
- H2 - 5 to 19 inches: silt loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 5 to 8 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.7 inches)

Interpretive groups

- Land capability classification (irrigated): 3e

- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

179—Warden silt loam, 8 to 15 percent slopes

Map Unit Setting

- National map unit symbol: 29rs
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: silt loam
- H2 - 5 to 19 inches: silt loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 8 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None

- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.7 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

180—Warden silt loam, 15 to 30 percent slopes

Map Unit Setting

- National map unit symbol: 29rv
- Elevation: 600 to 1,300 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 135 to 200 days
- Farmland classification: Farmland of unique importance

Map Unit Composition

- Warden and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warden

Setting

- Landform: Terraces
- Parent material: Loess over lacustrine deposits

Typical profile

- H1 - 0 to 5 inches: silt loam
- H2 - 5 to 19 inches: silt loam
- H3 - 19 to 60 inches: stratified very fine sandy loam to silt loam

Properties and qualities

- Slope: 15 to 30 percent

- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Calcium carbonate, maximum in profile: 5 percent
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: High (about 11.7 inches)

Interpretive groups

- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: B
- Ecological site: LOAMY 6-10 PZ (R007XY102WA)
- Hydric soil rating: No

181—Weirman sandy loam, channeled

Map Unit Setting

- National map unit symbol: 29rw
- Elevation: 400 to 2,200 feet
- Mean annual precipitation: 6 to 14 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Weirman and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weirman

Setting

- Landform: Terraces, flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 8 inches: sandy loam
- H2 - 8 to 21 inches: loamy fine sand
- H3 - 21 to 60 inches: very gravelly loamy sand

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: About 36 to 60 inches
- Frequency of flooding: Frequent
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 4w
- Hydrologic Soil Group: A
- Ecological site: LOAMY BOTTOM 6-10 PZ (R007XY402WA)
- Hydric soil rating: Yes

182—Weirman fine sandy loam

Map Unit Setting

- National map unit symbol: 29rx
- Elevation: 400 to 2,500 feet
- Mean annual precipitation: 7 to 14 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Weirman and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weirman

Setting

- Landform: Flood plains, terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 8 inches: fine sandy loam
- H2 - 8 to 21 inches: loamy fine sand
- H3 - 21 to 60 inches: very gravelly loamy sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4s
- Land capability classification (nonirrigated): 4s
- Hydrologic Soil Group: A
- Hydric soil rating: No

Minor Components

Zillah

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

183—Weirman gravelly fine sandy loam

Map Unit Setting

- National map unit symbol: 29ry
- Elevation: 400 to 2,500 feet
- Mean annual precipitation: 7 to 14 inches
- Mean annual air temperature: 48 to 50 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Weirman and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weirman

Setting

- Landform: Flood plains, terraces
- Parent material: Alluvium

Typical profile

- H1 - 0 to 8 inches: gravelly fine sandy loam
- H2 - 8 to 21 inches: loamy fine sand
- H3 - 21 to 60 inches: very gravelly loamy sand

Properties and qualities

- Slope: 0 to 5 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4s
- Land capability classification (nonirrigated): 4s
- Hydrologic Soil Group: A
- Hydric soil rating: No

Minor Components

Zillah

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

184—Weirman fine sandy loam, wet

Map Unit Setting

- National map unit symbol: 29rz
- Elevation: 400 to 2,500 feet
- Mean annual precipitation: 7 to 14 inches
- Mean annual air temperature: 50 to 52 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Weirman and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weirman

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 8 inches: fine sandy loam
- H2 - 8 to 21 inches: loamy fine sand
- H3 - 21 to 60 inches: very gravelly loamy sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: About 0 to 24 inches
- Frequency of flooding: Occasional
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

- Land capability classification (irrigated): 4w
- Land capability classification (nonirrigated): 6w
- Hydrologic Soil Group: A/D

- Hydric soil rating: No

Minor Components

Zillah

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

191—Zillah sandy loam

Map Unit Setting

- National map unit symbol: 29s7
- Elevation: 600 to 1,000 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 46 to 50 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

- Zillah, drained, and similar soils: 90 percent
- Minor components: 10 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zillah, Drained

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: sandy loam
- H2 - 12 to 42 inches: silt loam
- H3 - 42 to 60 inches: loamy sand

Properties and qualities

- Slope: 0 to 2 percent

- Depth to restrictive feature: 40 to 60 inches to strongly contrasting textural stratification
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 24 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

- Land capability classification (irrigated): 2w
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Hydric soil rating: Yes

Minor Components

Toppenish

- Percent of map unit: 5 percent
- Landform: Depressions
- Hydric soil rating: Yes

Weirman

- Percent of map unit: 3 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

Zillah

- Percent of map unit: 2 percent
- Landform: Alluvial cones
- Hydric soil rating: No

192—Zillah silt loam

Map Unit Setting

- National map unit symbol: 29s8
- Elevation: 600 to 1,000 feet
- Mean annual precipitation: 6 to 9 inches
- Mean annual air temperature: 46 to 50 degrees F

- Frost-free period: 130 to 180 days
- Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

- Zillah and similar soils: 100 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zillah

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: silt loam
- H2 - 12 to 42 inches: silt loam
- H3 - 42 to 60 inches: loamy sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: 40 to 60 inches to strongly contrasting textural stratification
- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 24 to 48 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

- Land capability classification (irrigated): 2w
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: C
- Hydric soil rating: No

Minor Components

Toppenish

- Percent of map unit:
- Landform: Depressions
- Hydric soil rating: Yes

Weirman

- Percent of map unit:
- Landform: Alluvial cones
- Hydric soil rating: Yes

193—Zillah silt loam, channeled

Map Unit Setting

- National map unit symbol: 29s9
- Elevation: 600 to 1,500 feet
- Mean annual precipitation: 6 to 12 inches
- Mean annual air temperature: 48 to 52 degrees F
- Frost-free period: 130 to 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Zillah and similar soils: 95 percent
- Minor components: 5 percent

- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zillah

Setting

- Landform: Flood plains
- Parent material: Alluvium

Typical profile

- H1 - 0 to 12 inches: silt loam
- H2 - 12 to 42 inches: silt loam
- H3 - 42 to 60 inches: loamy sand

Properties and qualities

- Slope: 0 to 2 percent
- Depth to restrictive feature: 40 to 60 inches to strongly contrasting textural stratification

- Natural drainage class: Somewhat poorly drained
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
- Depth to water table: About 0 to 12 inches
- Frequency of flooding: Frequent
- Frequency of ponding: None
- Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 5w
- Hydrologic Soil Group: B/D
- Ecological site: LOAMY BOTTOM 10-16 PZ (R008XY402WA)
- Hydric soil rating: Yes

Minor Components

Weirman

- Percent of map unit: 5 percent
- Landform: Alluvial cones
- Hydric soil rating: Yes

Cost of Living for Poor Families in the LYV

Costs include: Purchase of bottled water, purchasing and maintaining reverse osmosis systems, testing well water, drilling new wells, and health related costs.

I. Consider the budget for a family of four with an annual income of $36,000 – a monthly income of $3,000. This equates to parents working a total of 75 hours per week for $10/hr.

Cost of Bottled Water estimated at $1.20 per gallon

Calculate one gallon of water per person per day for drinking & cooking = $4.80 per day or $145 per month

Average property tax including school levies for Lower Yakima Valley cities = 6.797%

Average county property tax including fire protection and state school levy = 7.097%

Estimate an $80,000 mortgage with payments of $400 per month

Monthly Expenses

Income tax	$ 0
Sales tax = 8% of non-food purchases	
Social Security = 6.2% of gross income	186.00
Car payments	250.00
Car Insurance	125.00
Health Insurance	120.00
Out of Pocket Health Costs	150.00
Gasoline	200.00
Electricity	100.00
Telephone	80.00
Home Heating	200.00
Food at $30 per day	900.00
Clothing	

Car Repairs	
Home Repairs	
Church	
Computer Access	
School Supplies	
Child Care	
Bottled Water	145.00
Total	$3,322.67

This family has to find at least an extra $322.67 every month to meet their budget. Bottled water is 4.4% of their monthly income.

II. Consider the budget for a family of four with an annual income of $24,300 - the federal poverty level, a monthly income of $2,000. This equates to one parent working forty hours a week for $11.70 per hour

Monthly Expenses

Income tax	$ 0
Sales tax = 8% of non-food purchases	
Social Security = 6.2% of gross income	125.00
Rent	700.00
Health Insurance – eligible for low cost or free health insurance under ACA	
Electricity	100.00
Telephone	80.00
Home Heating	200.00
Food at $30 per day	900.00
Clothing	
Home Repairs	

Church	
Computer Access	
School Supplies	
Child Care	
Bottled Water	145.00
Total	$2,250.00

This family, without a car, must find an extra $250 per month to meet their budget. Bottled water is 6.4% of their monthly income.

* * * * * * * * * * *

Paying for certified childcare is cost prohibitive. Finding safe childcare is one of parents' highest priorities.

If a mother works in the warehouses and a school calls to tell her that her child is sick, she cannot leave or she will lose her job. Schools frequently label such mothers as uncaring.

During harvest people work 12 hour shifts seven days a week for months on end. The workday often begins at 4 AM and continues till late at night.

Due to forest fires last fall the air in Central Washington was "hazardous", the worst category for several weeks. This happened during harvest. Farmworkers continued to work in the polluted air.

75% to 90% of children in the Yakima Valley are eligible for free and reduced lunches. Everyone uses the food banks.

Draft Analysis of 2017 USGS Survey of Domestic Wells & Drains in the Lower Yakima Valley Groundwater Management Area

Jean Mendoza

April 30, 2018

Executive Summary

This document is a very preliminary effort to make sense of data from 901 well samples and 167 drain samples that were collected in 2017 by the United States Geological Survey for the Lower Yakima Valley Groundwater Management Area.

Data was gathered from the web site https://maps.waterdata.usgs.gov/mapper/index.html Readings were copied onto Excel spreadsheets and analyzed using Excel. The summaries that follow are my impressions from several weeks of study. There is much more work to be done.

At this point in time it appears that nitrate levels are higher in wells near the middle and southern portions of the GWMA. There is no statistical correlation between well depth and nitrate levels or ground surface elevation and nitrate levels. There were wells with low nitrate levels close to wells with high nitrate levels. There were a few wells with wide fluctuations in nitrate levels.

Wells near the Yakima River had much lower nitrate levels than those farther from the river. There is an area east of the Toppenish Wildlife Refuge with surprisingly low nitrate levels.

Drains likewise showed wide ranges in values from zero nitrates to as high as 20 mg/L nitrates. Drains showed major seasonal fluctuations.

This study requires a large time commitment and my knowledge of soils, hydrogeology and local farming practices is limited. I will continue to refine this very rough draft and welcome input from other members of the GWMA.

DRAFT

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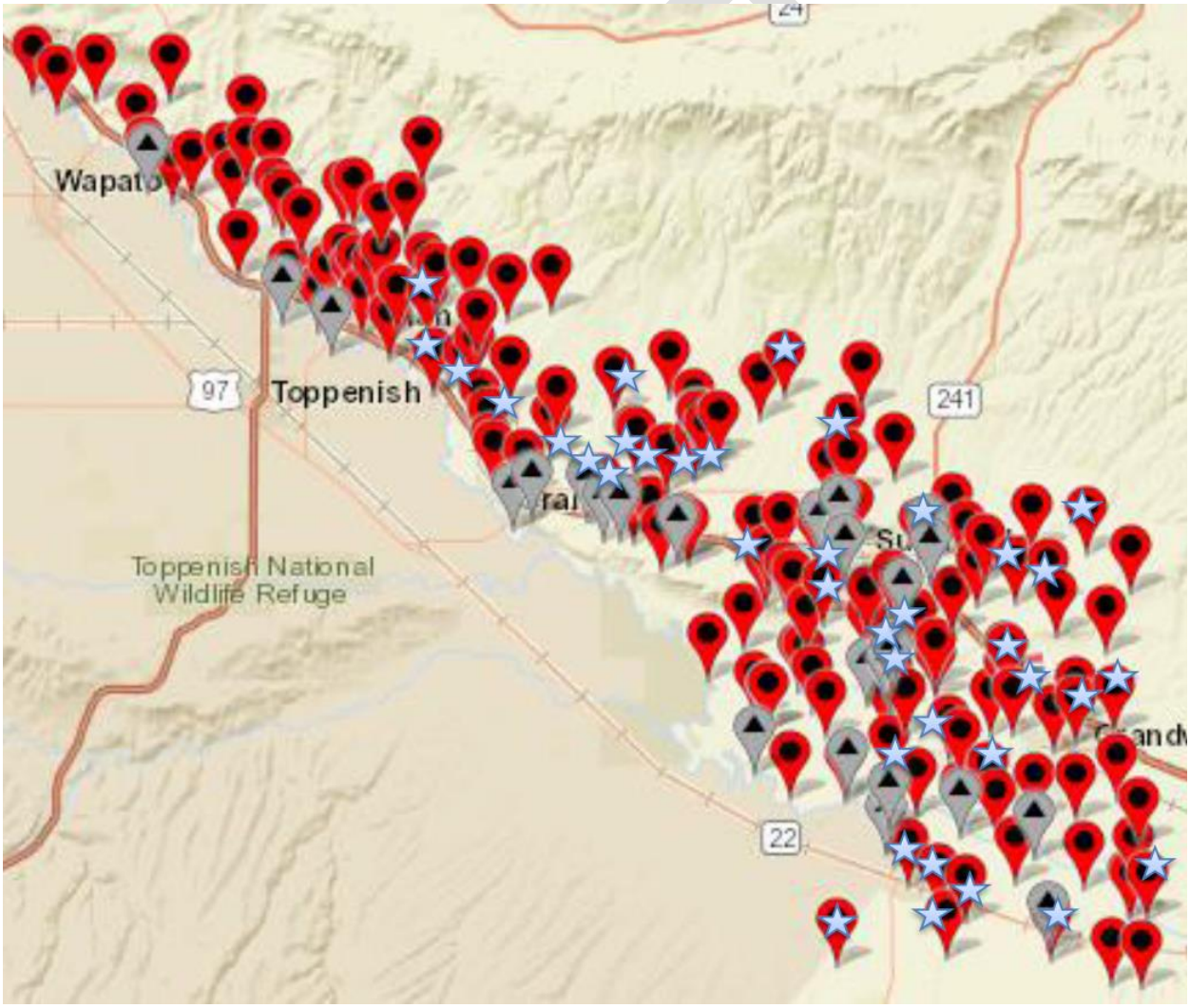
Introduction

Between April 3 and December 8, 2017 the United States Geological Survey (USGS) sampled 156 domestic wells and 24 drains in the Lower Yakima Valley (LYV) on behalf of the LYV Groundwater Management Area (GWMA). USGS sampled over 90% of the wells six times or approximately every two months. The study resulted in 901 well water samples and 167 drain samples. The purpose of the research was to describe nitrate levels across the GWMA target area at this point in time and to look for seasonal trends.

Here is a map that shows locations for the sampled wells and drains with stars next to wells that had nitrate levels > 10 mg/L.



Data was made available to the LYV Groundwater Advisory Committee (GWAC) at their April 5, 2018 meeting but there were no provisions for data analysis. The committee was essentially told, 'Here is the data. If you want to understand, analyze it yourselves.' This

paper is an effort on the part of Friends of Toppenish Creek to begin that analysis and share the results with other members of the GWAC.

Overview of Well Sampling

133 (15%) of the samples had non-detectable levels of nitrate + nitrite that were reported at < 0.040 mg/L. A surprising finding was that 6 of the wells with no detectable nitrate were in the 50 to 100 foot well depth range.

180 (20%) of the samples had readings > 10 mg/L, the EPA designated safety level for drinking water.

The low number of wells at depths greater than 400 feet makes conclusions in this range less reliable.

Well depths ranged from 52 ft to 795 ft. No well depths (ND) were reported for six wells.

Well Depth	# Samples	# Sites	WD Average	WD Median	N Average	N Median	N Range
0 - 100 ft	183	31	83.4 ft	90 ft	7.12 mg/L	7.97 mg/L	0 - 22.3 mg/L
100.1 - 200	434	75	150.33	145	7.34	5.5	0 - 45.2
200.1 - 300	179	31	239.7	238	3.84	3.14	0 - 17.7
300.1 - 400	41	6	357.71	354	3.03	2.51	0.078 - 7.05
400.1 - 500	17	3	415.12	405	0.22	0	0 - 0.773
500.1 - 600	0	0	NA	NA	NA	NA	NA
600.1 - 700	6	1	663	663	0	0	0
> 700 ft	6	1	795	795	2.18	2.18	1.98 – 2.32
ND	35	6			5.51	2.82	0 – 18.9

Land surface elevations ranged from 657 ft to 1241 ft.

Elevation	# Samples	# Sites	Elev. Ave	Elev. Median	Nitrate Ave	N Median	N Range
600 – 700 ft	78	14	679.88	674	1.7	0	0 – 11.3
700.1 – 800 ft	338	58	751-33	750	6.22	4.68	0 – 22.3
800.1 – 900 ft	257	44	848.59	851	7.92	6.57	0.961 – 43.1
900.1 – 1000	107	18	934.06	928	6.35	5.48	0 – 17.7
1000.1 – 1100	80	14	1040.7	1043	5.95	2.32	0 – 45.2
> 1100 ft	41	7	1175.78	1155	2.05	2.27	0 – 5.74

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Most of the samples, 721 out of 901, were under the safe level of 10 mg/L for nitrates.

Grouping	WD Average	Elevation Average	Nitrate Average	Nitrate Median	# Samples
0 – 10 mg/L	192 ft	846 ft	3.72 mg/L	3.21 mg/L	721
10.1 – 20 mg/L	120	803	13.35	12.4	159
20.1 – 30 mg/L	94	801	21.71	21.65	8
30.1 – 40 mg/L	151	850	36.15	NA	2
> 40 mg/L	112	949	43.16	43.1	11

Analysis by Well Depth

With 901 samples it is possible to look for a correlation between well depth and nitrate levels. We did this using calculation of a Pearson r correlation coefficient. The formula is:

$$r = \frac{1}{n-1}\sum_{i=1}^{n}\frac{(x_i-\bar{x})}{s_x}\frac{(y_i-\bar{y})}{s_y}$$

The first step in the calculation is to create a scatter plot in order to visualize a possible relationship. Here is the portion of scatter plot for N values to 25 mg/L. (See Attachment 1)

24.1-25		x						
23.1-24								
22.1-23	x							
21.1-22	xxx							
20.1-21	xx	x						
19.1-20	xx	xxxx						
18.1-19		x						
17.1-18	xxxxxxx	xx	xxxxxx					
16.1-17	xx	xxxx						
15.1-16	xxxxx	Xxxxxxxxx						
14.1-15	xxxx	xxxx						
13.1-14	x	xx						
12.1-13	Xxxxxxxxxxx	xxxxxxxx						
11.1-12	xxxxxx	Xxxxxxxxxxxxxxx						
10.1-11	Xxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx						
9.1-10	XxxxxxxXxxxxxxxx	Xxxxxxxxxxxxxxxxxxxx						
8.1-9	Xxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxx					
7.1-8	Xxxxxxxxxx	Xxxxxxxxxxxxxxx	Xxxxxxxxx					
6.1-7		Xxxxxxxxxxxxxxxxx	xxxxxx	xxxxxx				
5.1-6		Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxx	xxx				
4.1-5	xxxx	XxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxXxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	x				
3.1-4	Xxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxx	xxxxxx				
2.1-3	Xxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxx				xxxxx
1.1-2	xxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	xxxxxxxxx	xxxxxxx				x
0.1-1		Xxxxxxxxxx	xxxxxx	xxxxx	xxxxx			
0 mg/L	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxx	Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	x	Xxxxxxxxxxx		xxxxxx	
	0-100 ft	101-200 ft	201-300	301-400	401-500	501-600	601-700	701-800

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The first impression is that there is little overall correlation between well depth and nitrate levels. This is borne out by calculation of the Pearson r correlation coefficient = negative 0.281. Generally speaking there is poor correlation if |r| < 0.60. (Excel Calculations are available in Attachment 2)

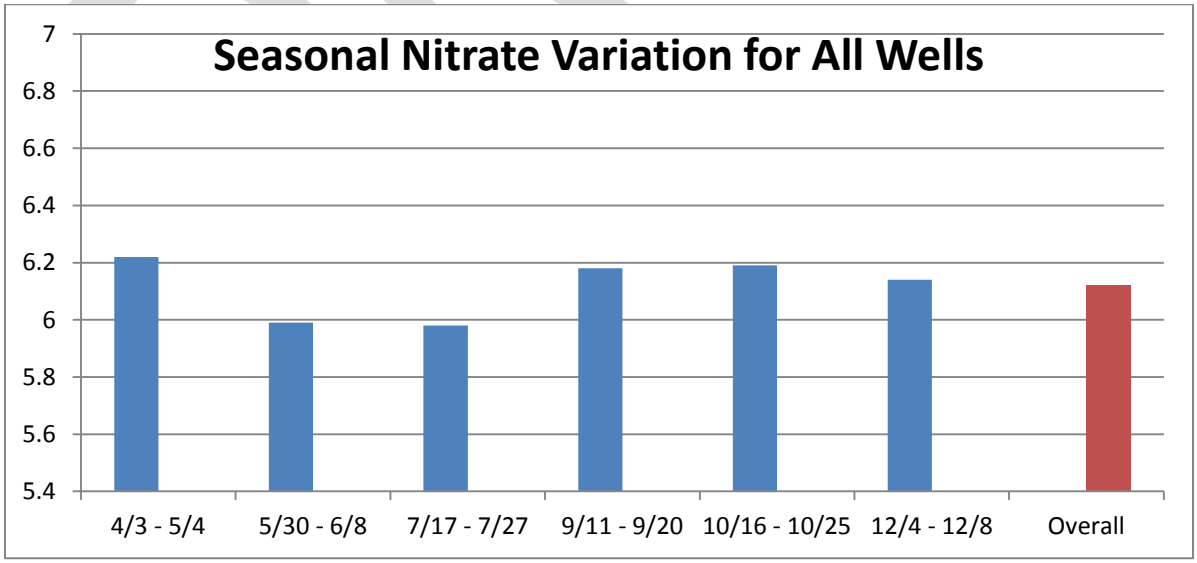
Analysis by Ground Surface Elevation

Based on a similar calculation of the Pearson r correlation coefficient regarding elevation and nitrate levels, r = negative 0.018. There is little relationship between elevation and nitrate levels. (See Attachment 2). This issue will be addressed more completely in the section on nitrate levels and distance from the Yakima River.

Seasonal Analysis

It is well known that nitrate levels in the LYV fluctuate with the seasons. Here are the seasonal results from this study.

Sampling Period	N	WD Ave	El. Ave	Nitrate Ave
4/3 - 5/4	149	175.79	836.66	6.22
5/30 - 6/8	151	178.08	839.04	5.99
7/17 - 7/27	154	178.26	839.83	5.98
9/11 - 9/20	154	178.26	839.83	6.18
10/16 - 10/25	152	178.66	841.36	6.19
12/4 - 12/8	141	177.04	840.87	6.14
Overall	901	177.69	839.59	6.12



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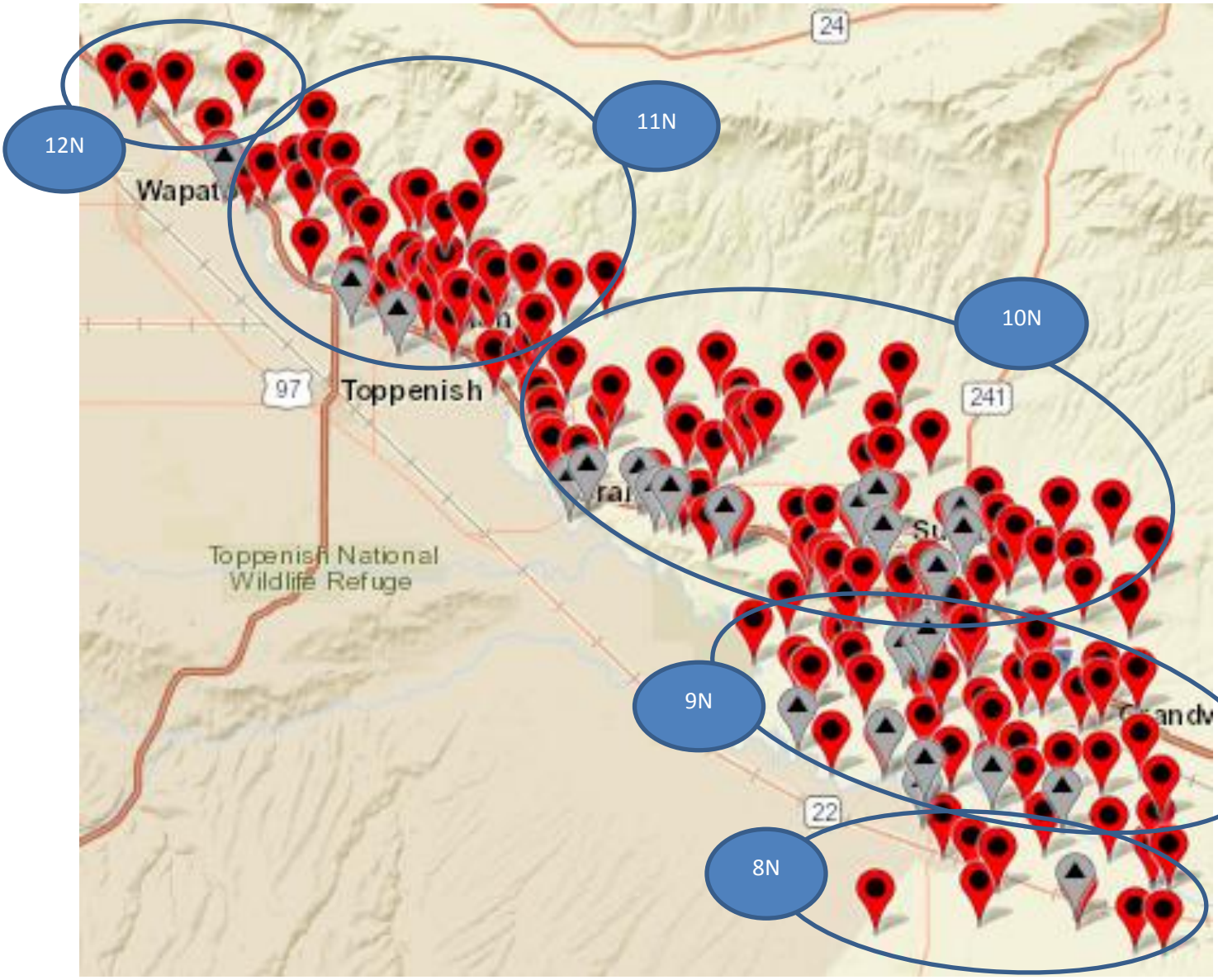
USGS Groupings

USGS uses five major categories for well classification in the GWMA Target Area. The categories begin with 8N, 9N, 10N, 11N, and 12 N.

Here is a map that shows where wells in each grouping are located:



This table describes the number of wells in each grouping with depths and average nitrate levels:

Grouping	N Samples	N Sites	Well Depth Average	Elevation Average	Ave. Nitrate Level
All Sites	901 ft	156 ft	177.79 ft	839.59 ft	6.12 mg/L
N12	29	5	276.48	1013.48	0.50
N11	218	38	243.71	959.66	4.00
N10	344	58	166.30	841.00	8.62
N9	260	45	133.63	739.27	5.11
N8	54	10	130.15	728.15	6.45

The northern wells are at a higher elevation, are deeper and have lower nitrate levels. Within the middle and southern groups a higher elevation and deeper well depth is associated with higher nitrate levels. My conclusion is that there are other factors involved besides well depth.

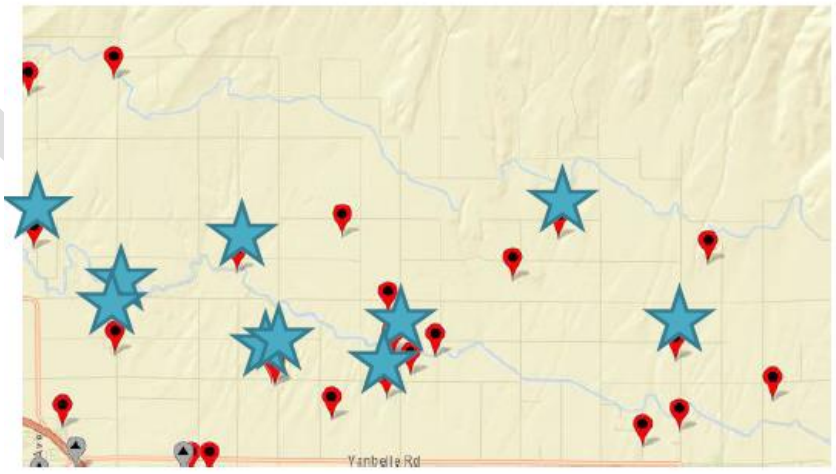
High Risk Wells & Low Risk Wells

Here is a mapping of high and low risk wells

Wells with > 10 mg/L nitrate at least once are covered with a star =

Wells with < 1 mg/L nitrate are covered with a sphere =

Northeast Quadrant – North of Outlook & Sunnyside



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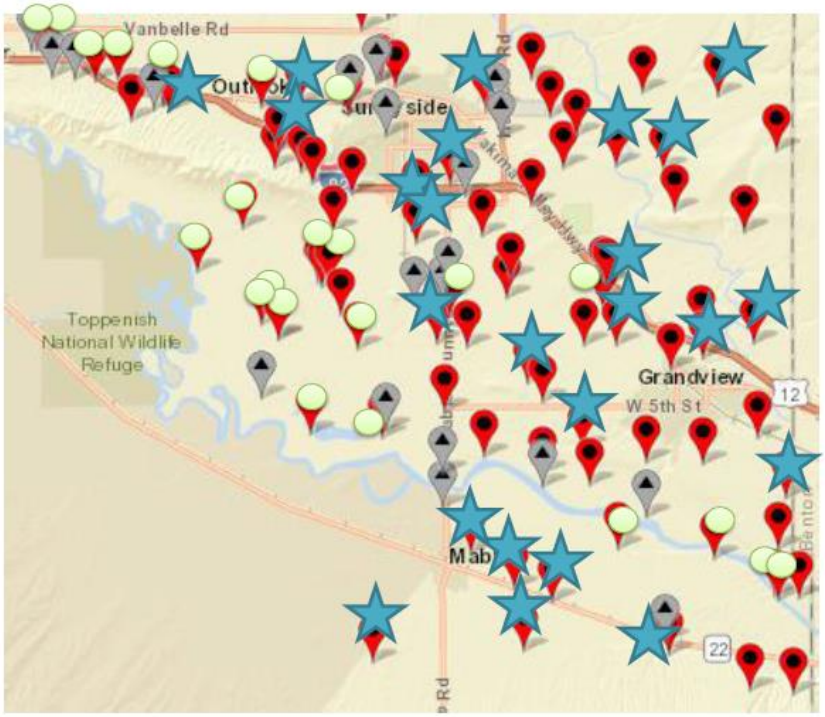
Northwest Quadrant



Southeast Quadrant



There are multiple wells with very low nitrate levels near the Yakima River. There are also interesting pockets of low nitrate wells: 1. the area directly east of the Toppenish Wildlife Refuge, 2. the area north of Snipes Mountain and south of Van Belle Road.

Special Cases

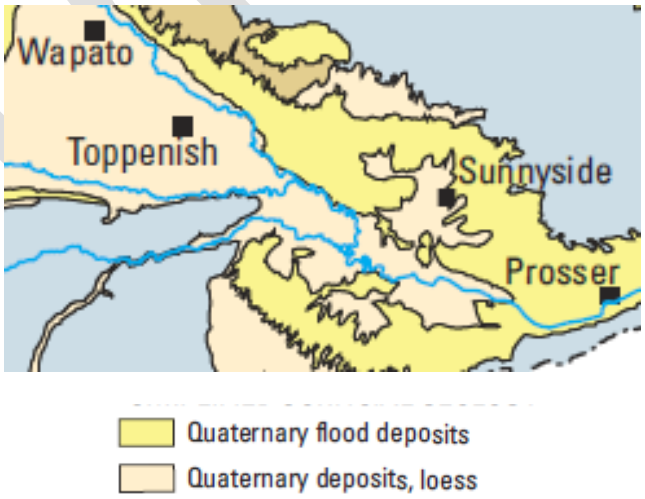
We have assumed that shallower wells are more vulnerable to nitrate pollution. After looking at the data it appears that other important factors are involved.

Near the Yakima River - I divided the data set into wells within 2 miles of the Yakima River and wells > 2 miles from the Yakima River. The results show shallower well depths and lower elevation nearer the river which is no surprise. The results also show lower nitrate levels on parcels within 2 miles of the river. (See Attachment 3)

Distance from the River	Well Depth	Hole Depth	Elevation	Average Nitrate Level
< 2 Miles	159 ft	160 ft	800 ft	4.34 mg/L
> 2 Miles	190 ft	191 ft	867 ft	7.32 mg/L

This deserves analysis by people who know more about hydrogeology than I do.

Let me point out that the 2006 USGS study *Hydrogeologic Framework of Sedimentary Deposits in Six Structural Basins, Yakima River Basin, Washington*, available at https://pubs.usgs.gov/sir/2006/5116/pdf/sir20065116.pdf lists two major soil types for this area. They are quaternary flood deposits and quaternary loess as shown in this excerpt from the map on page 7 of that document.



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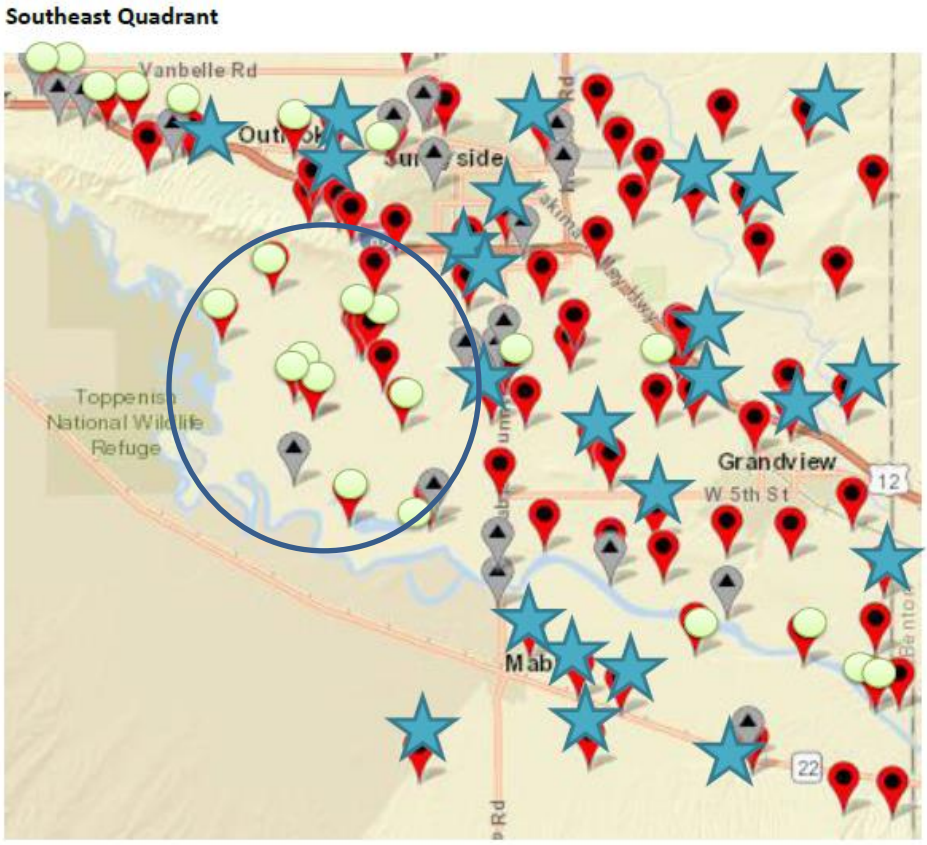
1990 Agricultural Chemicals Pilot Study

In 1990 Ecology released a document entitled the *Washington State Agricultural Chemicals Pilot Study.* Available at https://fortress.wa.gov/ecy/publications/documents/9046.pdf



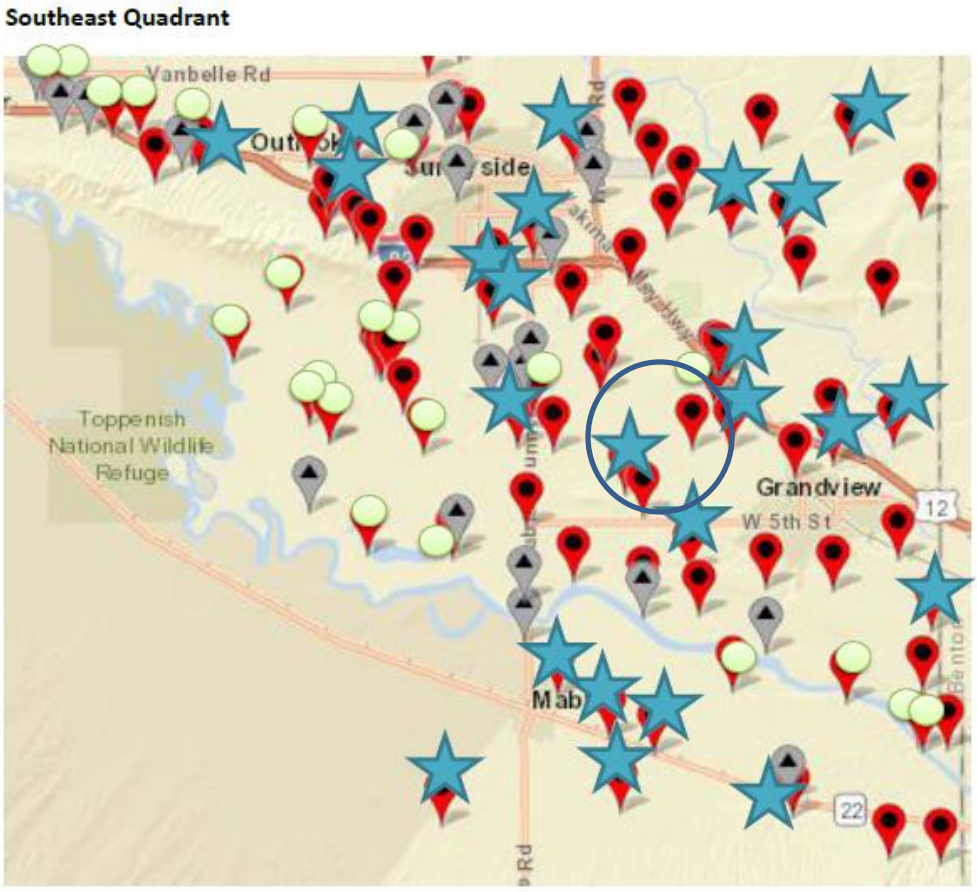
The study found. "Eight wells of the 27 wells (30%) sampled in the Yakima County study area showed detectable concentrations of nitrate/nitrite-N. The concentrations ranged from less than 0.01 to 6.2 mg/L with a mean concentration of 0.7 mg/L. No wells exceeded the MCL of 10 mg1L." This correlates with our 2017 USGS sampling of domestic wells in the area that shows most wells with < 1 mg/L nitrate.

This suggests different patterns of groundwater flow compared to other parts of the GWMA.

1992 Hornby Lagoon Study

In 1992 Ecology published the *Groundwater Quality Assessment, Hornby Dairy Lagoon, Sunnyside Washington.* https://fortress.wa.gov/ecy/publications/documents/92e23.pdf

The purpose was to study water quality down gradient from a new two stage dairy lagoon. After one year only chloride was elevated in the monitoring wells and Ecology recommended further observations for long term effects. It appears that long term monitoring was not done.

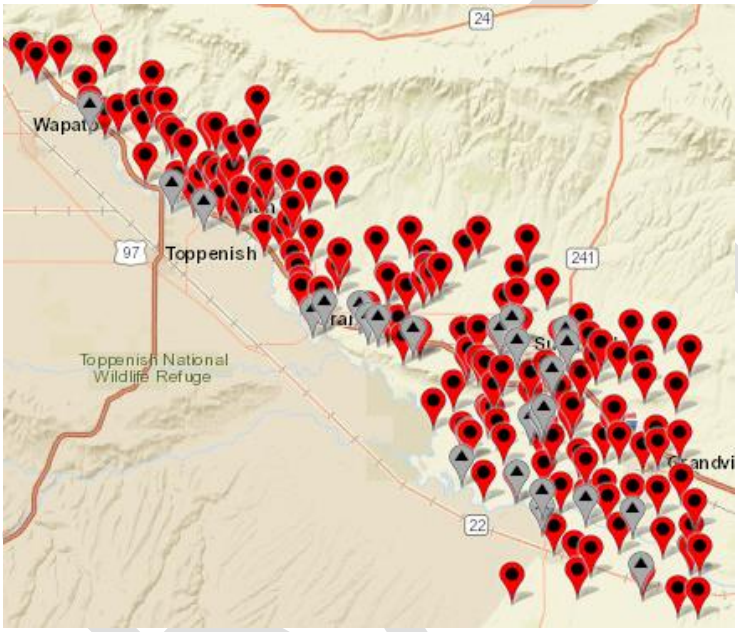


There are two wells in our study that are 0.8 miles and 1.5 miles downgradient from the Hornby Lagoon study. The nearest well had nitrate levels that ranged from 19.2 to 20.7 mg/L. The other had nitrate levels that ranged from 1.69 to 1.89 mg/L.

Lower Valley Drains

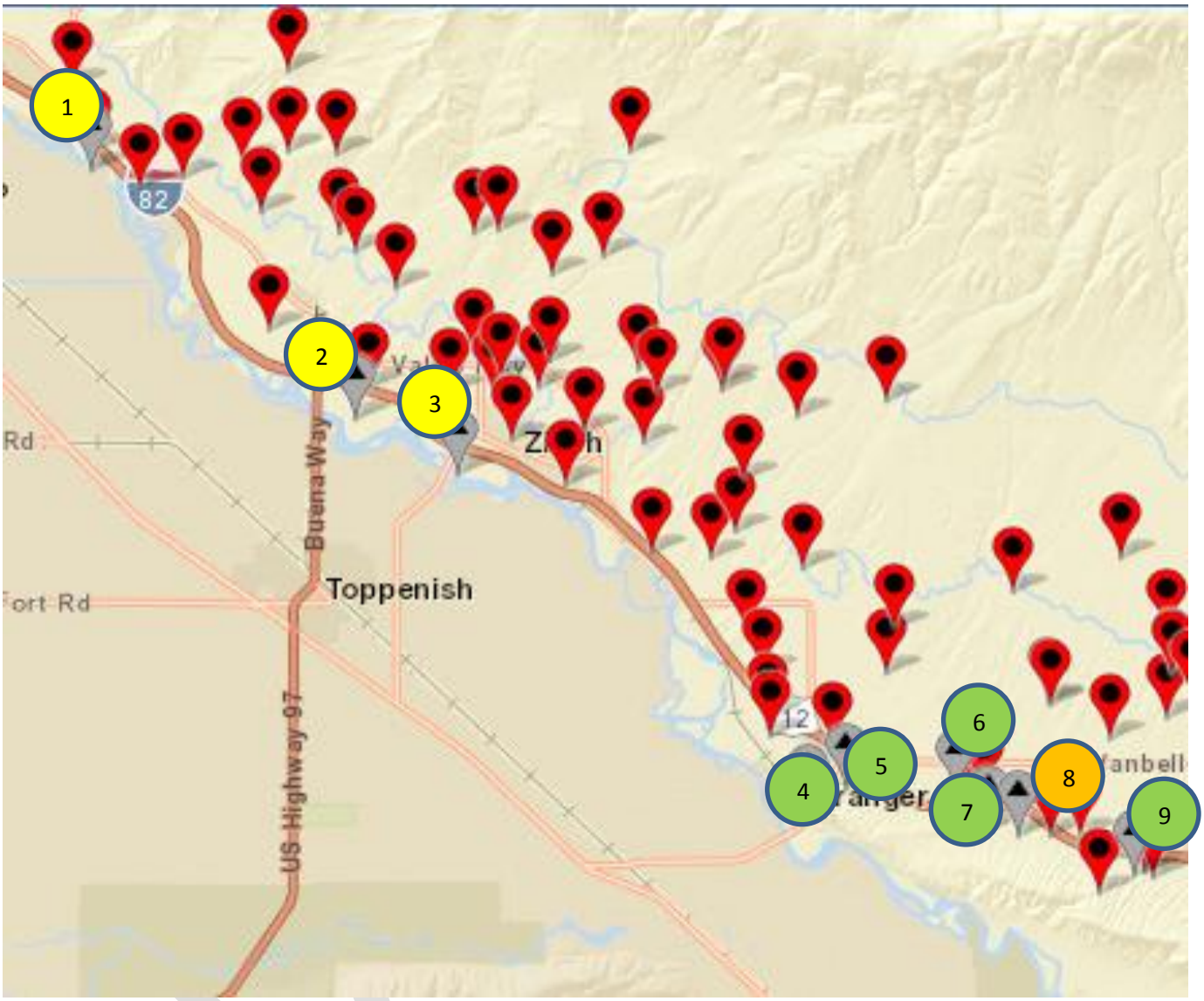
Variations in Bi-Monthly Nitrate Levels - Drain Testing Lower Yakima Valley 2017

In 2017, from April through December, the United States Geological Survey sampled 24 drains in the Lower Yakima Valley on behalf of the LYV Groundwater Management Area. USGS tested for nitrates and other variables. Most drains were sampled about seven times. The readings varied by season. The USGS map below identifies test sites. Domestic wells are coded in red and drains are coded in gray.

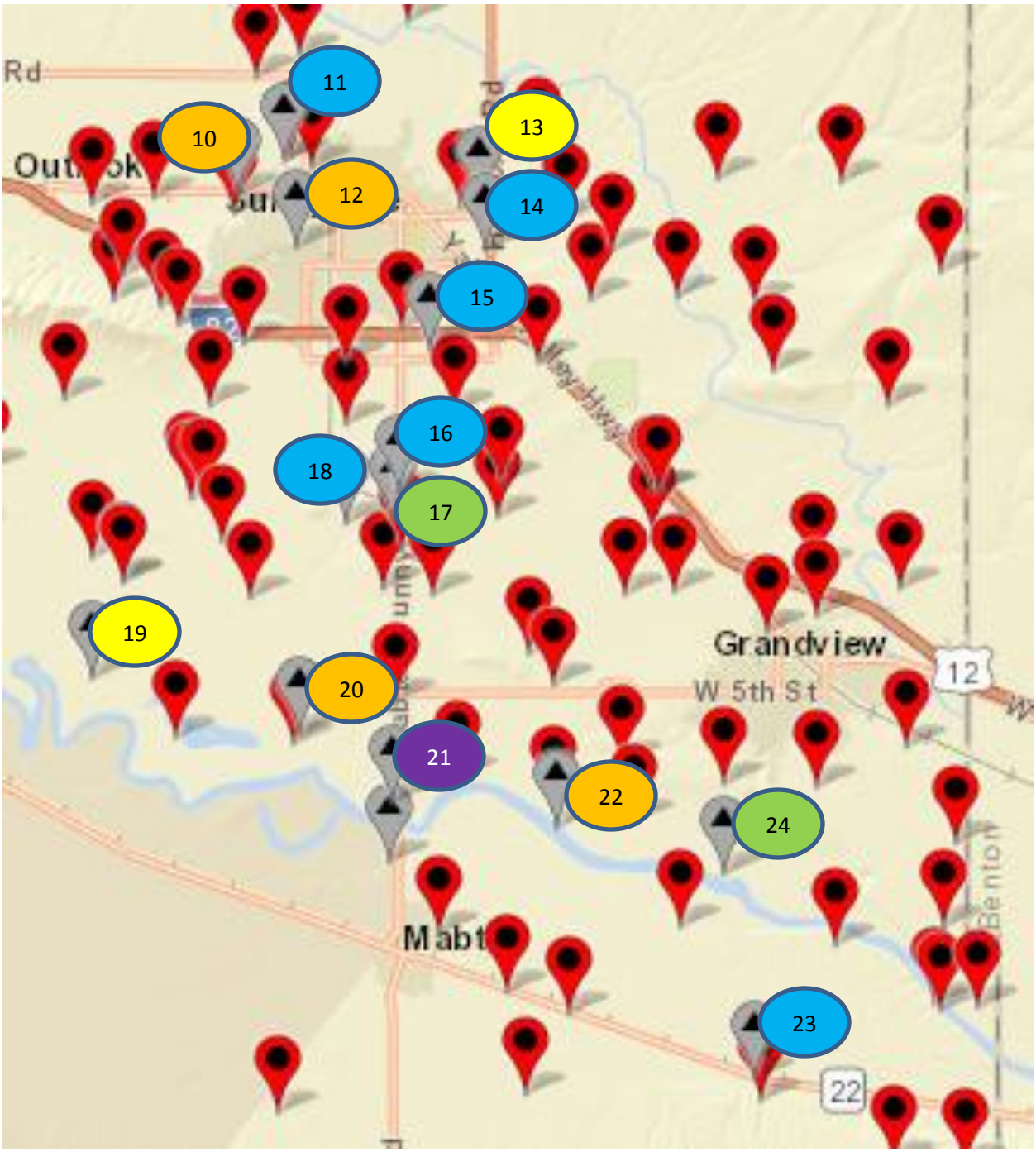


There were wide ranges in values for the various drains. For clarity the average readings are color coded on larger maps on the following pages. There is a map for the northern section of the GWMA and a map for the southern section.

	< 2.5 mg/L nitrate
	2.5 - 5 mg/L nitrate
	5 - 7.5 mg/L nitrate
	7.5 - 10 mg/L nitrate
	> 10 mg/L nitrate



1 = Roza Wasteway	6 = Joint Drain at Van Belle Road
2 = Buena Drain	7 = Joint Drain 28 near Granger
3 = Joint Drain at Chevron Station, Zillah	8 = Drain 2 NEET Site Number 3
4 = Granger Drain at Granger	9 = Joint Drain 32 at Outlook
5 = Joint Drain, Yakima Valley Hwy at Granger	



10 = Joint Drain from Rougk Land near Sunnyside	18 = DID Drain 3 near Sunnyside
11 = Joint Drain 34.2 at Woodin Road	19 = DID 7 near Mabton
12 = Joint Drain near S. First St. in Sunnyside	20 = Sulfur Creek Wasteway near Sunnyside
13 = Sulfur Creek Wasteway at Scheller Road	21 = Drain 31 at West Charvet Road
14 = DID Drain 18 at Sunnyside	22 = Drain 35 off Charvet Road
15 = Washout Drain at Sunnyside	23 = Joint Drain 1 at Bus Road
16 = Joint Drain 40.2 near Tear Road	24 = Grandview Drain at Chase Road
17 = Joint Drain 43.9 at Mabton	

Summary of Average and Median Nitrates for the 24 Lower Yakima Valley Drains

Number	Name	N Average	N Median	N Range
1	Roza Wasteway	0.01	0	0 - 0.072
2	Buena Drain	1.12	0.83	0.177 – 2.61
3	Joint Drain at Chevron Station, Zillah	0.31	0.09	0 – 1.29
4	Granger Drain at Granger	5.21	3.58	2.8 – 8.39
5	Joint Drain, Yakima Valley Hwy at Granger	6.82	5.46	3.49 – 10.9
6	Joint Drain at Van Belle Road	5.24	3.56	3.1 – 9.85
7	Joint Drain 28 near Granger	6.84	5.96	4.06 – 9.98
8	Drain 2 NEET Site Number 3	4.92	4.82	1.27 – 7.97
9	Joint Drain 32 at Outlook	7	4.33	2.33 – 14.3
10	Joint Drain from Rougk Land near Sunnyside	4.58	4.09	1.35 – 9.06
11	Joint Drain 34.2 at Woodin Road	8.95	5.88	4.03 – 16.5
12	Joint Drain near S. First St. in Sunnyside	4.98	4.74	1.97 – 7.78
13	Sulfur Creek Wasteway at Scheller Road	0.11	0.08	0 – 0.242
14	DID Drain 18 at Sunnyside	7.5	6.41	5.57 – 9.87
15	Washout Drain at Sunnyside	8.17	8.3	5.7 - 11
16	Joint Drain 40.2 near Tear Road	9.69	8.32	7.58 – 13.9
17	Joint Drain 43.9 at Mabton	5.36	4.58	3.68 – 8.22
18	DID Drain 3 near Sunnyside	7.99	8.22	3.07 – 12.3
19	DID 7 near Mabton	0.7	0.65	0 – 0.995
20	Sulfur Creek Wasteway near Sunnyside	4.81	3.91	2.4 – 9.2
21	Drain 31 at West Charvet Road	13.07	6.86	4.64 – 25.2
22	Drain 35 off Charvet Road	3.87	3.42	2.41 – 5.49
23	Joint Drain 1 at Bus Road	9.81	7.13	4.35 – 18.6
24	Grandview Drain at Chase Road	5.76	6.24	3.94 – 6.98

Ron Cowin from the Sunnyside Valley Irrigation District kindly provided this description of the different drains:

Wasteways are earthen ditches or concrete flumes designed to take excess water from RID's & SVID's main canals so the canal doesn't over top its banks. We can also use the wasteways to dump large volumes of water in an emergency situation such as a canal break. The Sulphur Creek Wasteway takes excess water or waste water (thus the name wasteway) from both RID & SVID. The Sulphur Creek Wasteway also has many large and small drains that flow into it making it the largest drain/wasteway in the GWMA. The Granger drain on the other hand is not a wasteway, it is strictly a drain. Neither RID or SVID spill or waste water directly into the Granger drain from our main canals.

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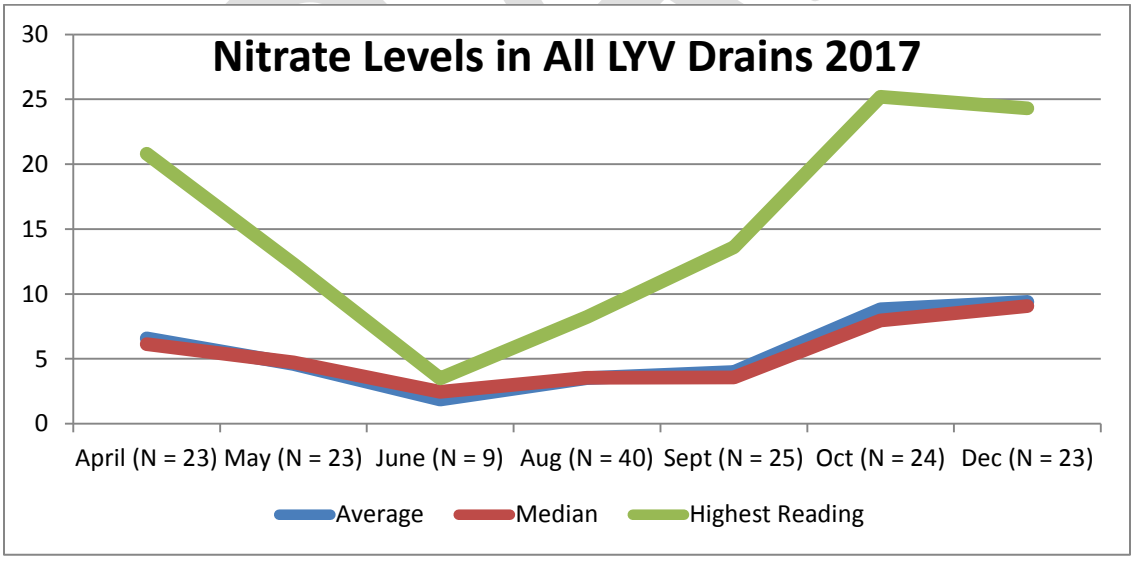
The drains were all built with the purpose of collecting ground water and to provide irrigators with a place to spill unused water and/or tailwater. SVID also spills tailwater from open laterals into the drains. Open laterals aren't piped solid and can't back the water up into the main canal so we will spill the excess water to the drains. The drains vary in size which is usually due to the quantity of acres that they receive water from. The more acres you have in a drainage basin the more water it produces and that creates the need for a larger drain.

Drainage Improvement Districts (DID's) are drains which are paid for through county assessments to landowners in the DID and maintained by local landowners. I believe the County is just the treasurer who collects the assessments and pays the bills but doesn't do the work. There are still a few DID's operating within the SVID but most of them have been handed over to us. We eventually renamed the ones we now maintain from DID's to DR's since this made more sense. It's really a matter of ownership. They're both drains with DID's being maintained by landowners and DR's being maintained by the District. There are also about 30 Joint Drains (JD's) which don't just serve SVID like the DR's do, but both SVID and RID and so the cost of maintaining them is borne by both entities.

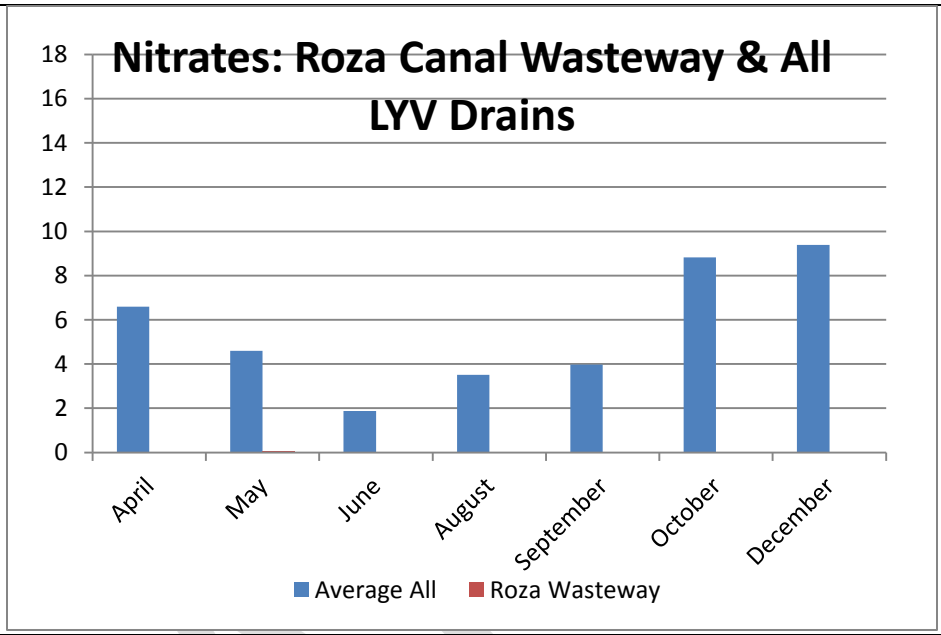
Hopefully this is helpful.

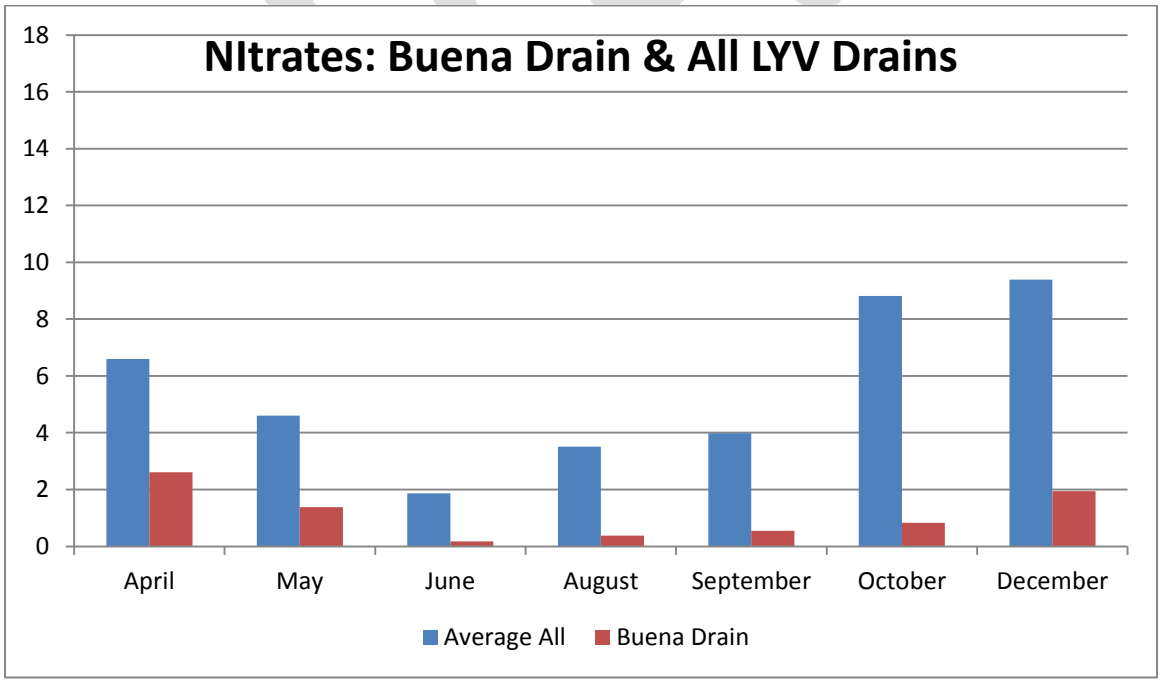


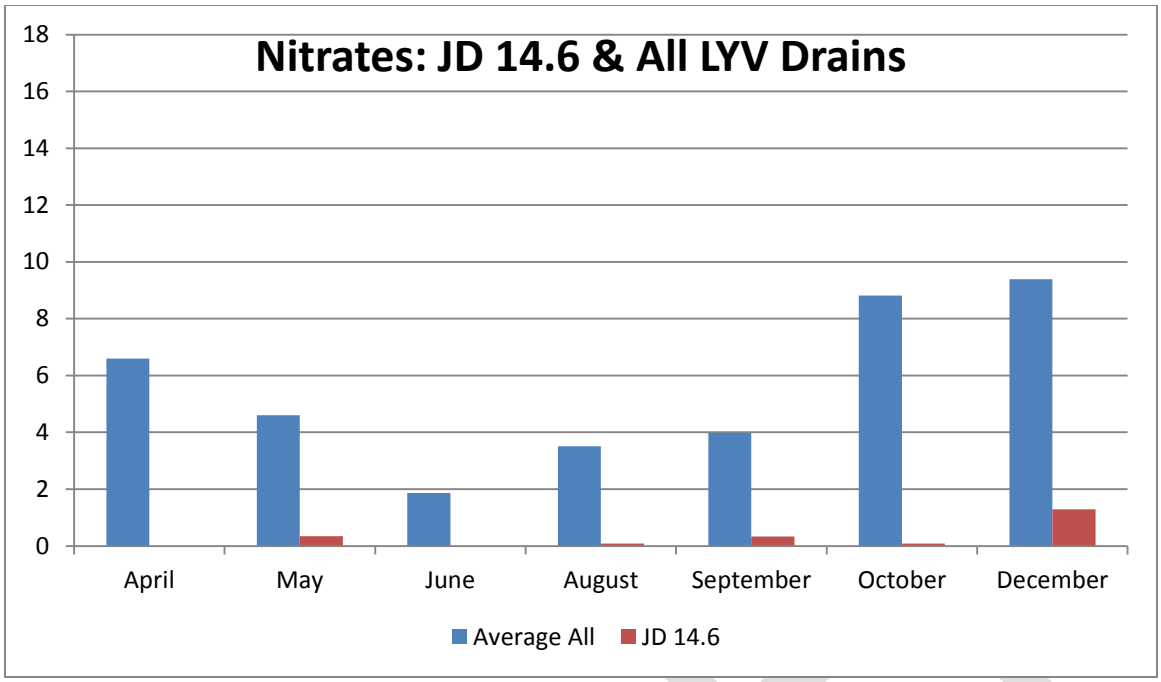
The graphs on the following pages compare readings for each drain with the overall average readings for all drains during the study period. Please note that only 9 drains were sampled in June, 2017, so the June numbers are less reliable.

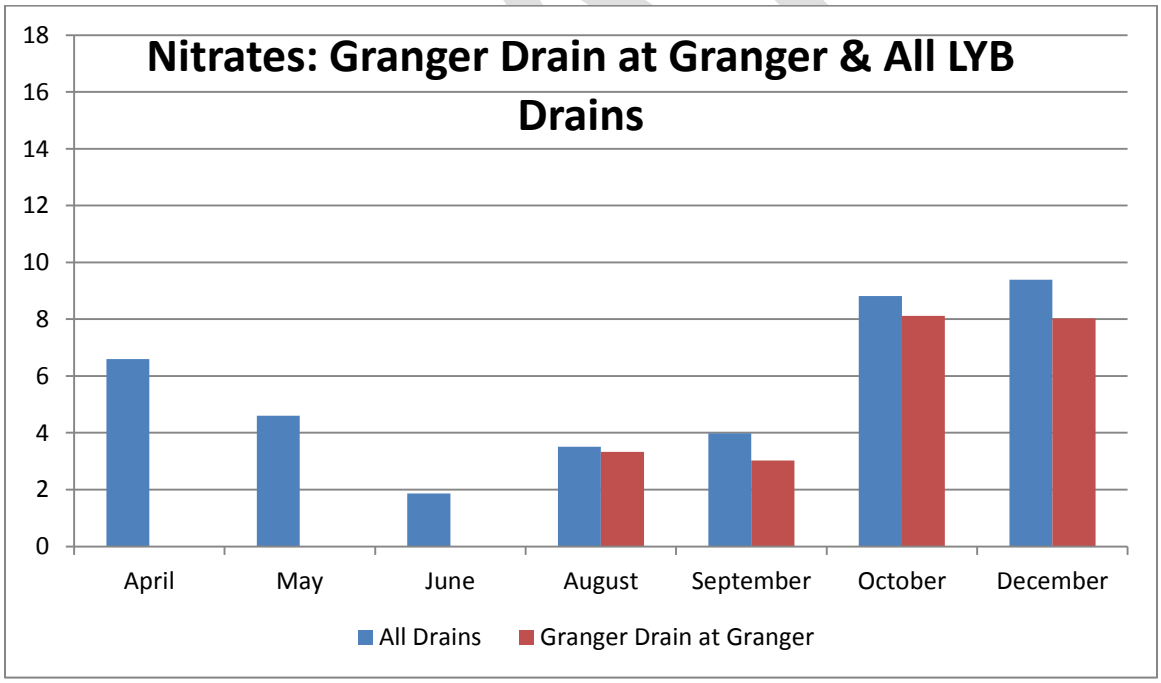
Roza Canal Wasteway had essentially zero nitrates in the 2017 sampling

Month	Roza
April	0
May	0.072
June	0
August	0
September	0
October	NA
December	NA

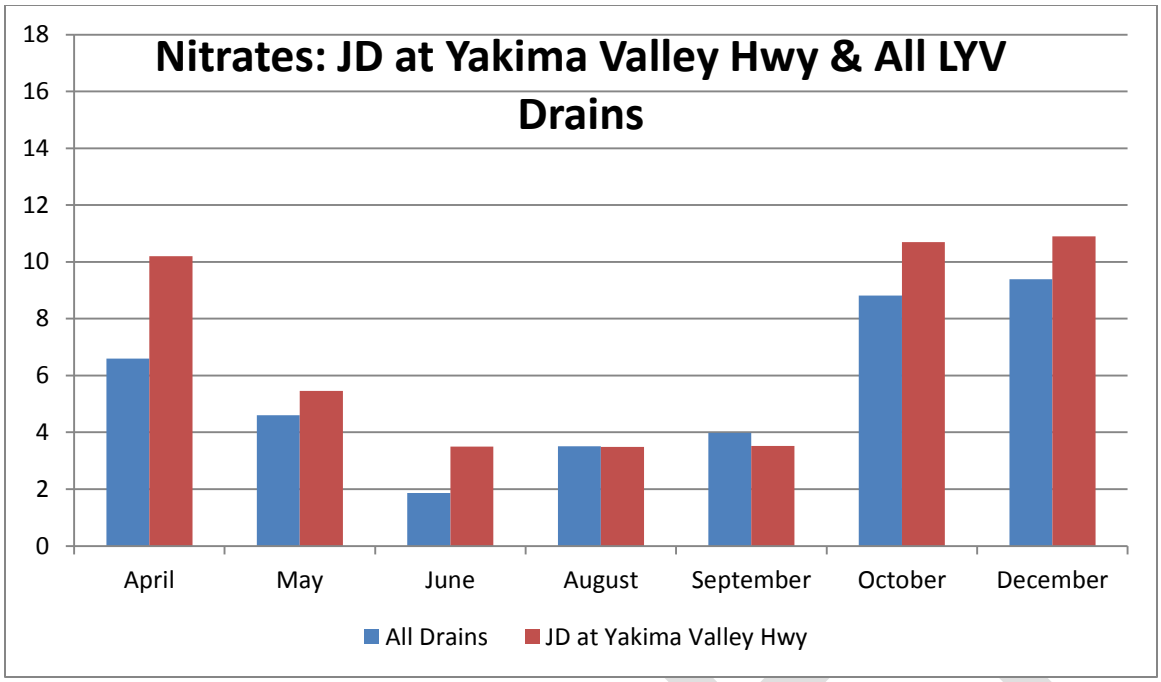


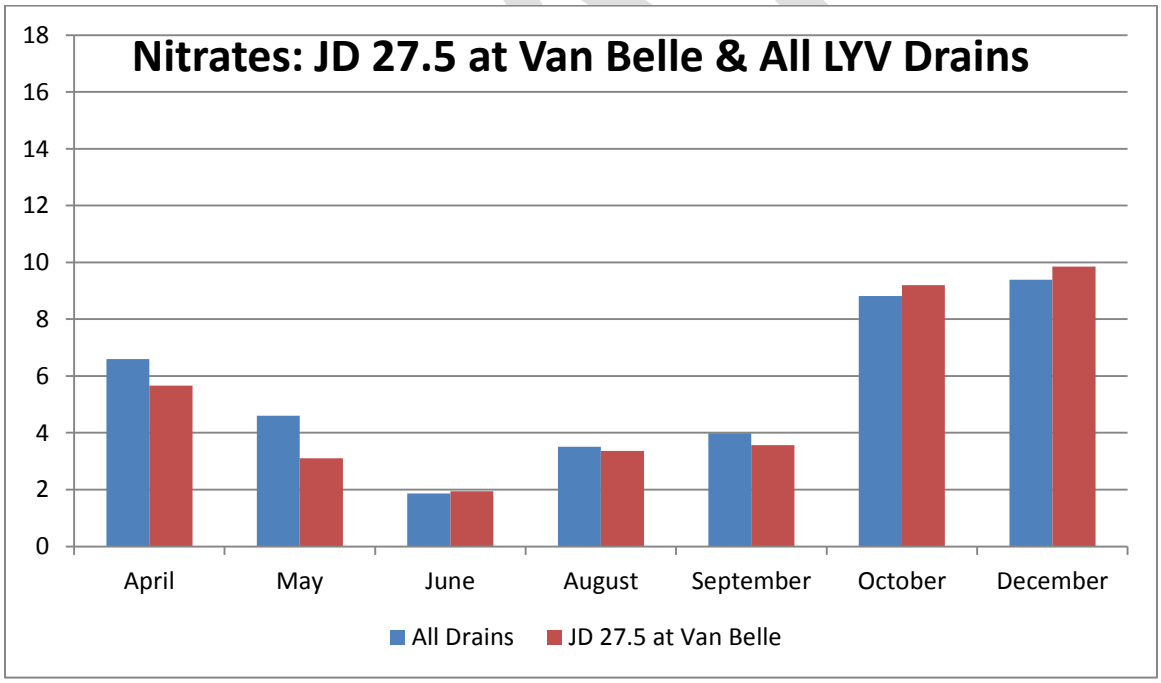


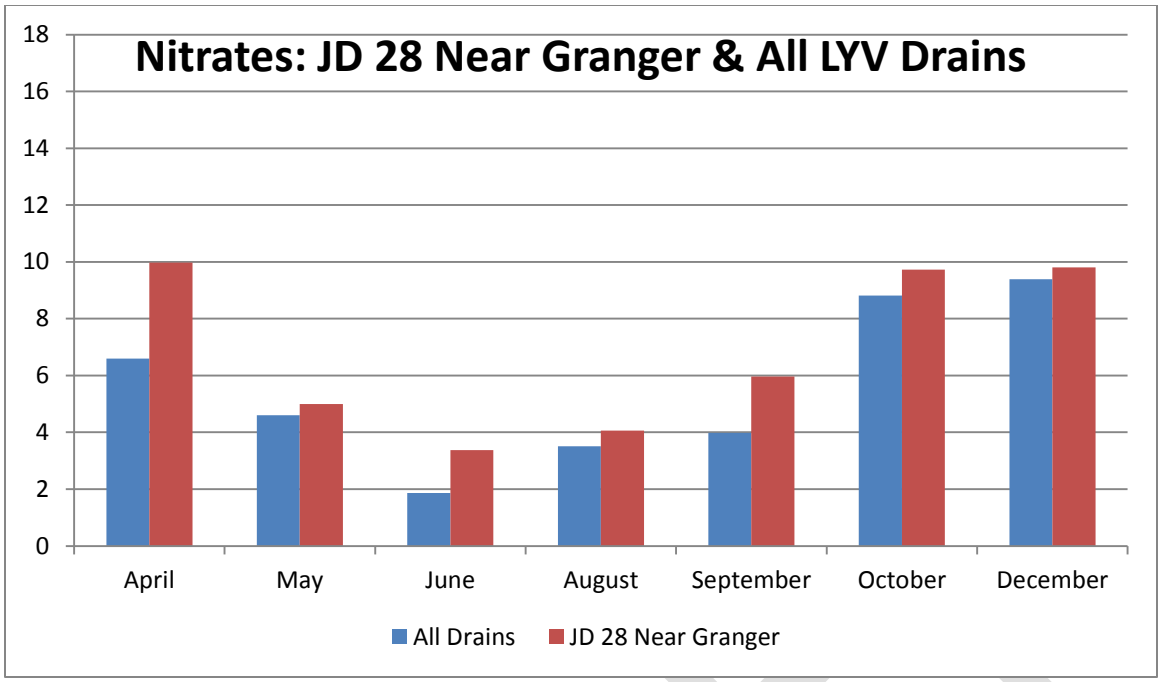


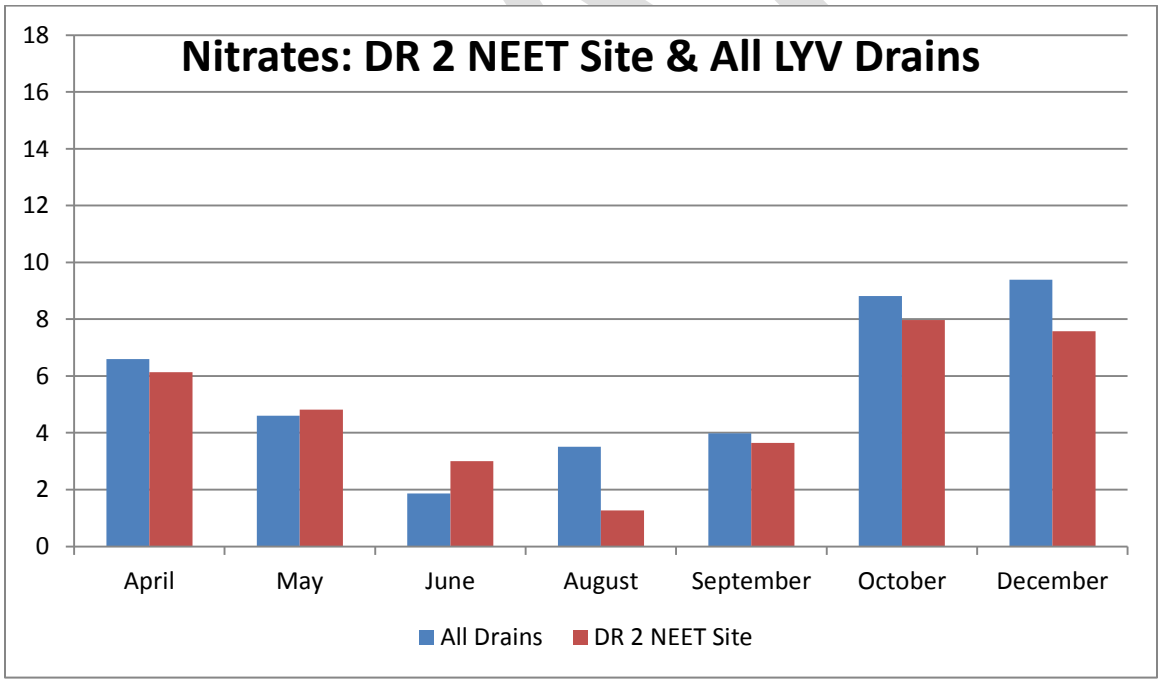


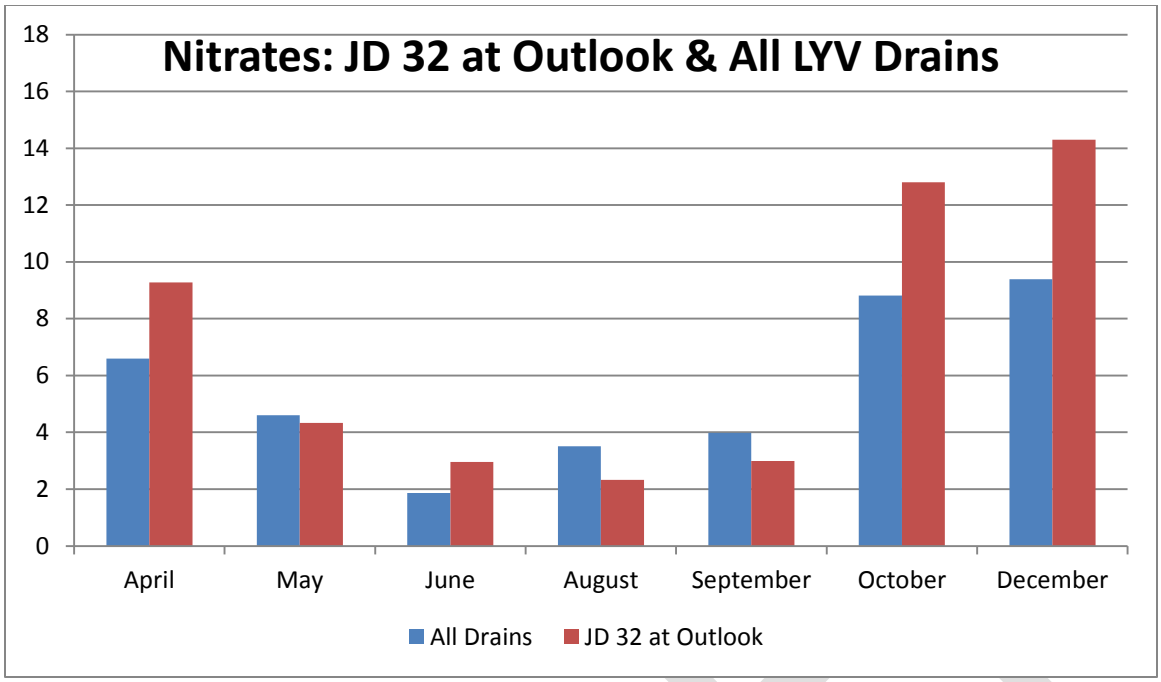
(There was no sampling of the Granger Drain at Granger in April, May & June)

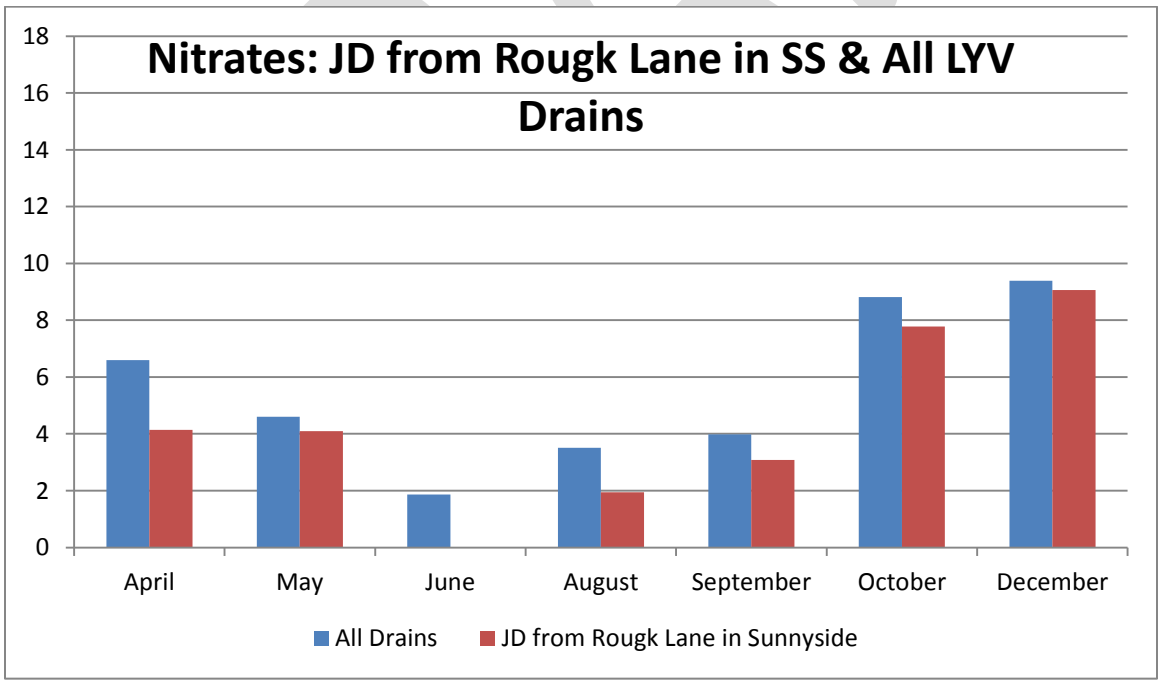

Nitrates: JD at Yakima Valley Hwy & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD at Yakima Valley Hwy

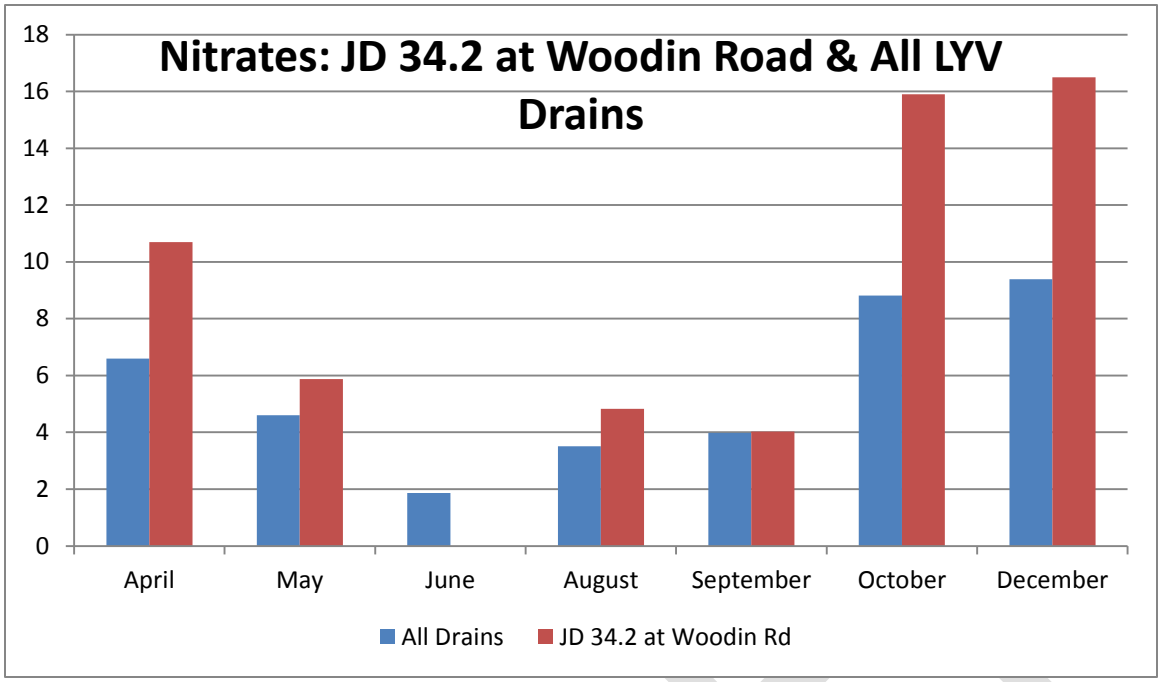

Nitrates: JD 27.5 at Van Belle & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 27.5 at Van Belle

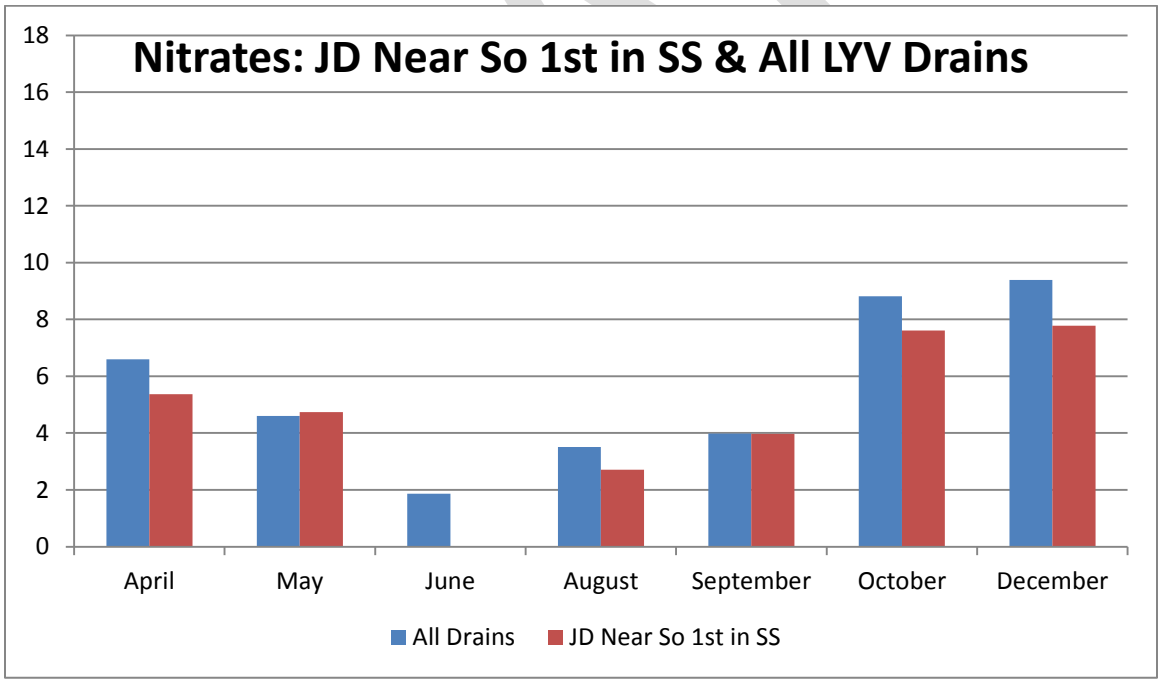

Nitrates: JD 28 Near Granger & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 28 Near Granger

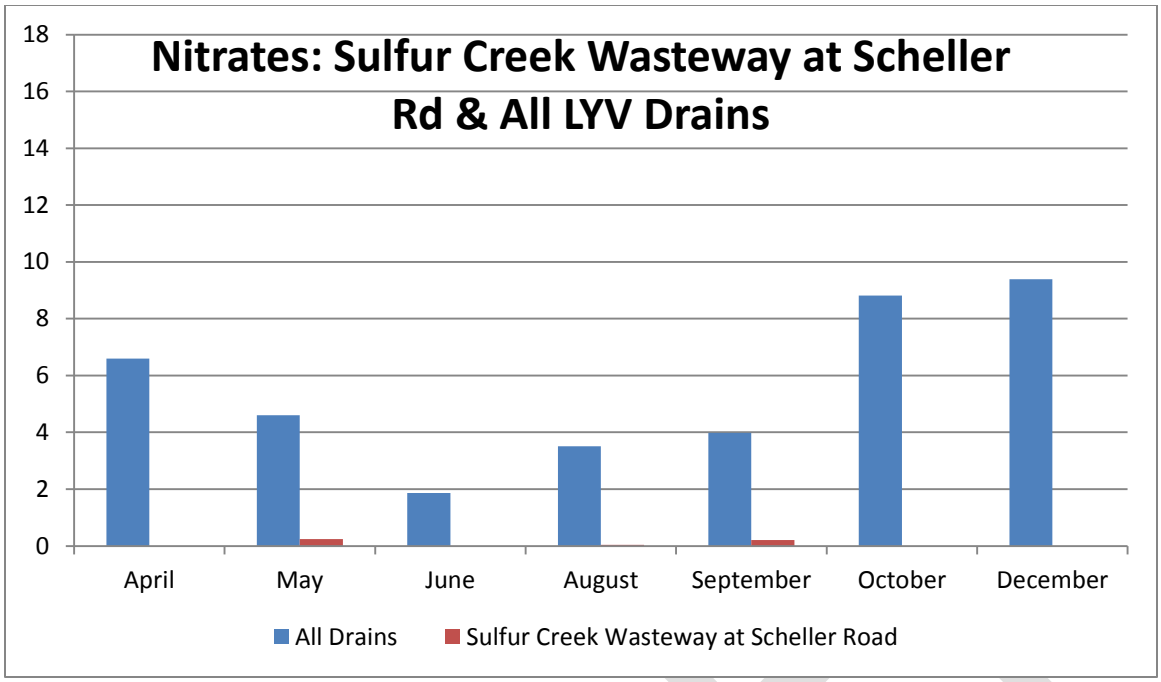

Nitrates: DR 2 NEET Site & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DR 2 NEET Site

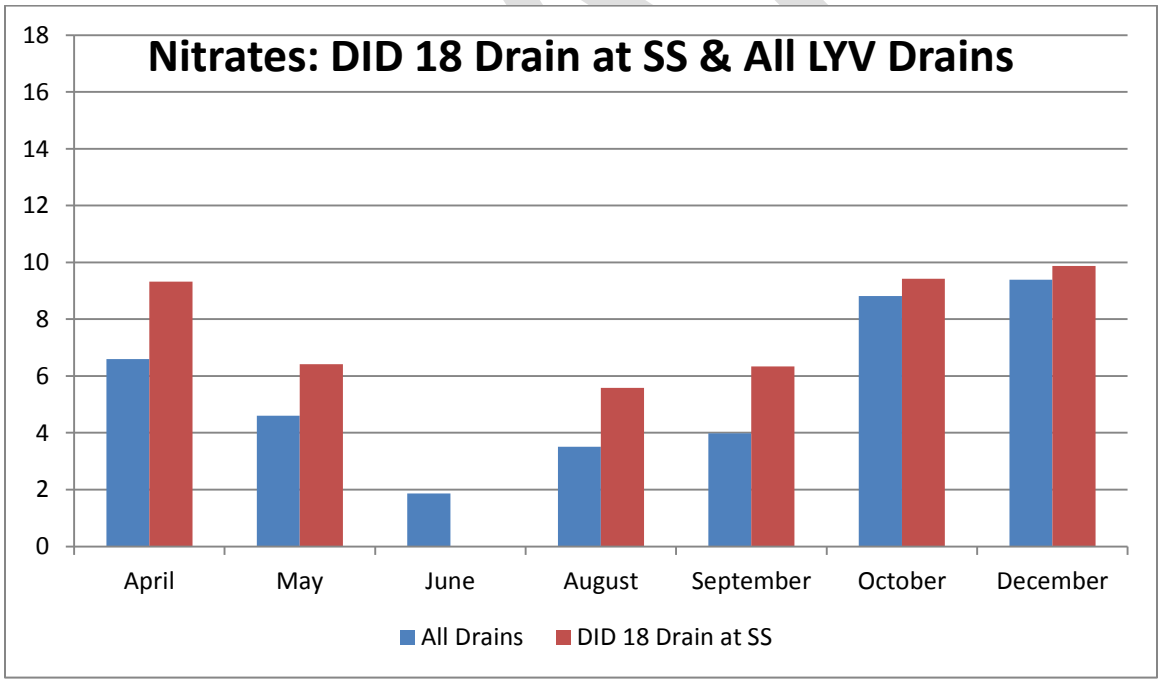

Nitrates: JD 32 at Outlook & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 32 at Outlook

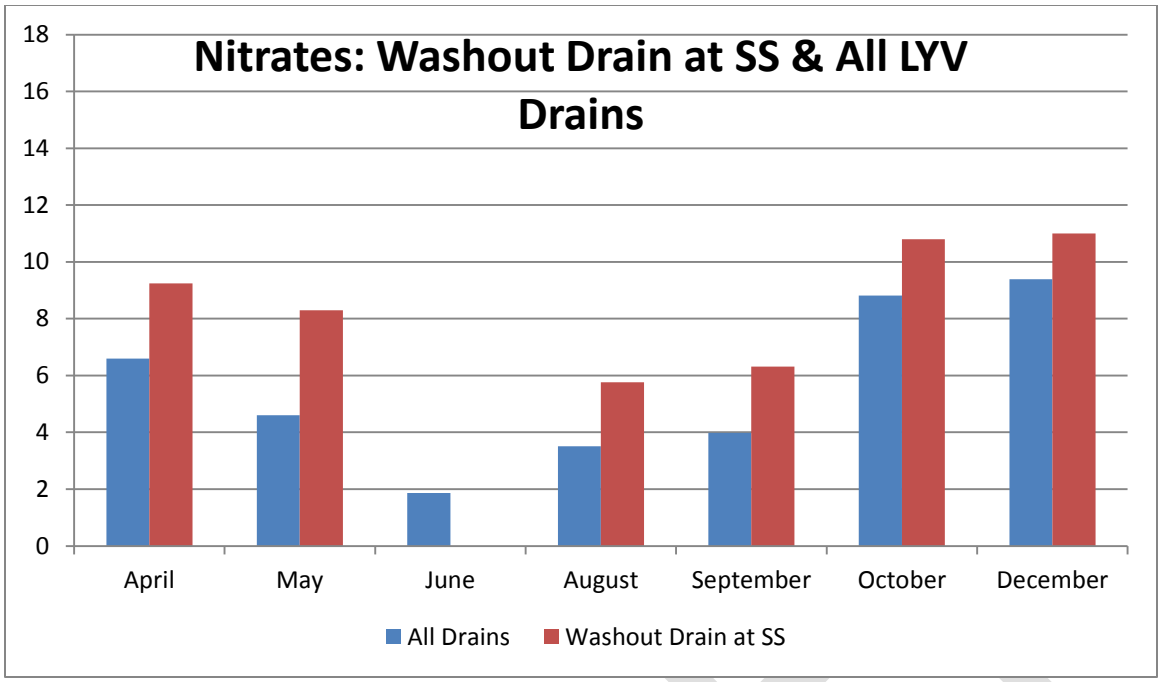

Nitrates: JD from Rougk Lane in SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD from Rougk Lane in Sunnyside

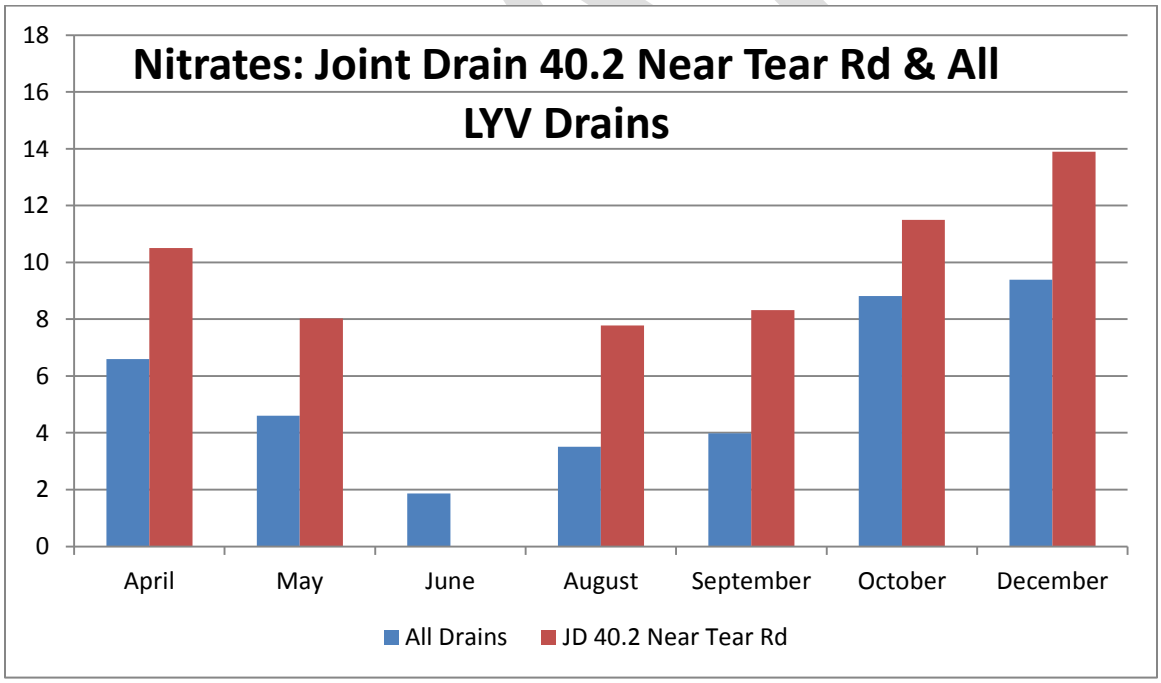

Nitrates: JD 34.2 at Woodin Road & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 34.2 at Woodin Rd

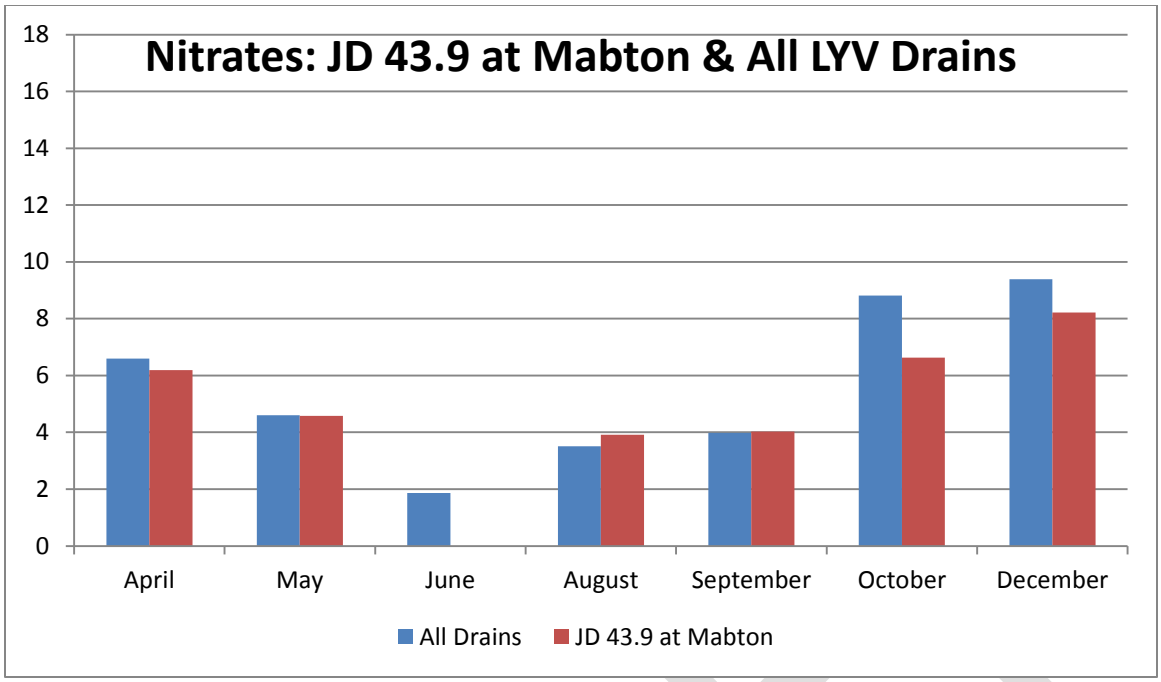

Nitrates: JD Near So 1st in SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD Near So 1st in SS

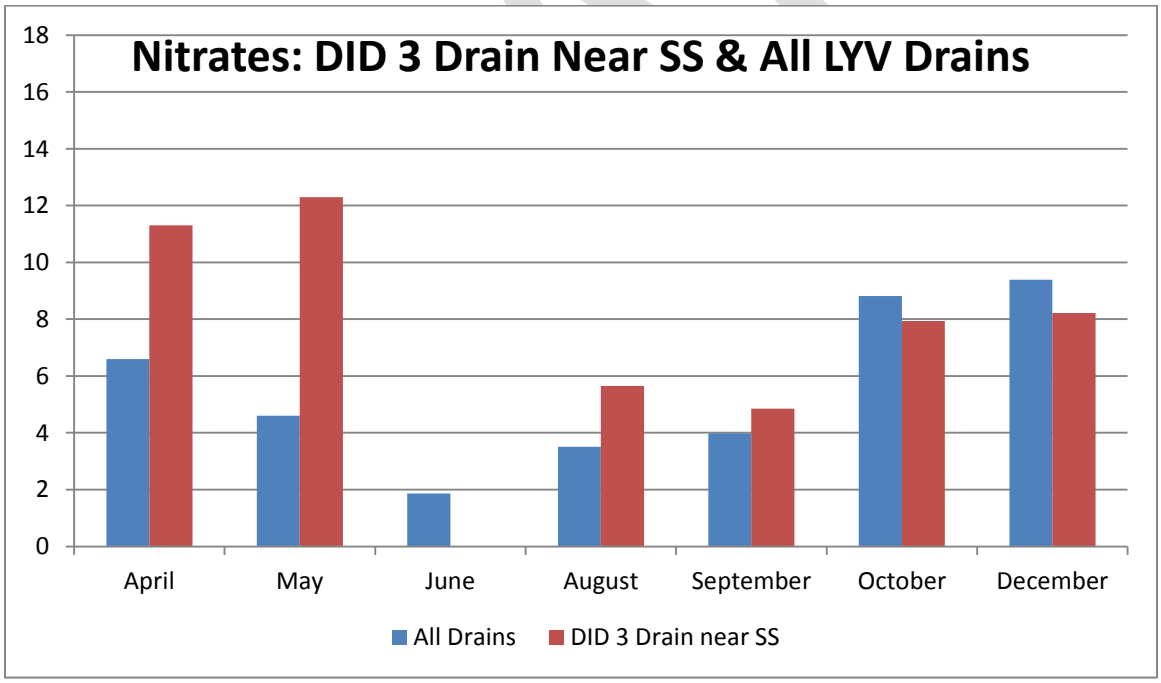

Nitrates: Sulfur Creek Wasteway at Scheller Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Sulfur Creek Wasteway at Scheller Road

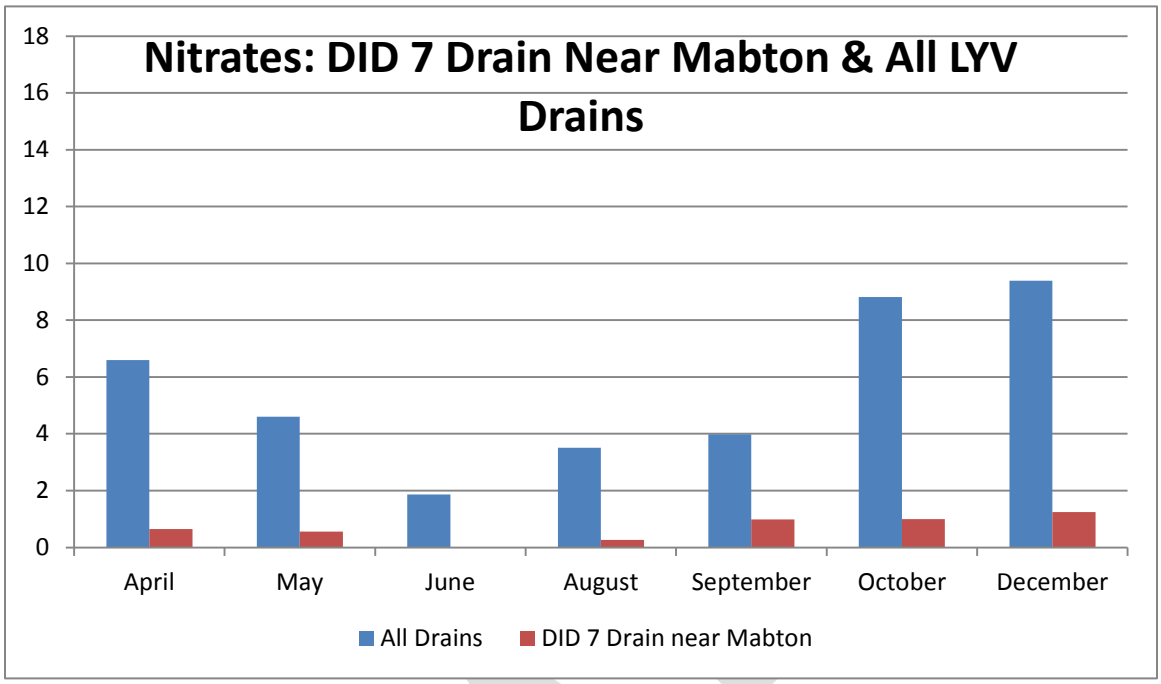

Nitrates: DID 18 Drain at SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DID 18 Drain at SS

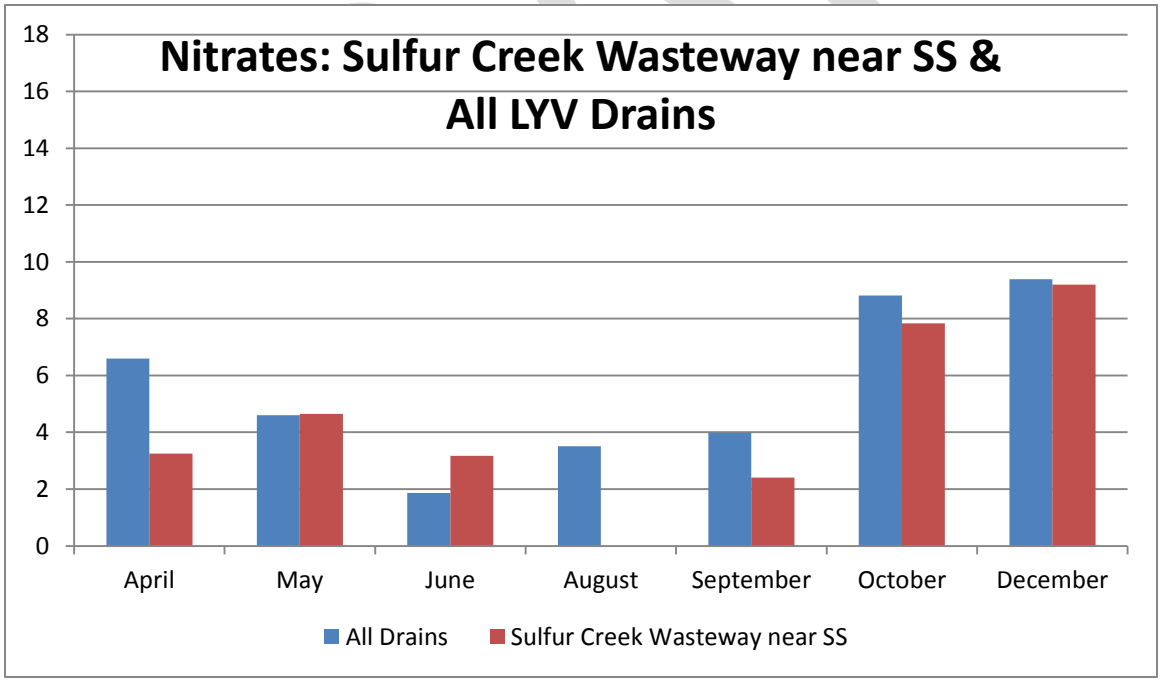

Nitrates: Washout Drain at SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Washout Drain at SS

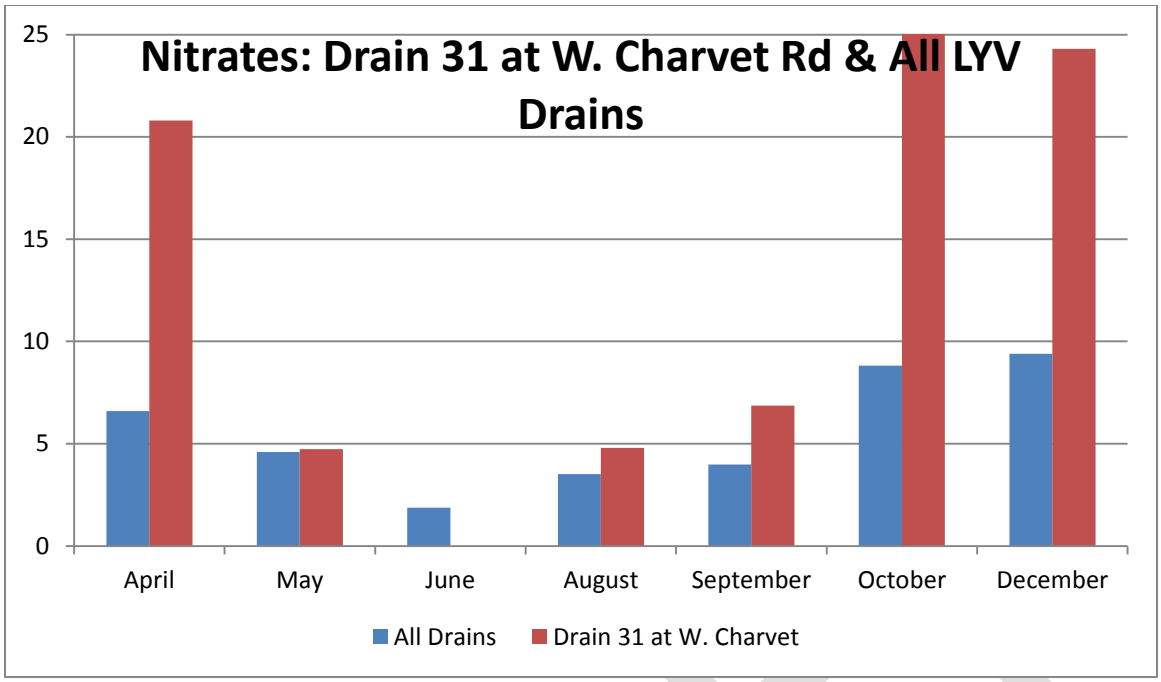

Nitrates: Joint Drain 40.2 Near Tear Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 40.2 Near Tear Rd


Nitrates: JD 43.9 at Mabton & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 43.9 at Mabton

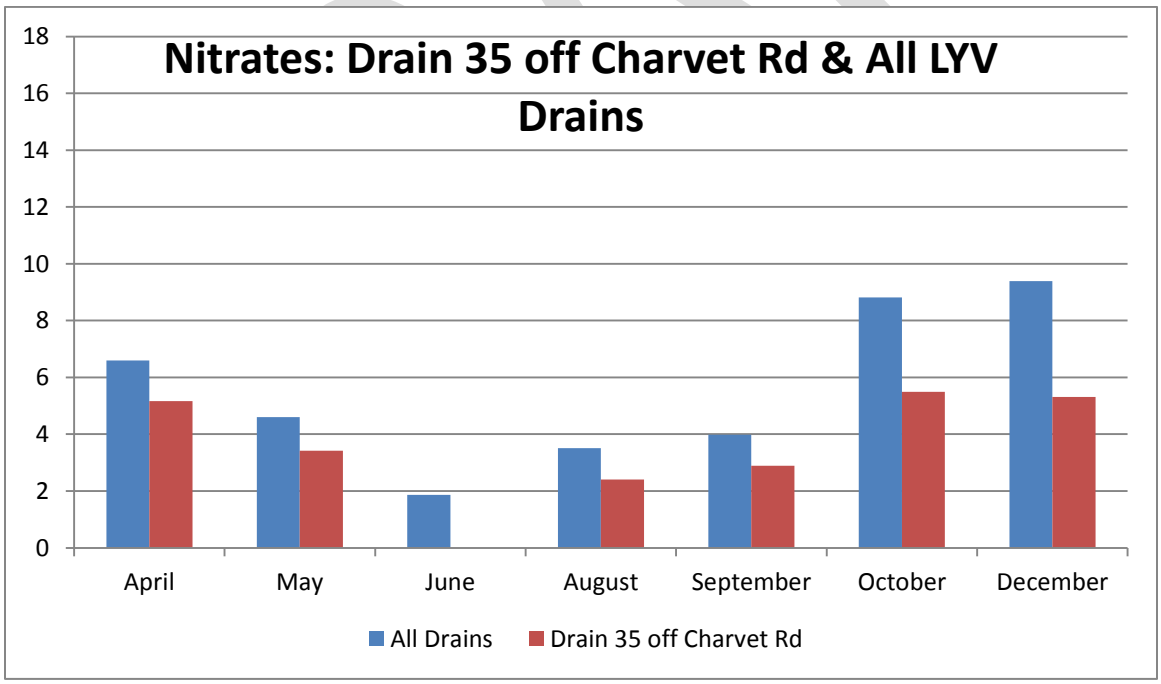

Nitrates: DID 3 Drain Near SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DID 3 Drain near SS

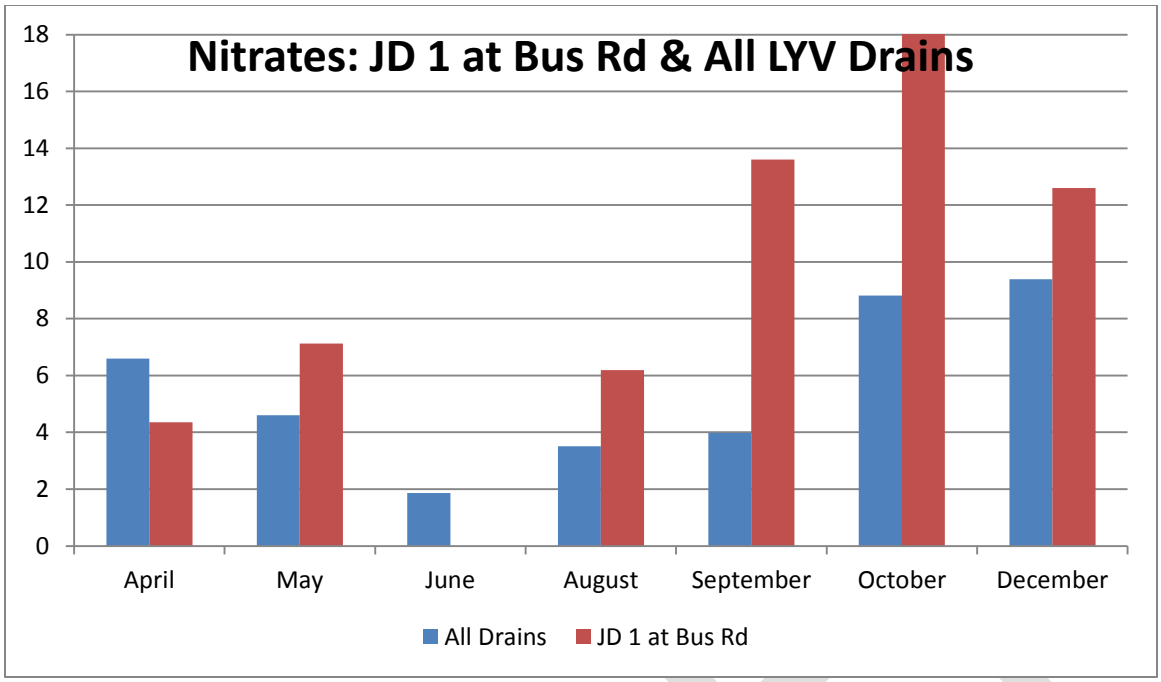

Nitrates: DID 7 Drain Near Mabton & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
DID 7 Drain near Mabton

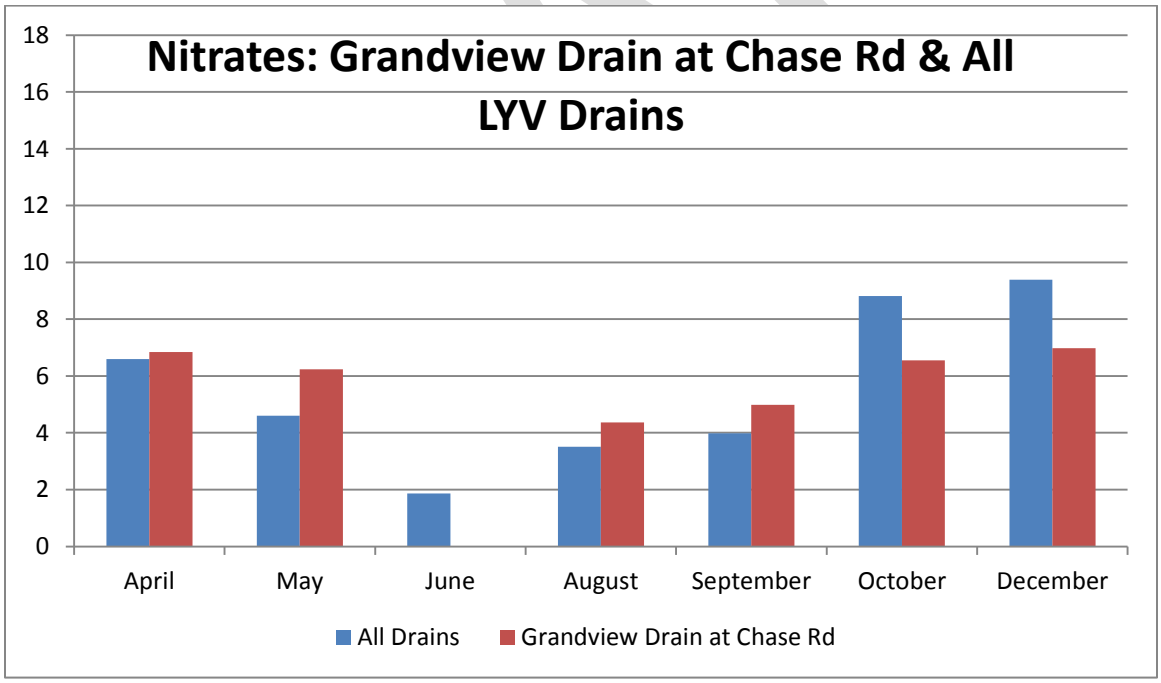

Nitrates: Sulfur Creek Wasteway near SS & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Sulfur Creek Wasteway near SS



(Note change in Scale)




Nitrates: JD 1 at Bus Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
JD 1 at Bus Rd


Nitrates: Grandview Drain at Chase Rd & All LYV Drains
18
16
14
12
10
8
6
4
2
0
April
May
June
August
September
October
December
All Drains
Grandview Drain at Chase Rd

Conclusions

Average nitrate levels for five well groupings are:

- North of Wapato – 0.50 mg/L
- Wapato to Toppenish – 4.00 mg/L
- Granger to Sunnyside – 8.62 mg/L
- Sunnyside to Mabton – 5.11 mg/L
- South of Mabton – 6.45 mg/L

Wells near the Yakima River had lower nitrate levels than those farther from the river

Wells in the area studied by the WA Agricultural Chemicals Pilot Project continue to have low nitrate levels

There was no overall correlation between well depth and nitrate levels

Drains in the northern study area had low nitrate levels

The highest drain nitrate levels were found in the area between Sunnyside and Mabton

Average nitrate levels in drains ranged from 0.01 mg/L to 13.07 mg/L

DRAFT

Last Updated on July 4, 2018

Relevant Agencies & Organizations

Nation to Nation

Yakama Nation http://www.yakamanation-nsn.gov/programs.php

Department of Natural Resources

> *The Department of Natural Resources was established to manage, co-manage and protect the Yakama Nation's Ancestral, Cultural, and Treaty Natural Resources on Reservation, in the Ceded Area and at Usual and Accustomed Sites, to meet the tribal culture, protecting tribal sensitive areas and sites and restoring diminished damaged resources.*

Engineering Program Department of Natural Resources Yakama Nation

> *Mission: Provide professional engineering and surveying services necessary to enhance and develop infrastructure that serves the collective needs of the Yakama Nation.*
>
> *Goals and Objectives: 1) Utilize existing contract funding and pursue additional funding to fulfill the stated mission of the Engineering Program. 2) Supervise the WIP General Engineer Program, Indian Reservation Roads contracts and other engineering and surveying contracts as awarded. 3) Improve communication between DNR Programs and assist in developing a shared vision for the appropriate utilization, preservation and enhancement of infrastructure and natural resources reserved by the Treaty of 1855.*

Water Code Administration

> *The Water Code operates according to Resolutions GC-01-93 and T-161-92; also enforces Resolution T-136-91 Hydraulic Code. The Water Code is responsible for the enforcement of the Yakama Nation surface and ground waters and all water rights for*

the Yakama Nation. The Water Code was amended by Tribal Council action in April 2005.

Water Resource Program

Mission Statement: *The mission of the Yakama Nation Water Resource Program is to protect, manage, restore and develop the water resources of the Yakama Nation in a manner that will protect the political integrity, economic security as well as the health and welfare of the tribe and its members.*

Federal Government

U.S. Bureau of Reclamation https://www.usbr.gov/pn/programs/yrbwep/index.html

In 1979, Congress directed the Bureau of Reclamation to conduct a feasibility study of the Yakima River Basin Water Enhancement Project. The congressional objectives of the YRBWEP study were to develop a plan that would provide supplemental water for presently irrigated lands, water for new lands within the Yakama Indian Reservation, water for increased instream flows for aquatic life, and a comprehensive plan for efficient management of basin water supplies.

Early in the YRBWEP study process, fish passage problems were identified as needing immediate early attention and congressional legislation in 1984 authorized YRBWEP Phase 1, which primarily involved rebuilding fish ladders and constructing fish screens on river diversions.

The YRBWEP study proceeded through the 1980s but was not fully completed primarily due to issues and uncertainties associated with the adjudication of the basin surface waters that began in 1978. Consequently, Congress passed legislation in 1994 for what is generally referred to as YRBWEP Phase 2. This legislation provided for significant water conservation and acquisition activities, studies to define the long-term water needs of fish and current irrigators, improvements to the Wapato

Irrigation Project, and development of an interim plan for management of basin water supplies.

The Yakima River Basin Water Enhancement Project (YRBWEP) Lower Yakima Valley Groundwater Work Group is studying storage. See https://www.usbr.gov/pn/studies/yakimastoragestudy/reports/07-11-044/Groundwater_Storage_Alternatives.pdf

The groundwater storage alternatives include surface recharge with passive recovery, municipal aquifer storage and recovery, and direct injection with passive recovery. These alternatives include placing water in the aquifer system and storing it to realize benefits in the form of increased streamflow from increased groundwater discharge, recovery of the stored water for out-of-stream uses, and/or replenishing depleted groundwater storage. The groundwater storage alternatives are conjunctive use tools in which the use of surface water and groundwater can be coordinated to minimize impacts to the hydrologic system and provide environmental benefits.

U.S. Geological Survey – Yakima River Basin Project
https://wa.water.usgs.gov/projects/yakimagw/

The Yakima River flows 215 miles from the outlet of Keechelus Lake in the central Washington Cascades southeasterly to the Columbia River, draining an area of 6,155 square miles. The Yakima River Basin is one of the most intensively irrigated areas in the United States. Population in the Yakima River Basin was about 238,000 in 1990.

Increasing demands for water for municipal, fisheries, agricultural, industrial, and recreational uses will affect the ground-water resources of the basin. A better understanding of the ground-water flow system and its relation to rivers and streams is needed to effectively manage the basin's water resources.

In cooperation with the U.S. Bureau of Reclamation, the Washington Department of Ecology, and the Yakama Indian Nation, the USGS is studying the ground-water system

in the Yakima River Basin and how it interacts with rivers and streams in the basin. The study includes data collection, mapping of hydrogeologic units and ground-water levels, and a computer numerical model to bring together all the information.

Environmental Protection Agency Region X – Lower Yakima Valley Groundwater
https://www.epa.gov/wa/lower-yakima-valley-groundwater

EPA is responding to community concerns in Washington's Lower Yakima Valley about high nitrate levels in residential drinking water wells and the potential for disproportionate impacts on low income and minority rural populations, local, state, and federal agencies collaborated to develop a Preliminary Assessment and recommendations for moving forward.

One of the recommendations was to develop new projects that could help to identify sources of the contamination in groundwater supplies.

In accordance with this recommendation, EPA conducted sampling in 2010 as part of a study to identify potential sources of nitrate contamination in local groundwater and residential drinking water wells. EPA issued a report in March 2013 entitled, Relation between Nitrate in Water Wells and Potential Sources in the Lower Yakima Valley. The study concluded that several dairies in the report were likely sources of elevated nitrate levels that were measured in residential drinking water wells downgradient of the dairies.

In December 2012 and January 2013 EPA installed and sampled 10 groundwater monitoring wells in the vicinity of the Yakima Valley dairies that were included in the 2010 study. Data collected by EPA from the monitoring wells confirmed that that the dairies are a source of nitrate contamination to the groundwater beneath and downgradient of these dairies. More recent and extensive data collected by the dairies under the Consent Order affirm this conclusion.

Natural Resources Conservation Service
https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/

As the leading Federal agency for assisting in restoring watershed health on private land, NRCS provides technical and financial assistance to producers who implement conservation practices and management strategies, including the restoration and protection of wetlands, that benefit water quality and improve water management. The science behind the implementation of these conservation practices and management strategies is developed and supported by the NRCS Science and Technology Divisions, National Technical Support Centers, the Water and Climate Center, and the Wetlands Team, who are continually developing new tools to, among other things, improve snowmelt prediction capabilities, improve current conservation practice technology, improve models to track nutrients, and improve irrigation efficiency so that agricultural producers can more efficiently use water, increase water storage, and protect water quality by minimizing the potential loss of sediment and nutrients from their operations by applying science based conservation practices.

Washington State

WA State Dept of Ecology

Groundwater https://ecology.wa.gov/Research-Data/Monitoring-assessment/Groundwater-quality-assessment/Active-studies-index/Lower-Yakima-Valley

Our staff provide ongoing technical assistance, monitoring, research, and education and outreach to help find strategies to improve groundwater quality in the Lower Yakima Valley.

Led by Yakima County, the program was initiated in response to nitrate contamination found in drinking-water wells in the valley. The goal is to implement strategies to bring aquifers into drinking water standards, as well as educate citizens about the problem and provide information on how they can protect themselves. Additional information about the Lower Yakima Valley GWMA is available on our Lower Yakima Valley groundwater quality page.

Solid Waste/Composting/Bio-solids https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Solid-waste-permits

> *As directed by RCW 70.95.060, we adopt standards for solid waste facilities, while local jurisdictional health departments (county, regional, or local health departments or districts) have primary oversight of solid waste facilities and issue permits and enforce the standards. Under RCW 70.95.160, health departments must adopt regulations that are at least as stringent as state standards, or may adopt more stringent standards. Because of this, it is important for any person or business planning to manage solid waste to first contact the health department where the facility is located to discuss local permit application standards and fees.*

National Pollution Discharge Permitting https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-permits/Water-Quality-general-permits

> *General water quality permits regulate specific discharge categories that release treated stormwater or wastewater to either surface or groundwater.*
>
> *Categories of general permits include:*

- *All stormwater permits*
- *Aquatic pesticide permits*
- *Boatyard Permit*
- *Bridge & Ferry Terminal Washing Permit*
- *Concentrated Animal Feeding Operation Permit*
- *Construction Stormwater Permit*
- *EPA Vessel Permit (greywater)*
- *Fresh Fruit Packing Permit*
- *Industrial Stormwater Permit*
- *Municipal Stormwater Permit*
- *Sand & Gravel Permit*
- *Upland Fin Fish Permit*

- *Vessel Deconstruction Permit*
- *Water Treatment Plant General Permit*
- *Winery General Permit*

Concentrated Animal Feeding Operation General Permit
https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Concentrated-animal-feeding-operation

> *We issue the Concentrated Animal Feeding Operation (CAFO) General Permit to operations that confine livestock for long periods of time in pens or barns and discharge pollution to surface or groundwater.*
>
> *You must get this permit if you:*
>
> - *Confine livestock in pens or barns for 45 days or more during the year.*
> - *Discharge from your operation.*
>
> *There are two CAFO permits:*
>
> - *A state permit that only covers groundwater discharges.*
> - *A federal permit that covers discharges to surface and groundwater.*

Fresh Fruit Packing General Permit https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Fresh-fruit-packing-general-permit

> *This permit outlines uniform conditions and treatment, discharge, and disposal methods for fresh fruit packing wastewater based on the similarities of wastewater characteristics among facilities.*
>
> *The combined State Waste Discharge Permit and National Pollutant Discharge Elimination System Permit (NPDES) provides assurance that fruit packers are protecting nearby lakes, rivers, and groundwater when managing the wastewater coming from their facilities.*

The current permit went into effect Sept. 1, 2016 and expires Aug. 31, 2021.

Winery General Permit https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Winery-permit

Washington is the second-largest wine-producing state in the nation. If not properly managed, corrosive wastewater from wineries can potentially harm aquatic life and even people.

Washington's first Winery General Permit regulates discharges of process wastewater from wineries to land, groundwater, and wastewater treatment plants. No surface water discharges are allowed under this permit.

The permit was issued on May 17, 2018, goes into effect on July 1, 2019, and expires on July 1, 2024.

Memorandum of Understanding between Ecology and WSDA
https://agr.wa.gov/FP/Pubs/docs/MOUAgricultureEcology2011Final.pdf

The Washington State Department of Ecology (Ecology) and the Washington State Department of Agriculture (WSDA) enter into (MOU) for the purpose working towards the shared goal of using their respective authority and resources as efficiently and effectively as possible to assure water quality compliance relative to livestock activities.

With this MOU, Ecology and WSDA will identify the areas that are the responsibility of each agency and in cases where the two agencies share responsibilities specify how they will coordinate and work together. The agencies are authorized for implementing water quality activities under Chapter 90.48 RCW and Chapter 90.64 RCW.

WA State Dept of Agriculture

Natural Resources Assessment Section
https://agr.wa.gov/pestfert/natresources/default.aspx

> *The activities of the Washington State Department of Agriculture (WSDA) Natural Resources Assessment Section (NRAS) focus on the impacts of agriculture chemicals on Washington State's natural resources.*
>
> *The goal of WSDA is to work together with the agricultural community and regulators to protect Washington's natural wealth and the environment.*
>
> *WSDA is developing analytical tools that will be used to identify, evaluate and mitigate impacts to Washington's renewable and non-renewable resources.*
>
> *Staff includes a hydro-geologist; an environmental toxicologist; specialists in crop and pesticide use, crop mapping and groundwater.*

Dairy Nutrient Management Program https://agr.wa.gov/FoodAnimal/Livestock-Nutrient/

> *Dairy Nutrient Management is a water quality program administered by Washington State Department of Agriculture under Chapter RCW 90.64, Dairy Nutrient Management Act. Elements of the program are managed in conformance with a Memorandum of Understanding with the Washington State Department of Ecology. Ecology is the delegated agency in Washington for the Federal Clean Water Act.*
>
> *Washington's Dairy Nutrient Management Act requires all licensed cow dairies to develop and implement nutrient management plans , register with WSDA, and participate in a program of regular inspections and compliance.*
>
> *Mission:*
>
> - *Protect water quality from livestock nutrient discharges*
> - *Help maintain a healthy agricultural business climate*

Tools:

- *Clear guidance, education, and technical assistance*
- *Equitable enforcement of state and federal water quality laws*
- *Good communication with industry, related agencies, and other stakeholders*

Commodity Commissions

Washington State's 22 agricultural commodity commissions [PDF 38kB] are engaged primarily in marketing and/or research related to a specific commodity. They are funded by producer assessments and vary in size and activity.

The Director of Agriculture is a board member of each commission and has specific duties related to commissions.

WA State Apple Commission https://bestapples.com/

WA State Dairy Products Commission https://wadairy.org/

WA State Fruit Commission http://www.wastatefruit.com/

WA State Hops Commission

WA State Mint Commission

WA State Dept. of Health

Drinking Water Systems
https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater

> *More than 6.2 million Washington State residents, 85 percent of the state's population, get their drinking water from public water systems. Public water systems and their water works operators are our first line of defense against contaminants getting into our public water supply and people getting sick.*

The Drinking Water Systems website above provides access to water testing data from all regulated systems. WA DOH does not regulate private water wells.

Washington Tracking Network https://fortress.wa.gov/doh/wtn/WTNPortal/

Provides statistical data on:

- *Climate and Health*
- *Community*
- *Environment*
- *Exposure*
- *Health*

Health Equity https://www.doh.wa.gov/CommunityandEnvironment/HealthEquity

Are you interested in learning more about how place can impact health? We have a new tool that allows you to look up Washington State information by location, including:

- *Health outcomes.*
- *Social determinants of health.*
- *Economic determinants of health.*

This interactive tool can be used to identify health disparities in a community, but should not be used to diagnose a health issue or label a community. Visit the Washington Tracking Network IBL Mapping Tool for health disparities information.

WA State Dept of Fish and Wildlife https://wdfw.wa.gov/

Mission and Goals

Our Mission: To preserve, protect and perpetuate fish, wildlife and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities.

WDFW defines "Conservation" as: Protection, preservation, management, or restoration of natural environments and the ecological communities that inhabit them; including management of human use for public benefit and sustainable social and economic needs.

Department Goals: To achieve its mission, WDFW will continue to focus its activities on the following four goals:

Goal 1: Conserve and protect native fish and wildlife

Goal 2: Provide sustainable fishing, hunting, and other wildlife-related recreational and commercial experiences

Goal 3: Promote a healthy economy, protect community character, maintain an overall high quality of life, and deliver high-quality customer service

Goal 4: Build an effective and efficient organization by supporting our workforce, improving business processes, and investing in technology

South Central Region 3:

This region offers more than 400,000 acres of department owned land, all of which is open for public recreation. The department has also secured hunter access to an additional 180,000 acres of private land. These lands offer good to excellent hunting prospects for upland birds, waterfowl, and big game.

WA State Conservation Commission http://scc.wa.gov/

The Washington State Conservation Commission (SCC) is the coordinating state agency for all 45 conservation districts in Washington State. Together, the SCC and conservation districts provide voluntary, incentive-based programs that empower private landowners to implement conservation on their property.

The SCC was created by the legislature in 1939 (RCW 89.08.070) to support conservation districts through financial and technical assistance; administrative and operational oversight; program coordination; and promotion of district activities and services.

Local Agencies & Government

Yakima County – Lead Agency for the LYV GWMA
https://www.yakimacounty.us/766/County-Commissioners-Office

Responsibilities
All Yakima County Elected Officials are responsible for the administration and operation of their respective and independent departments. The Board of County Commissioners is responsible for the overall executive administration of Yakima County government.

As an elected board, the County Commissioners are responsible for direct oversight of the following County operations: Public Services, Department of Corrections, Human Resources, Technology Services, Purchasing, Grants Management, Financial Services and Department of Assigned Counsel. The county is divided into 3 districts on the basis of population. At the time of election each commissioner must live in and represent his/her district. The commissioners are partisan and are nominated in a primary election by voters in their particular district. All the voters in the county are given an opportunity in the general election to vote for the commissioner who will ultimately serve the 4-year term.

Further Duties
In addition to the oversight of these departments, the Board's duties include adopting and enacting ordinances and resolutions, levying taxes and establishing county policies. As the County's legislative authority, the Board is responsible for adoption of the annual budget, provision and maintenance of public facilities, construction and

maintenance of County roads, development and implementation of planning and zoning policies, and appointments to advisory boards and commissions.

Lower Yakima Valley Groundwater Management Area
https://www.yakimacounty.us/541/Groundwater-Management-Area

The purpose of the Groundwater Management Area is to reduce the nitrate contamination concentrations in groundwater below state drinking water standards.

Yakima County Voluntary Stewardship Program
https://www.yakimacounty.us/1657/Voluntary-Stewardship-Program-VSP

The Voluntary Stewardship Program (VSP) is an optional, incentive-based approach to protecting critical areas while promoting agriculture. The VSP is allowed under the Growth Management Act as an alternative to traditional approaches to critical areas protection, such as "no touch" buffers. Yakima County is one of 27 counties that has "opted in" to VSP, and has received funding to develop a VSP work plan. The VSP is locally prepared and monitored at a watershed scale by agricultural and environmental stakeholders participating in a VSP Work Group; the VSP is voluntarily implemented by individual agricultural producers to protect critical areas and improve agricultural viability through conservation practices. Unnecessary regulations are avoided.

Yakima Health District https://www.yakimacounty.us/275/Health-District

Services Mandated By State Legislature

- *Communicable Disease Control Prevention and Treatment Services*
- *Tuberculosis Services*
- *Sexually Transmitted Disease Services*
- *Water and Vector-borne Disease Services*
- *Food Service Licenses, Inspection and Certification Programs*
- *Vital Statistics Services*

- *Solid and Hazardous Waste Services*
- *Water Recreation Inspection Services*
- *Waste Water Treatment Services*
- *School Sanitation Inspection Services*
- *Food Handler Education and Certification*
- *General Sanitation Inspection/Control*
- *Such other services as mandated by State Board of Health*

Yakima County Water Conservancy Board https://www.yakimacounty.us/1042/Water-Conservancy-Board

> *The Board rules on applications for volunteer water rights transfers. All decisions are subject to review by the Department of Ecology.*

Yakima County Extension Service https://extension.wsu.edu/yakima/

> *Yakima County Extension is part of the world-class outreach and engagement enterprise of Washington State University. We partner with local agencies, businesses, our community, and volunteers to drive innovation, invention and technology transfer. We specifically focus on expanding the problem-solving capacity of communities within the county, enhancing and sustaining the local economy, enhancing natural resources and the environment, enhancing economic opportunities for agriculture and eliminating barriers to success for youth and families.*

City of Grandview https://grandview.wa.us/

Population: 10,862

Annual Budget for 2018: $6,026,255.00

Port of Grandview http://portofgrandview.org/

The Port is in the middle of the fruitful orchards, vineyards, and farmlands of the Yakima Valley, and the Port's mission will become to provide support and development for the food-processing industry and to encourage other industries to locate in the Grandview region.

The Port's main goal from the beginning was to acquire and develop land for industrial and business use. In 1998, the Port purchased the Stover Road Development Site. This 50-acre site on the west side of Grandview contains 17 lots ranging from 11 acres to one acre.

In 1999, the Port acquired the 44-acre Wallace Way Development Site, also on the west side of Grandview. The Port developed it with the infrastructure necessary for industrial use, including rail access.

City of Granger http://www.grangerwashington.org/

Population: 3,905

Annual Budget for 2018: $1,335,064.00

City of Mabton https://www.cityofmabton.com/

Population: 2,230

Annual Budget for 2018: $5,300,100.00

City of Sunnyside http://www.ci.sunnyside.wa.us/

Population: 15,858

Annual Budget for 2017: $30,813,531.00

Port of Sunnyside https://www.portofsunnyside.com/

> Organized in 1964 by a vote of the people, the Port of Sunnyside is governed by a three-member Port commission and administered by an executive director. Currently the Port employs 16 full-time employees. Included in the Port's sources of revenue are: leases of various Port properties and buildings, Industrial Waste Water Treatment Plant. Currently, there are 13 industries located at the Port of Sunnyside, employing 635 people.

Roza Irrigation District http://www.roza.org/

Sunnyside Irrigation District http://www.svid.org/

> *SVID is the largest entity in the Sunnyside Division which encompasses all lands served by the Sunnyside Canal. The Sunnyside Division serves 94,614 irrigable acres and is comprised of Sunnyside Valley Irrigation District, two ditch companies Konowac Ditch Company and Piety Flat Ditch Company and five cities Zillah, Granger, Sunnyside, Grandview and Prosser. SVID provides irrigation service to roughly 92,000 acres with mostly senior, non-proratable rights. The Sunnyside Division has, in the aggregate, 2/3 senior or non-proratable rights and 1/3 junior or proratable rights.*

Roza-Sunnyside Board of Joint Control http://www.roza.org/governance/rsbojc/

> *The RSBOJC's mission is to "implement a program to enhance water supplies by supporting storage development, improving water quality, and increasing management efficiency". The RSBOJC's goal is to achieve the following within ten years:*

- *System improvements such as canal automation, regulatory reservoirs, and J/B enclosed conduit delivery systems and additional storage which will protect existing rights while providing higher quality and more reliable irrigation service to Sunnyside Division landowners*
- *Water savings sufficient to support the goal of furnishing at a minimum, 75% of entitlement to Roza Irrigation District landowners in all years*
- *Compliance with the total maximum daily load process for return flows discharging from lands under Roza-Sunnyside Board of Joint Control jurisdiction*

South Yakima Conservation District http://www.sycd.us/

The South Yakima Conservation District is a political subdivision of the State of Washington that seeks, utilizes, and coordinates assistance from all available sources. We are authorized under provisions of the Washington State Soil and Water Conservation District Law, Chapter 89.08 in the revised code of Washington (RCW).

Our primary goal is to promote the wise use, development, and conservation of our renewable natural resources in our district by providing assistance to local landowners to solve conservation resource problems.

South Yakima Conservation District was organized and chartered by the State of Washington September 24, 1974. It was a consolidation of the former Toppenish District whose name changed from Wapato (1949) and Lower Yakima Valley District (1947).

The Conservation District is governed by a Board of Supervisors. The five Supervisors are local residents who serve voluntarily without pay. Three Supervisors are elected by local citizens and two Supervisors are appointed by the Washington State Conservation Commission.

Yakima Valley Conference of Governments https://www.yvcog.org/about-us/

> *Governed by an Executive Committee of 6 local elected officials and 1 member at large, the YVCOG is a membership organization that is funded by Federal, State, local resources, member dues, and professional service contracts. Founded in 1966, the YVCOG provides a forum for our members to address regional issues for 14 cities and Yakima County. We are a regional agency with the ability to conduct any activity that can be legally assigned or contracted to perform projects of mutual concern under the Interlocal Cooperation Act.*

Institutions of Higher Learning

Washington State University College of Agriculture Human and Natural Resource Sciences https://cahnrs.wsu.edu/about/

> *Learning: With 16 academic units, 4 research and extension centers, and 40 county and tribal Extension offices distributed across the state, our regional presence is the largest of any college at WSU.*
>
> *Our 550 faculty and 700 staff embody excellence in teaching, practical training, and pivotal research.*
>
> *The CAHNRS mission: each and every one of our close to 3,000 undergraduate and graduate students leave equipped with the knowledge base, experience, and interpersonal communication skills to be job ready, day one.*
>
> *Research: CAHNRS students work with renowned faculty committed to the training of future scientists. They pursue meaningful research projects, and they extend science to serve communities at home and around the world.*
>
> *Research at CAHNRS is as diverse as the communities, businesses, agriculture systems, natural resources, and landscapes of Washington state. Our strong, dynamic research*

engine helps to feed a growing population, protect the natural resources we rely on for food, water, and energy, and create greater capacities for resilience in the face of change.

Extension: Extension is about giving everyday people exceptional tools to thrive in a world that is constantly changing.

For over 100 years, Extension has provided educational, personal, and professional development opportunities throughout the state—impacting lives in ways that few other organizations can. Because of these efforts, communities, organizations, and individuals are able to solve local issues and improve their futures.

Biological Systems Engineering https://bsyse.wsu.edu/

From solar drying and pasteurization research in the 1970's to today's emphasis on biological waste analysis and treatment, chemical transport through soils, food engineering, bioenergy, bioproducts, and more, our department has a long history of technical environmental stewardship, research, and education.

Community and Economic Development https://ced.cw.wsu.edu/about/

CED activities focus on promoting local business expansion and retention; increasing transfer funds within a local economy (such as tourism dollars and retirement dollars); economic analysis; and increasing exports and local entrepreneur development. In addition, efforts include programs that result in local leadership development and effective community non-profits. In undertaking this work, CED has a number of special emphases.

Crop and Soil Science http://css.wsu.edu/

Soils are everywhere. We walk on them, eat food grown on them, and enjoy the aesthetic things that they support such as ornamental plants and wildlife habitats. And soils are as complex at the different aspects of our lives as they support.

Our faculty works across all of the diverse aspects of soil science (soil biological, chemical, and physical processes; soil as a supplier of water and nutrients to plants, a host to an array of living organisms, and natural and imposed events can degrade soils). We do this in concert with the broad array of animal and crop production systems in our state to support economically and environmentally sustainable practices.

Extension Economics http://ses.wsu.edu/extension/

Community and Regional Economics

Washington is the most export reliant state in the country. Many development projects have an outward component. Thus regional development is intertwined and connected to the global economy.

Health Economics

Projects in health extension economics include studies on maternal work status and infant feeding practices, obesity and child nutrition, and mental health among older individuals due to job loss.

Environmental & Natural Resources

This site contains applied economics studies focusing on a diverse array of environmental and natural resources issues in the State of Washington

Specialty Crop Economics

This site contains information on extension economic studies focusing on a diverse array of specialty crops produced in Washington State.

Livestock Economics

Economics-oriented extension programming for livestock producers and industries. Program focuses on applied economics related to record keeping and financial analysis; cost of livestock diseases and their control; value-added enterprises; and environment interactions such as waste management, and grazing issues.

Tree Fruit Economics

Washington State is blessed by climate as one of the top tree fruit producing regions in the world. However, the world market for tree fruits is highly competitive. Effective economic knowledge is integral to both the Washington growers' profitability and consumers' satisfaction.

Wheat and Small Grains

This site includes updates and analyses of the marketing and economics issues of Washington produced wheat and small grains.

University of Washington School of Public Health - #3 Ranked School of Public Health in the World http://sph.washington.edu/

Our Vision: Healthy people in sustainable communities – locally, nationally, and globally.

The UW School of Public Health is grounded in teaching, research, and service. Our 10,000 graduates have gone on to transform communities, lead health organizations, and find solutions to emerging public health challenges.

Leading-edge student experience

Our major departments are Biostatistics, Environmental and Occupational Health Sciences, Epidemiology, Global Health, and Health Services.

We offer interdisciplinary programs in Health Administration, Maternal and Child Health, Nutritional Sciences, Pathobiology, and Public Health Genetics. Our more than 40 centers and institutes bring together faculty from throughout the School to collaborate and do research across disciplines.

Center for One Health Research http://deohs.washington.edu/cohr/

> *The growing recognition of the links between human health, animal health, and the environment requires new tools for cooperation and collaboration between professionals working in these sectors.*
>
> *Such transdisciplinary "One Health" approaches demand further development of a common body of knowledge and a common scientific and clinical vocabulary for understanding and controlling diseases affecting both human beings and animals that often are related to shared environmental exposures.*
>
> *Emerging infectious diseases such as SARS, West Nile Virus infection, and avian/swine influenza have focused attention on infectious diseases that cross between animals and human beings; many of these diseases are manifestations of important environmental changes related to land use, climate change, intensification of food production, and other factors. Therefore, preventing such diseases must involve creating and maintaining healthy environments. Other environmental health risks that may be shared by human beings and animals include toxicants, allergens, and psychosocial issues. Working to improve such environments is a complex process that involves both professionals and communities.*

Center for Child Environmental Health Research http://deohs.washington.edu/chc

> *Working to understand the mechanisms that define children's susceptibility to pesticides and air pollution. Identifying the implications of this susceptibility for developmental and learning trajectories, and partnering with our communities to translate our findings into risk communication, risk management and public health prevention strategies.*

Northwest Agricultural Safety and Health Center http://deohs.washington.edu/pnash/

The Pacific Northwest Agricultural Safety and Health Center conducts research and promotes best health and safety practices for Northwest producers and workers in farming, fishing and forestry. Affiliated with the UW School of Public Health, PNASH integrates expertise from multiple disciplines, institutions and community partners. Areas of emphasis include new production technologies and the needs of under-served and vulnerable populations.

Pediatric Environmental Health Specialty Unit http://deohs.washington.edu/pehsu/

Exposures from the environment can have significant and potentially lifelong health consequences. Environmental exposures of concern include biological, chemical, and radiological hazards, both naturally occurring and as a result of human activity. Children are especially at risk because exposures can interfere with their rapid ongoing development. In addition, children are at increased risk for certain exposures due to their behaviors, such as crawling on the ground, putting their hands and other objects in their mouths, or eating paint chips or other non-food items. Children also breath more air, drink more water, and eat more food per pound of body weight than adults, increasing their potential level of exposure. Fortunately, much can be done to protect children by identifying and eliminating or minimizing any ongoing exposures of concern and avoiding future exposures.

Pediatric Environmental Health Specialty Units (PEHSU) is a national network of academically based specialists dedicated to providing expertise to clinicians, public health professionals, policy-makers, and the public on environmental factors that influence children's health. The Northwest PEHSU:

- *Is an academically based, nonprofit agency that offers its services at no cost. It is funded by the U.S. Environmental Protection Agency (EPA) and the Agency for Toxic Substance and Disease Registry (ATSDR).*
- *Serves the EPA's Region 10, which consists of Alaska, Idaho, Oregon, and Washington*

- *Was established in 1997 with the Department of Environmental and Occupational Health at the University of Washington in Seattle, WA.*
- *Has a staff of seven, including two pediatricians who specialize in environmental medicine, a medical fellow and public health professional, two nurse/public health consultants, an industrial hygienist, and a program coordinator.*
- *Our mission is to improve reproductive and pediatric environmental health outcomes by:*
    - *Increasing knowledge and awareness about environmental health issues through training, outreach, and education*
    - *Offering consultation services to assist healthcare professionals with the recognition, management, and prevention of environmentally related health conditions in children and in adults of reproductive age*
    - *Providing evidence-based medical information and advice to public health professionals, clinicians, policy-makers, individuals, and communities*

El Proyecto Bienestar http://deohs.washington.edu/pnash/pnash/epb

> *El Proyecto Bienestar (EPB) or, Well Being Project, is a long standing community health intervention effort guided by a Yakima Valley community advisory board and a partnership of: The University of Washington; Northwest Communities Education Center/Radio KDNA; Heritage University; Yakima Valley Farm Workers Clinic*

Heritage University Environmental Studies http://www.heritage.edu/academic-paths/undergraduate-degrees/environmental-studies/

> *The Environmental Science program at Heritage University prepares students for careers that deal with complex environmental issues like air and water quality, conservation, watershed management, and natural resources planning. Emphasizing*

biology, chemistry, and geology, the program examines Earth's ecosystems, climate changes and effects on the environment by human activities.

Students in the program complete research projects and internships with top environmental agencies and programs such as the U.S. Department of Agriculture, U.S. Forest Service, the Environmental Protection Agency and major research universities. Upon completion of this program, students can apply their skills to a variety of careers within industry, nonprofit organizations and government as well as take advanced graduate studies in environmental sciences.

Agricultural Associations

Washington State Farm Bureau https://wsfb.com/

Farm Bureau is a voluntary, grassroots advocacy organization representing the social and economic interests of farm and ranch families at the local, state and national levels. By providing leadership and organizational skills, Farm Bureau seeks to gain public support on the issues affecting farm and ranch families.

Washington State Dairy Federation http://wastatedairy.com/#

The Washington State Dairy Federation develops and promotes initiatives directed toward the financial strength, political support, and public awareness of our industry to achieve a successful business climate for dairy farmers in Washington State.

Environmental Groups

Community Association for the Restoration of the Environment

A 501 (C) (3) non-profit group that has led the fight against water and air pollution in the Lower Yakima Valley since the 1990's. In the early years CARE won a landmark

lawsuit that funded the VIRE study and cast a spotlight on pollution of the Granger Drain

Concerned Citizens of the Yakama Reservation

CCYR is composed of residents from the Yakama Reservation who came together to advocate for policy change and resist pollution from dairies and feedlots in their communities

Friends of Toppenish Creek http://www.friendsoftoppenishcreek.org/

Friends of Toppenish Creek is dedicated to protecting the rights of rural communities and improving oversight of industrial agriculture. FOTC operates under the simple principle that all people deserve clean air, clean water and protection from abuse that results when profit is favored over people. FOTC works through public education, citizen investigations, research, legislation, special events, and direct action.

Local Health Care

Yakima Valley Farmworkers Clinics http://www.yvfwc.com/

It was 1973 and healthcare for migrant and seasonal farm workers was almost non-existent. Underfed, poorly clothed and with little to no education, the farm worker community was facing a health crisis that was not being addressed at a local or national level.

Respected physicians - Dr. Paul Monahan, Dr. Donald Gargas and Dr. Julie Ricking - cared deeply about this 'forgotten' community and, together with a group of committed care providers, set up the clinic in a small house made out of plywood and built by VISTA volunteers. Conditions were far from perfect, but it was a start.

We've come a long way since and Yakima Valley Farm Workers Clinic has grown into a Joint Commission-accredited community/migrant health center, and is the largest community based health center in the Pacific Northwest.

Today, Yakima Valley Farm Workers Clinic has locations throughout Washington and Oregon, impacting the lives of thousands of adults and children each year. We embrace new technologies and systems that engage and empower patients to actively participate in their own care and are well placed to meet the evolving needs of our communities.

Our Mission statement is our daily guide:

"Together we are dedicated to lead, with the courage to care, the determination to promote personal growth, and the compassion to champion the cause of those who have no voice".

We are committed to providing quality services to everyone, regardless of an individual's financial or citizenship status. A sliding-fee scale is available for those without health insurance. Yakima Valley Farm Workers Clinic is a FTCA Deemed facility.

Neighborhood Health Services https://www.ynhs.org/

Established in 1975, Yakima Neighborhood Health Services today serves more than 23,000 patients annually. We were the first Health Center in the state to achieve the highest level of recognition possible as a Patient-Centered Medical Home and we are accredited by the Joint Commission.

Mission: To provide affordable, accessible, quality health care, promote learning opportunities for students of health professions, end homelessness and improve quality of life in our communities.

Astria Health – Sunnyside, Toppenish & Yakima http://www.astria.health/

The Astria Health system, headquartered in the heart of Yakima Valley in the state of Washington, is the parent nonprofit organization of Astria Sunnyside Hospital, Astria Regional Medical Center and Astria Toppenish Hospital.

Astria Health's leadership team has worked with some of the largest systems in the nation with dozens of successful hospital turnarounds throughout the country. Providing the expertise, know-how, processes and resources hospitals need, Astria Health ensures profitable growth and stability in today's ever-changing healthcare environment.

Virginia Mason Memorial/Yakima Valley Memorial Hospital
https://www.yakimamemorial.org/about-us.asp

Founded: 1950
Ownership: Yakima Valley Memorial Hospital Association, a private not-for-profit organization governed by a board of directors.
Location: Based in Yakima with locations throughout Yakima County
Accreditation: The Joint Commission
Patient admissions: 11,751
Hospital inpatient services include: Cancer Care, Heart Care, Critical Care, Orthopedics, Surgery, The Family Birthplace, Pediatric Care, Neonatal Intensive Care Unit, Surgery, and Psychiatric Care
Hospital square footage: 600,684
Campus size: 26.4 acres
Total employees: approximately 2800
Total licensed hospital beds: 226
Total Operating Revenue: $433,163,870

Education and Outreach

Radio KDNA La Voz del Campesino/ Northwest Communities Education Center
http://www.kdna.org/

In 1979, Northwest Communities Education Center (NCEC), launched a Spanish language, public radio station in the heart of the Yakima Valley located in Eastern Washington. Broadcasting on a frequency of 91.9 FM with an effective radiated power of 20,000 watts, from studios located in Granger, Washington, the station is governed by a minority Board of Directors representative of its listening community.

Radio KDNA, a community public radio station, went on the air with an educational and informational format. Radio KDNA has been instrumental in educating, informing, mobilizing, motivating and encouraging its listeners to become involved in every aspect of the Valley's culture that affects their lives: health, education, and civic participation; to learn English, to become citizens and to fully understand all the implications of benefits received from schools, state and federal agencies.

The Mission: KDNA will direct its efforts as a minority public radio station in response to the cultural and informational isolation of Hispanic/Latino and other disadvantaged communities. Radio KDNA will produce quality radio programming to help such communities overcome barriers of literacy, language, discrimination, poverty, and illness. In this way, KDNA will empower these communities to more fully participate in our multiethnic society.



Significance of Nitrogen Emissions and Atmospheric Deposition for the Lower Yakima Valley – A Briefing

J. Mendoza – November 1, 2018

This paper addresses the assessment and evaluation of nitrogen emissions from agricultural operations and the subsequent atmospheric deposition of reactive nitrogen in the Lower Yakima Valley. There are major errors in the Lower Yakima Valley Groundwater Management Area's 2017 *Nitrogen Availability Assessment (NAA)* regarding atmospheric deposition.

The Science

If you open a bottle of ammonia and measure the concentration of ammonia six inches above the bottle with a test strip you will get a positive response. If you measure the air 15 feet away from the bottle you may not see a response at all. The concentration is higher at the source. This is a scientific experiment that has been replicated over and over. It is a fact.

Nitrogen compounds are essential components of commercial fertilizers and manure. When exposed to air these compounds volatilize and enter the atmosphere. This is especially true for ammonia. The rate of volatilization, also called emission, depends on temperature, wind, nitrogen concentration in the source, etc. Ammonia by itself is lighter than air and rises. Ammonia in the air readily combines with other chemical compounds to form ammonium nitrate and ammonium sulfate which are classified as fine particulate

matter. (Hristov, 2011; WA Dept. of Ecology, 2014) Most ammonium compounds are heavier than air and stay close to the surface.

When nitrogen compounds in the air fall back to earth this is called atmospheric deposition. Atmospheric deposition of reactive nitrogen contributes to eutrophication, increased fine particulates in the ambient air and climate change. (Sutton et al, 2011)

The relationship between the amount of ammonia in the air and deposition rates is not linear. The rate of deposition also depends on multiple factors including temperature, wind, and nitrogen concentrations at the land surface and in the air. (Personal Communication, Dr. Ranil Dhammapala, October, 2018)

Estimation of Atmospheric Deposition in the GWMA Nitrogen Availability Assessment

The GWMA Nitrogen Availability Assessment (NAA) estimates that, on average 2.05 lbs of nitrogen deposit on every acre in the GWMA target area every year. (WSDA, 2017)

WSDA and Ecology base this estimate, in part, on data from the only place in Washington where wet and dry deposition is measured. The station is on the top of Mt. Rainier and it was chosen because even small amounts of reactive nitrogen in the air damage the alpine plant life. The air over Mt Rainier is a Class I Air Space. This means it is a pristine area with special protections under the Federal Clean Air Act, 42 U.S.C. §7472.

The National Atmospheric Deposition Program (2018) states that atmospheric deposition of nitrogen compounds on Mt. Rainier is near 1.53 lbs per acre. WSDA and Ecology used this number as the low estimate for the LYV. They added 0.52 lbs per acre and arrived at an average deposition of 2.05 lbs N per acre. (WSDA, 2017)

Here is the NAA rationale:

> *The lowest number used is the combination of the most recently available annual wet and dry deposition data from the NADP Mt. Rainier station. Deposition reported includes dry nitric acid, dry ammonium, dry nitrate, wet ammonium, and wet nitrate (EPA 2016).* *This is believed to be a good surrogate for low deposition due to the considerable transportation corridor along I-5 in western Washington mimicking farm-related emissions and deposition seen in eastern Washington.* *(Emphasis added)*
>
> (WSDA, 2017, page 68)

You decide, is this real science?

Emissions from animal agriculture are a major source of reactive nitrogen in the ambient air. Research from California, where the concentration of dairies is similar to that in the Yakima Valley, says that nitrogen deposition averages 9 lbs per acre in the Tulare Lake Basin and 5 lbs per acre in the Salinas Valley.

WSDA rationalizes that:

> *In addition, the scale of animal agriculture in the Central Valley is an order of magnitude greater than that found in Yakima County (approximately 640 dairies compared to about 50 in the GWMA)*

In fact, California's Central Valley covers ten times more land area than the GWMA target area. The concentration of cows is approximately equivalent. The Lower Yakima Valley actually has a slightly higher number of cows per acre.

Reasons Why the NAA Estimate of Atmospheric Deposition Should Be Higher

WSU Modeling of Nitrogen Deposition: On the ground measurement of atmospheric deposition is difficult. Washington State University has developed a program, AIRPACT-5,

that models nitrogen deposition for Washington, Oregon and Idaho. This program is based on the EPA's Community Multiscale Air Quality Modeling System (CMAQ) and is endorsed by Ecology.

Monthly estimates are published at http://lar.wsu.edu/airpact/monthly_depo_ap5.php# According to FOTC's reading pf the maps the average monthly nitrogen deposition in the Lower Yakima Valley is about 1 kg per hectare which equals .89 lbs per acre. Over twelve months this equals about 10 lbs per acre. WSU mapping clearly shows a correlation with similar areas in Whatcom County, Jerome County, Idaho and Morrow County, Oregon.

National Atmospheric Deposition Program: South Central Idaho has a concentration of dairies and cows, economy, geography and climate that closely resembles the GWMA target area. The National Atmospheric Deposition Program has measured average ammonia concentrations in the Twin Falls region at 8.8 micrograms per cubic meter and average ammonia concentrations in Tulare County, CA at 3 micrograms per cubic meter. (NADP, 2018) This should suggest the importance of ammonia emissions in Yakima County and prompt a more realistic analysis. (The ammonia concentration in the air at Mt. Rainier averages 0.18 micrograms per cubic meter).

Ecology's Emissions Inventory: The Washington State Department of Ecology has estimated that 24% of all Washington State ammonia emissions from livestock in 2014 came from Yakima County. These Yakima emissions totaled about 3,890 tons of atmospheric ammonia in that year. (WA Dept of Ecology, 2018)

National Air Emissions Monitoring Study (NAEMS): In 2010 scientists from Washington State University conducted emissions studies at two dairy barns in the Lower Yakima Valley as part of the National Air Emissions Monitoring Study (NAEMS). They found that an average Yakima milk cow produces 56 grams per day per cow of ammonia. (Ramirez-Dorronsoro et al, 2010)

The 100,000 milk cows in Yakima County will produce 5,600,000 grams = 5,600 kilograms = 12,320 lbs = 6.16 tons of ammonia every day. This equates to 2,190 tons per year which fits well with Ecology's estimate of 3,890 tons per year from all animal agriculture in Yakima County.

> Caveat 1: This high rate of ammonia production is the result of mixing urine and feces. There is a chemical reaction when the two combine and this does not occur to such a high degree when animals are not kept in confined quarters.
>
> Caveat 2: This estimate does not account for manure and urine that is stored in lagoons, for manure that is composted or for emissions from land application of manure.

Doing the Math:

- 2,190 tons or 4,380,000 lbs of nitrogen from milk cows is emitted every year in the GWMA target area
- Around 13% or 569,400 lbs redeposits on 179,346 acres of the target area
- This is a deposition rate of 3.17 lbs N per acre, just from the milk cows

NRCS Research - Emissions from crop fertilization: The Natural Resources Conservation Service (NRCS) estimates that an average 2.3 lbs of nitrogen per year is deposited on every acre of cropland in the western states. When the land is planted in silage corn the average deposition is 2.6 lbs N per acre per year. About 13% of the nitrogen that volatilizes from agriculture in the western states redeposits on farm land. (US NRCS, 2006)

Ammonia containing fertilizers and manures are the source and this process is highly dependent on temperature, wind, and time to incorporation in the soil. Volatilization rates range from 0% when fertilizers and manures are directly injected into the ground to 100% when fertilizers and manures are not incorporated and the weather is hot and dry. (Shaw, 2015)

Contribution from Composting: Steve George from the Yakima Farm Bureau and Laurie Crowe from the South Yakima Conservation District have shared their expert opinions with the GWMA regarding nitrogen flows from dairies. (Attachment 1) They state:

> *75% of manure generated is composted which reduces the volume by 50%. Over 50% of this compost is exported out of Yakima County.*

A significant portion of the 50% loss is volatilization of water and nitrogen from the compost.

Historical Data from Whatcom County:

Nitrogen balance has been studied much more intensely in Whatcom County compared to Yakima County. In their study of that area Cox & Kahle (1999, page 104) state:

> *However, additional dry deposition is expected in areas where substantial amount of manures are present due to volatilization of a large fraction of the ammonia in manures (Ivens and others, 1988). Sanderson and La Valle (1979) found that bulk deposition (combined wet and dry) at six farm sites in southern Ontario was 30 to 37 pounds of nitrogen per acre. In the dairy and agricultural region of southern Ontario, Barry and others (1993) estimated that dry deposition of nitrogen ranged from 5.9 to 15 pounds per acre and made up 44 to 55 percent of the bulk atmospheric nitrogen across the region. Similar rates were found by Goulding (1990) on adjacent farm lands in southern England. Barry and others (1993) suggest that nitrogen deposition on farms where large volumes of manure are susceptible to volatilization should include from 13 to 19 pounds of nitrogen per acre for dry redeposition of nitrogen resulting from manure volatilization.*

Almasri & Kaluarachchi (2003) estimated atmospheric deposition of 7.3 lbs N per acre in Whatcom County. This comprised 8% of the input in the nitrogen balance for that area. They attributed most of this input to the 53,000 milk cows in Whatcom County at that time and noted the differences in wet and dry deposition for different climates.

FOTC Requests

FOTC has asked the GWMA advisory Committee (GWAC) to recommend modeling in order to refine a nitrogen balance for the GWMA target area. How can we assess the nitrate problem if we do not understand the nitrogen pathways; if we do not know where the nitrogen goes?

In response to our request for an alternative solution that addresses atmospheric deposition of nitrogen, Yakima County advised that this work would be "inconsequential" with "cost disproportionate to benefits". The county described the proposal as "big and expensive". (Yakima County, 2018, page 58). None of the agencies informed us about the WSU AIRPACT-V program.

FOTC believes this is a conscious and deliberate effort to avoid documentation of the significant problem we have with loss of nitrogen to the atmosphere in Yakima County.

Efforts to Confuse and Deceive

Casual readers who study the document, *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area,* will likely look at charts and graphs to learn how much reactive nitrogen is deposited on the 280 square miles that make up the GWMA. They will read, and justifiably assume to be true, the statement that on average 76 tons of nitrogen are deposited in the GWMA every year. (WSDA, 2017, page 69)

Serious scholars will discover that this calculation only covers deposition on 73,976 acres of non-agricultural land. Atmospheric deposition on agricultural land was folded into calculations for irrigated agriculture and animal agriculture. Thus the authors were able to say that atmospheric deposition only accounts for 2% of the available nitrogen in the GWMA. If atmospheric deposition, even at the ridiculously low rate of 2.05 lbs per acre is calculated for all 179,346 acres in the GWMA, then the percentage due to atmospheric deposition is closer to 5%.

Conclusion

It is vitally important to publish accurate information and data so that students, scholars, policy makers, other experts and the general public can analyze the material and draw useful conclusions. The LYV GWMA's 2017 Nitrogen Availability Assessment is false and misleading with respect to atmospheric deposition. It should be withdrawn from dissemination to the public.

Respectfully,

The Friends of Toppenish Creek

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Attachment 1:

Confined Animal Feeding Operations (CAFOs)

Water Quality Requirements:

What laws or rules apply to CAFOs in regard to water quality, specifically groundwater protection?

Federal and State regulators and local Conservation Districts have a zero water discharge policy for dairies:

- Federal Clean Water Act
- Washington State Dairy Nutrient Management Plan (DNMP)
- Washington State Water Quality Standards for surface and Groundwater; and
- Washington State Solid Waste Handling Requirements

Federal Clean Water Act:

40 CFR part 122 – defines CAFOs, any size operation that confines animals for more than 45 days on non-growing surface. Facility has to have a permit if they have a discharge or propose discharge to surface waters of the state. The proposed combined permit will encompass groundwater. Discharges must meet criteria and cannot be excessive.

Washington State DNMA:

(WSDA) All dairies must comply (RCW 15.36). In place to protect surface and ground waters (RCW 90.64.026) Dairy producers that have a grade A license to sell milk must develop an DNMP that is approved and certified by conservation district. BMPs must follow NRCS specs. RCW 90.48 does

not allow discharge to surface or groundwater and is much more restrictive than the federal CWA. Dairies must keep application records, perform soil testing and adhere to maximum N levels in their fields.

Washington State Water Quality Standards for Surface and Groundwaters: (Ecology)

Applies to everyone regardless of industry.

Washington State Solid Waste Handling Requirements: (Ecology)

The current solid waste rules are in the process of being updated and may have some impact to dairies and others who generate manure. Currently, ag inputs are exempt from this statute. Ag inputs must be used at agronomic rates.

Practices pertaining to water quality protection in Yakima County:

The following are practices that dairy producers employee to prevent surface or groundwater contamination on the dairy foot print:

1. Sites engineered to have slope to a central collection site location

2. Catch basins for effluent at low spot on dairy

3. Manage effluent in catch basins or piped to lagoon – liquid evaporates, periodic removal of solid materials

4. Corral management: Packed and groomed

A) Grooming to prevent low spots that could accumulate water; fill holes to keep pen surface integrity

B) Haul bulk materials away as needed, generally composted

C) Clean solid material from under fence lines as needed

D) Animals fed on impervious surfaces

5. Feed management: Most feed that has excess moisture is kept on impervious surfaces such as concrete silage bunkers. Any excess moisture fed into catch basins or lagoon. Rations balanced by professional nutrition specialist that prevents excessive intake that reduces animal waste.

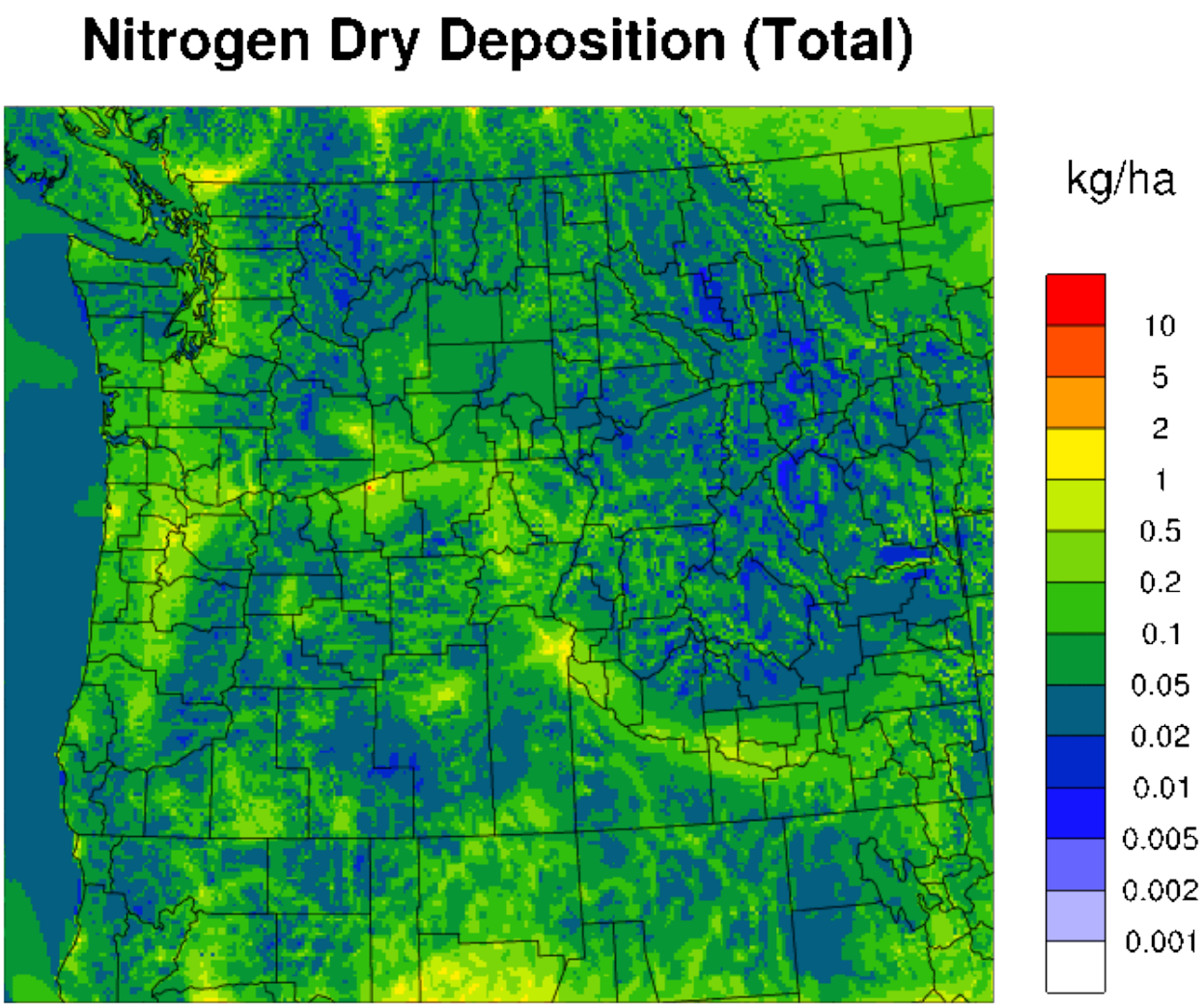
6. Lagoon Management: Solids reduction to limit volume and N and P concentrations going into lagoon. New technology includes centrifuge and floating filtration separation that takes out over 90% of solids. Concrete settling basins used in-line with this technology. Better separation reduces lagoon volume that translates into the dairy needing less lagoon space. Lagoons are engineered and most have clay liners. A few newer ones have put in synthetic liners. New permit will require testing of all existing lagoons. After solid separation, left over liquid is pumped or trucked to ag fields. This material generally runs less than 1% N per volume. Bio filter is new technology in testing that would add additional extraction of solids leaving 99% pure water.

7. Compost Areas: 75% of manure generated is composted which reduces the volume by 50%. Over 50% of this compost is exported out of Yakima County. (Information from WSDA, SYCD and Organix). Compost yards are placed on packed surfaces and are continually repacked by the use of large trucks and tractors running over them while hauling material in, out and turning compost. Compost areas do not generate moisture and during the summer must have moisture added to operate properly. Areas are kept smooth and flat to prevent ponding. Water is not applied that ponds up or runs off the compost area, but if water were to run off, it would be captured with the rest of the dairy's water.

This is a verbatim copy of a document that was prepared and shared by Steve George and Laurie Crowe with the Lower Yakima Valley Groundwater Management Area in November 2016.

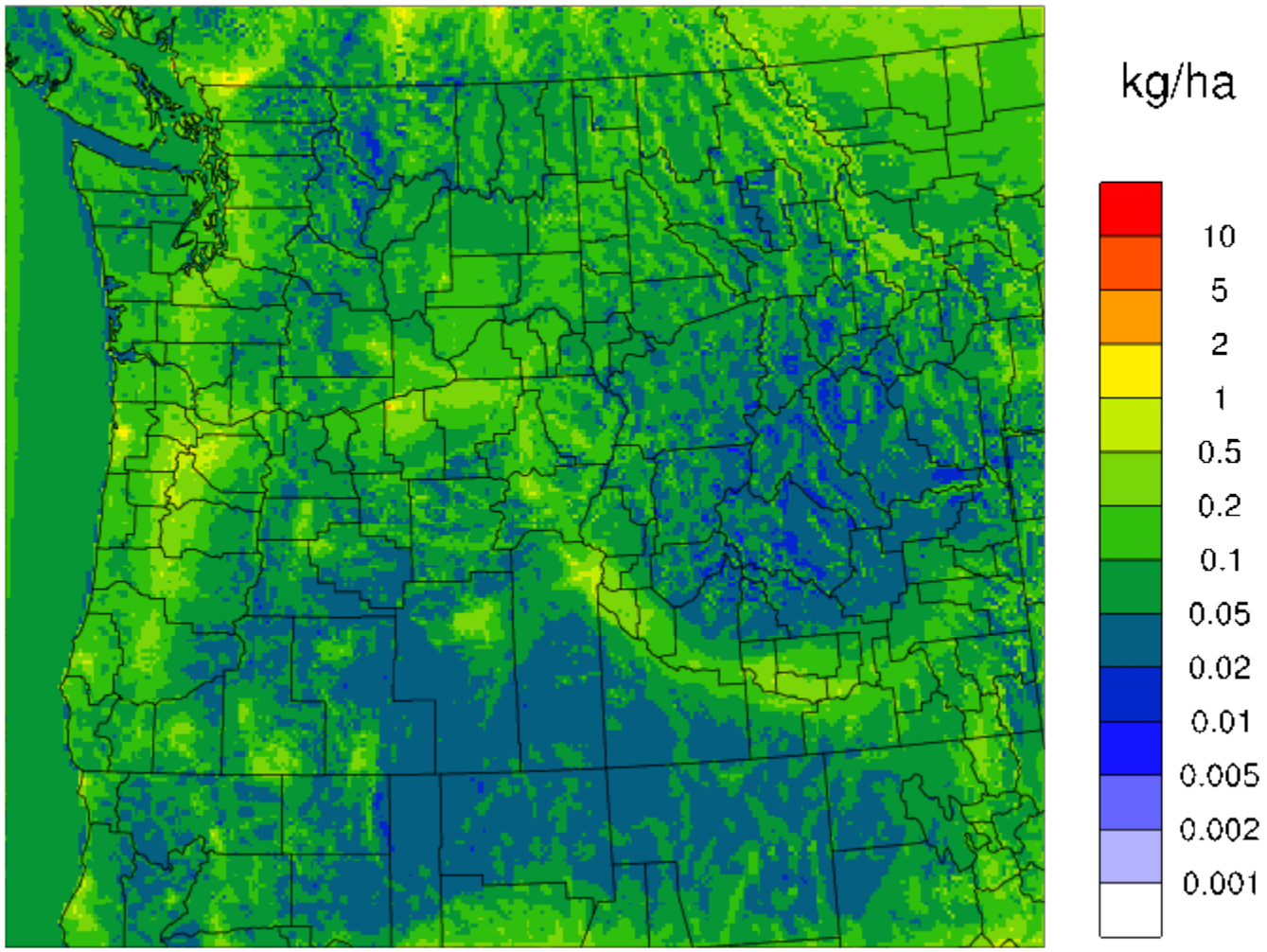
Atmospheric Deposition of Nitrogen from WSU Airpact V

January 2018



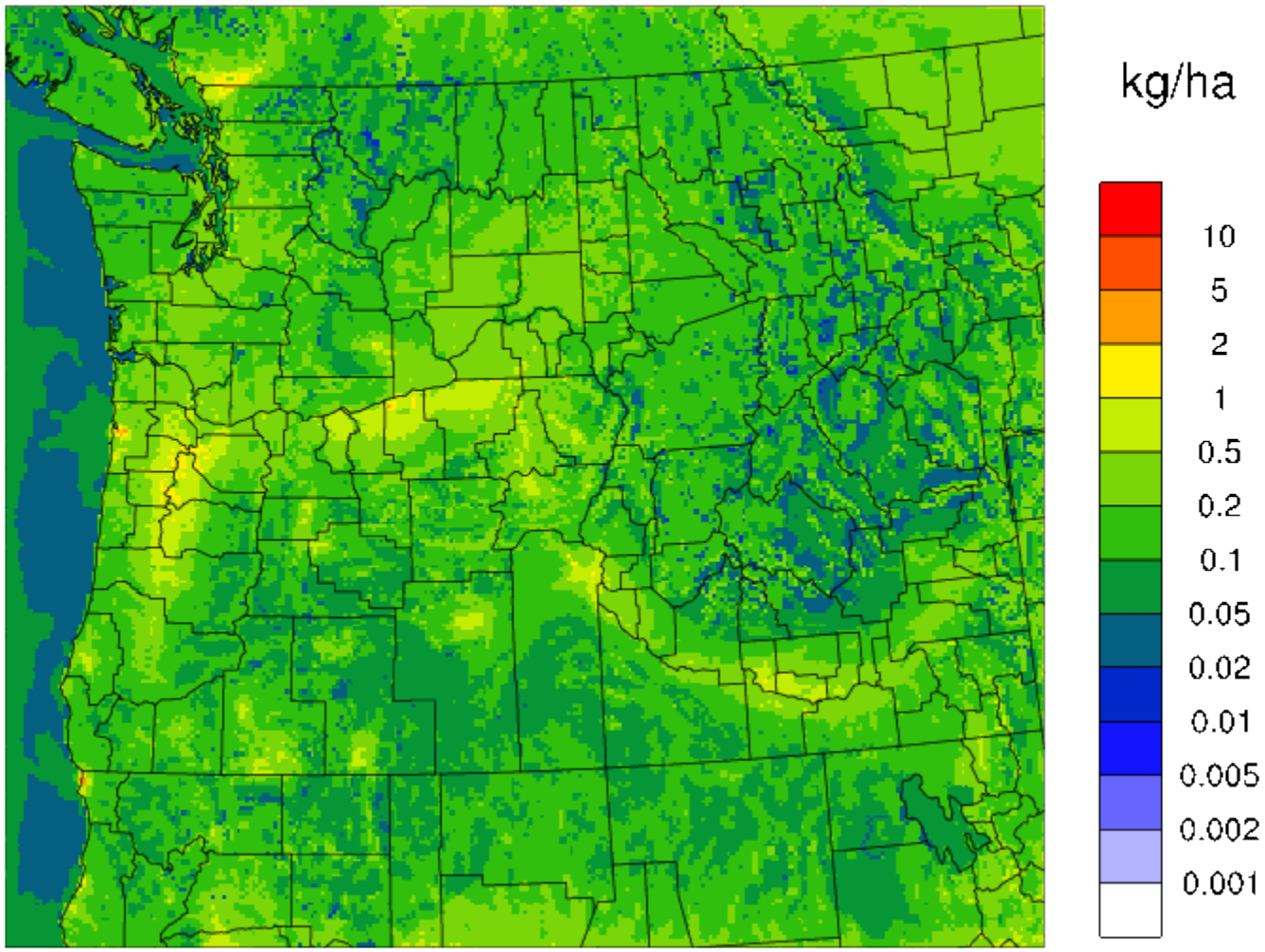
February 2018

Nitrogen Dry Deposition (Total)



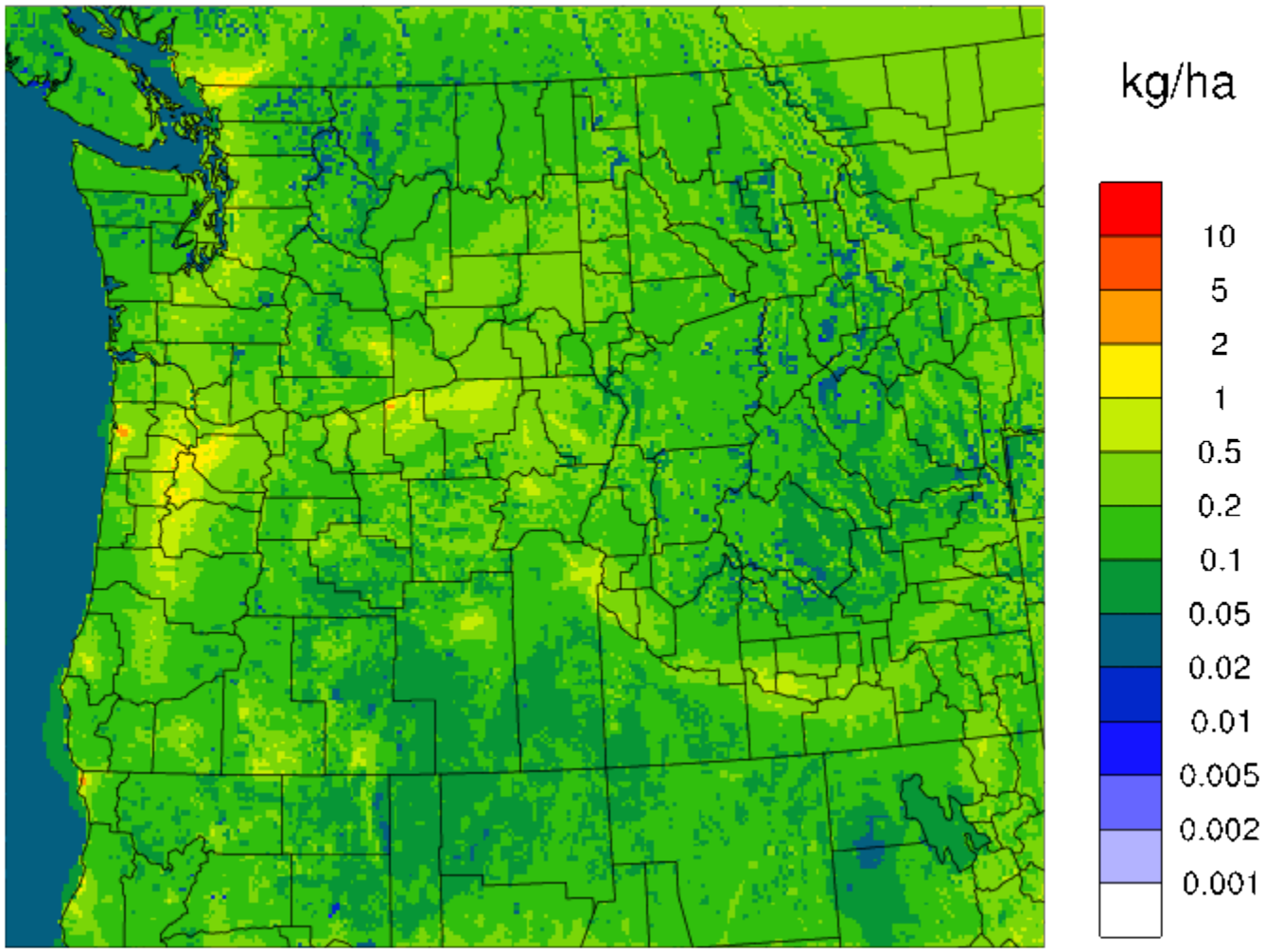
March 2018

Nitrogen Dry Deposition (Total)



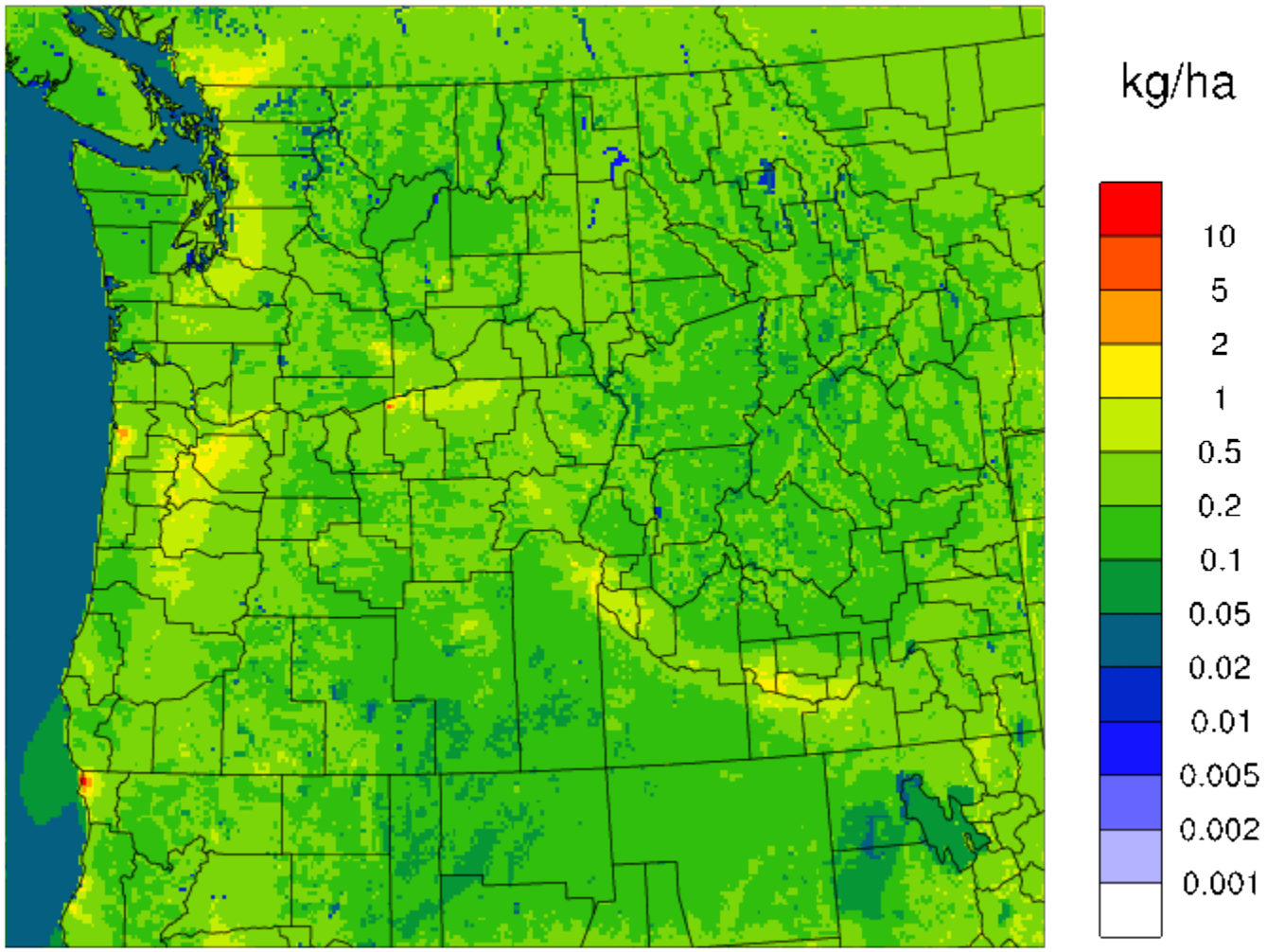
April 2018

Nitrogen Dry Deposition (Total)



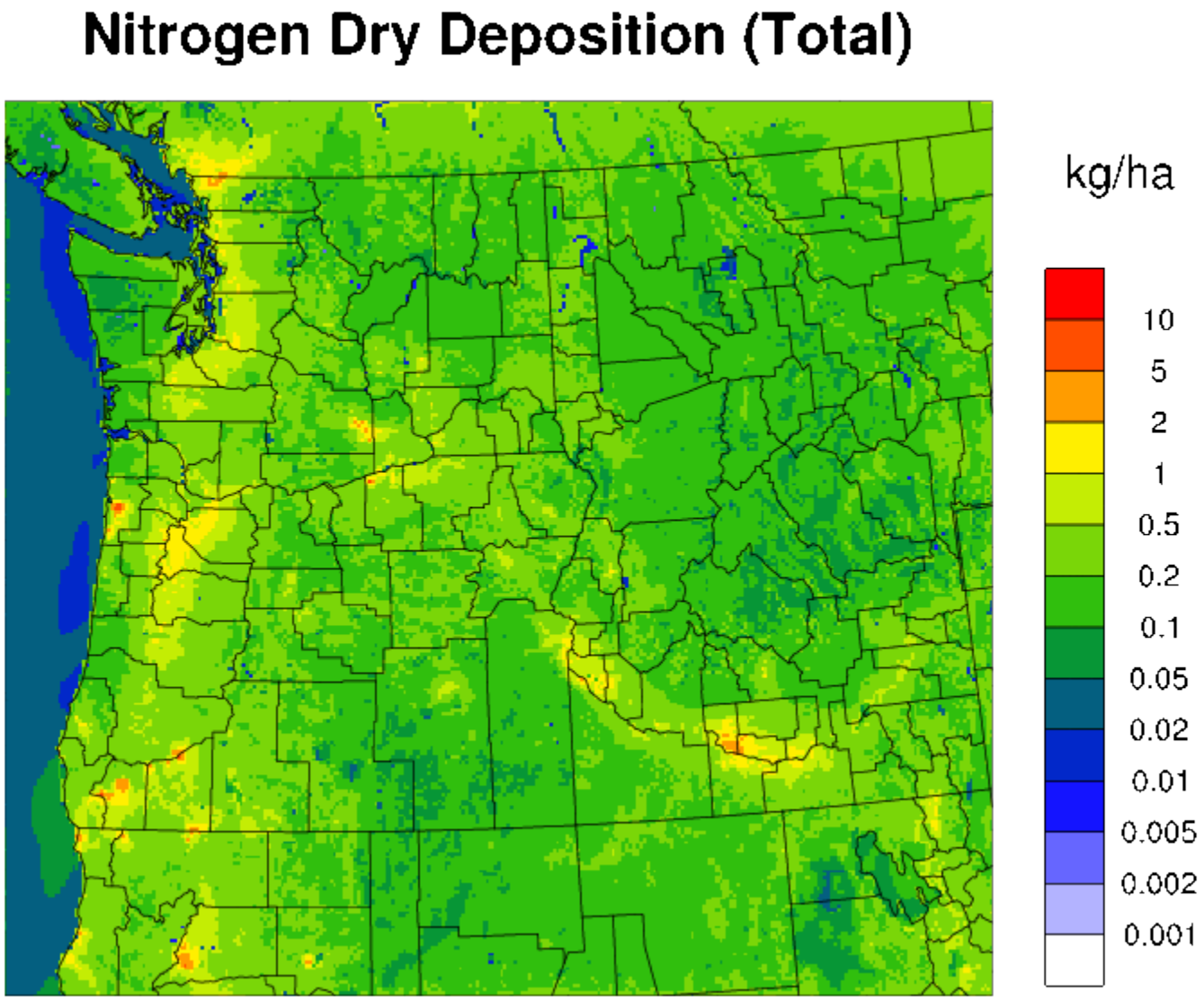
May 2018

Nitrogen Dry Deposition (Total)



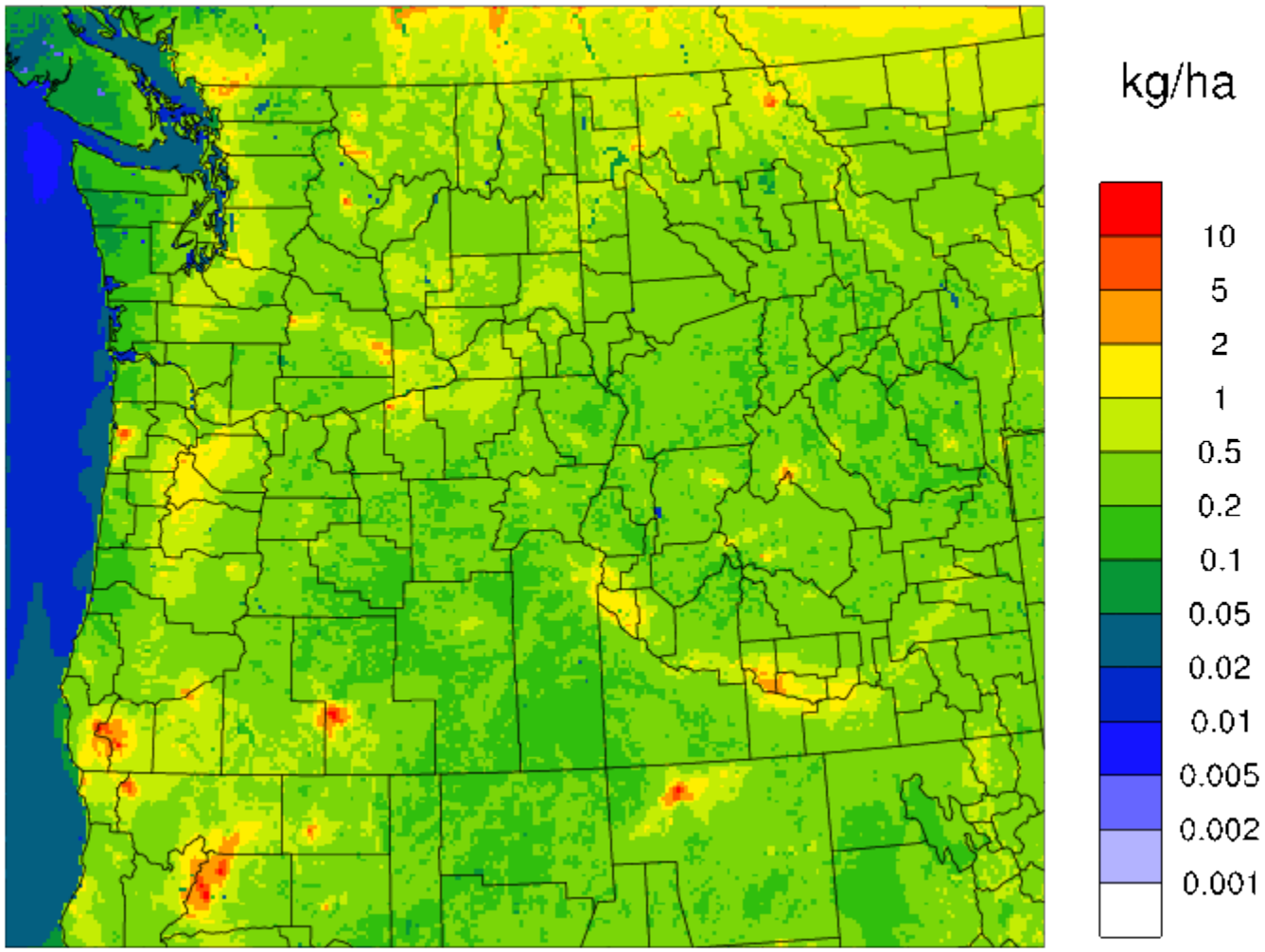
June 2018 – Not Found

July 2018



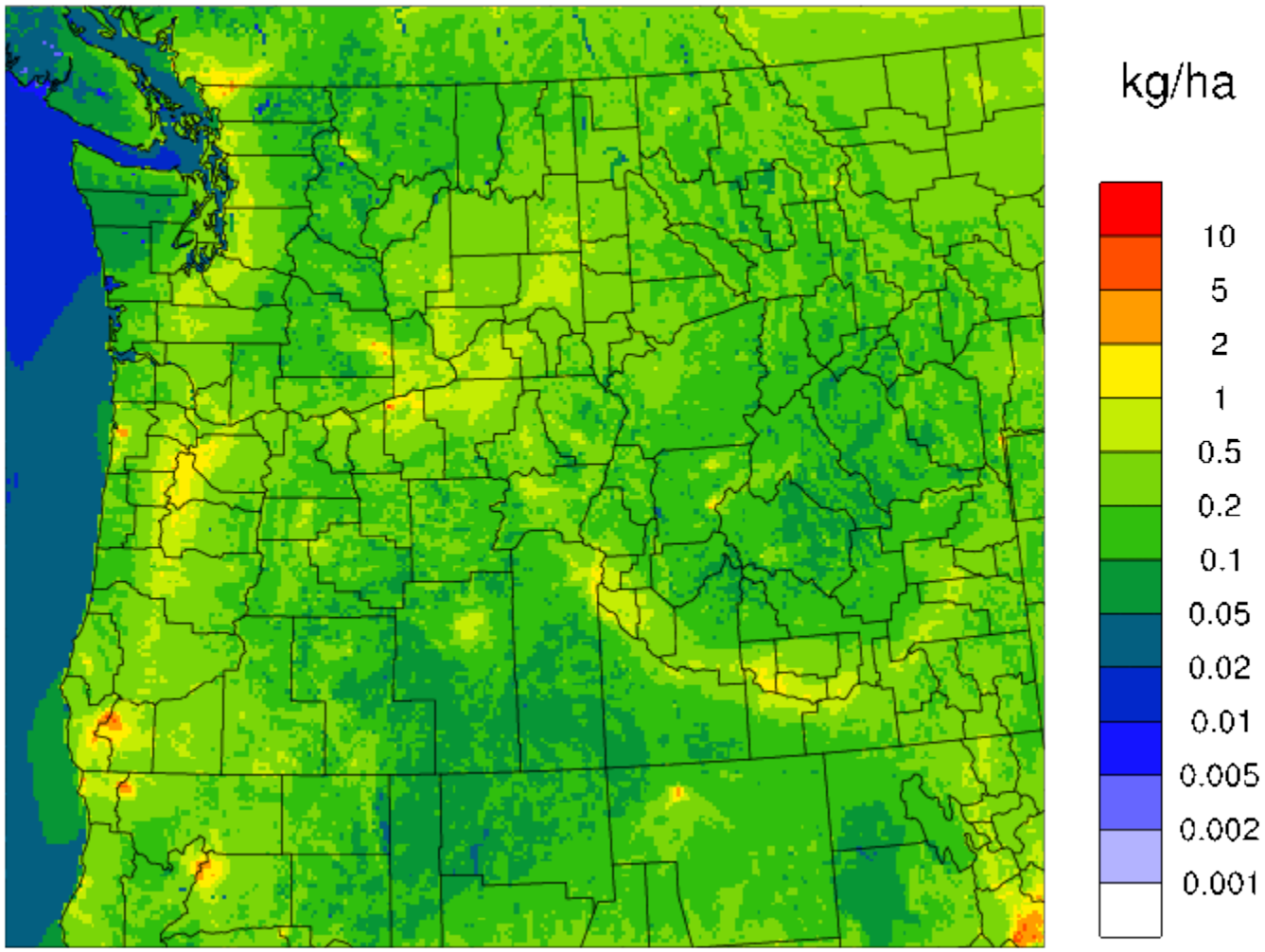
August 2018

Nitrogen Dry Deposition (Total)



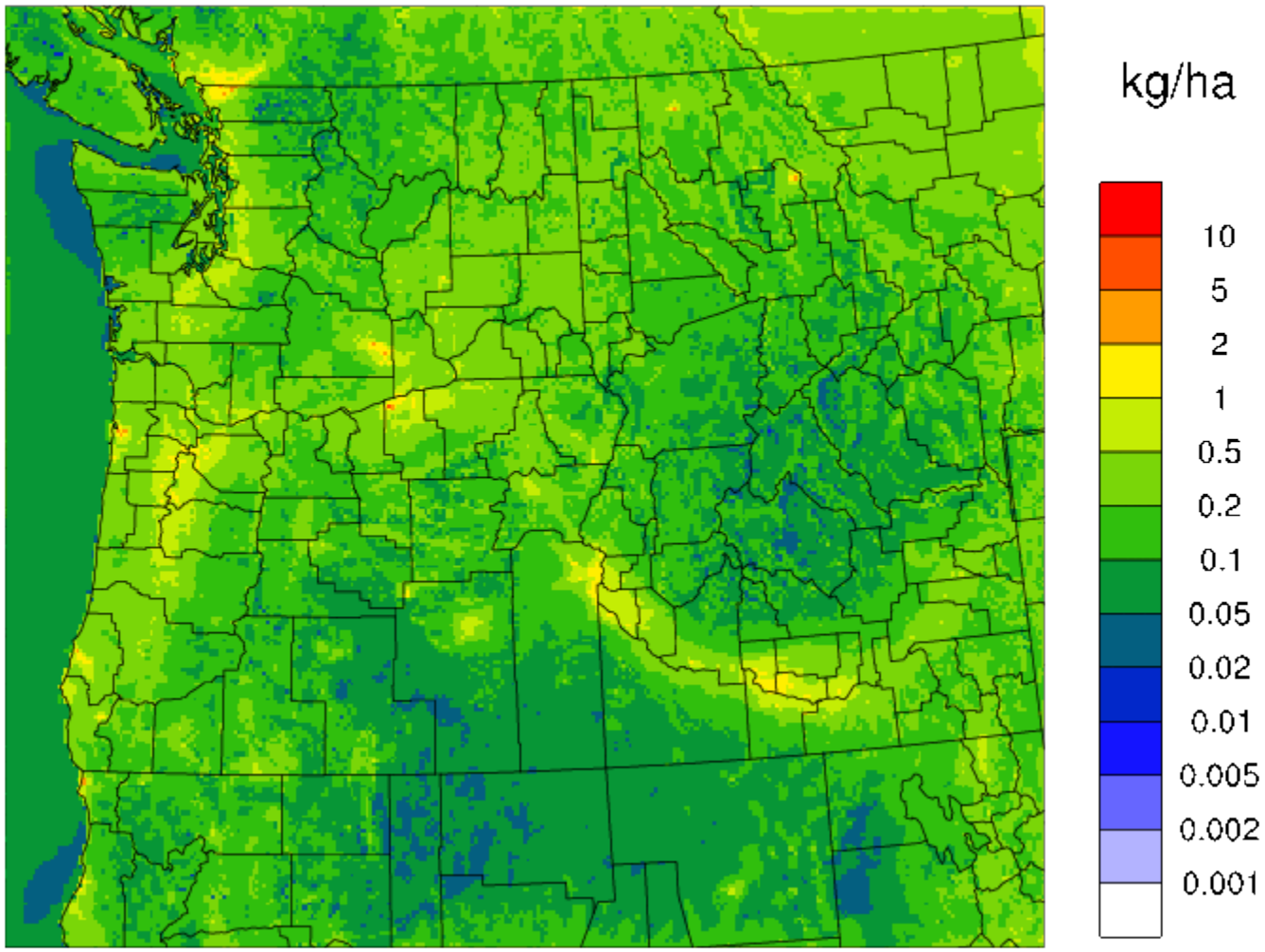
September 2018

Nitrogen Dry Deposition (Total)



October 2018

Nitrogen Dry Deposition (Total)



USGS
science for a changing world

Nitrate Tracking in the Lower Yakima Basin

Matt Bachmann, Ph.D.
September 19th, 2013

U.S. Department of the Interior
U.S. Geological Survey

57TH CONGRESS, 1st Session. | HOUSE OF REPRESENTATIVES. | DOCUMENT No. 55.

DEPARTMENT OF THE INTERIOR

WATER-SUPPLY

AND

IRRIGATION PAPERS

OF THE

UNITED STATES GEOLOGICAL SURVEY

No. 55

GEOLOGY AND WATER RESOURCES OF A PORTION OF YAKIMA COUNTY, WASH.—SMITH

WASHINGTON
GOVERNMENT PRINTING OFFICE
1901

Duplicate
Oregon State Agricultural College Library

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 339

QUALITY OF THE SURFACE WATERS OF WASHINGTON

BY

WALTON VAN WINKLE

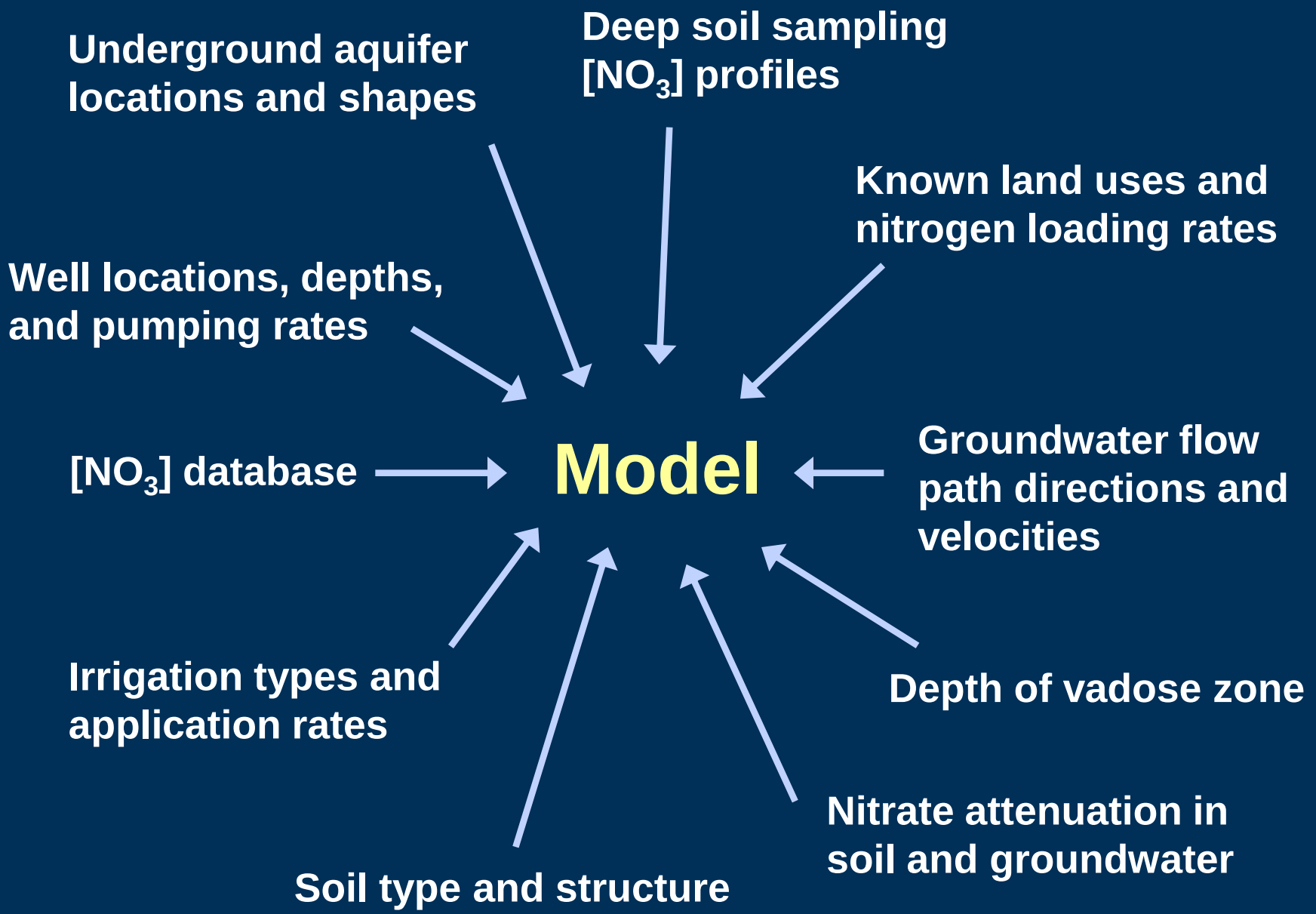
Prepared in cooperation with the State Board of Health of Washington

WASHINGTON
GOVERNMENT PRINTING OFFICE
1914

GWMA objectives

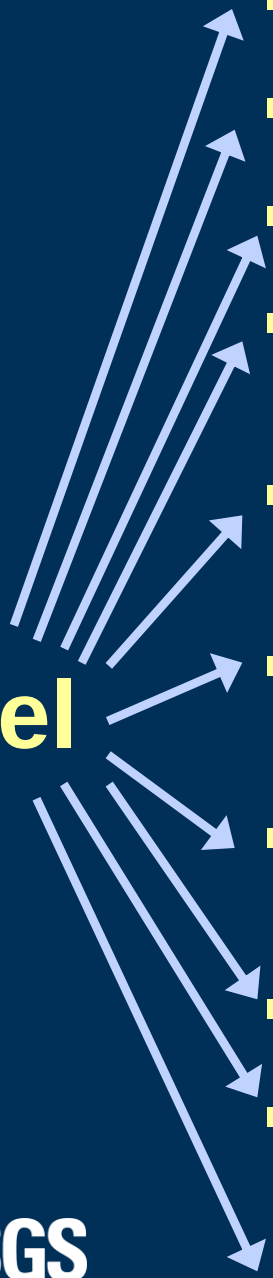
- “reduce nitrate concentrations in groundwater below state drinking water standards”
- “address all the significant sources of nitrate and bacterial pollution in a comprehensive manner”
- “contamination threat will be reduced or stabilized within 5 years”
- “reductions of contaminants will be measured… and shared with the public by 2013”
- “will identify and describe the contributing activities to groundwater contamination based on scientific data”

USGS


Underground aquifer locations and shapes
Deep soil sampling [NO3] profiles
Known land uses and nitrogen loading rates
Well locations, depths, and pumping rates
[NO3] database
Model
Groundwater flow path directions and velocities
Irrigation types and application rates
Depth of vadose zone
Nitrate attenuation in soil and groundwater
Soil type and structure

USGS

Model



- Defined recharge areas for all wells
- [NO_3] plume maps
- Plume velocities and directions
- Total N budget that is spatially and temporally discretized
- Identification of relative N contribution from each potential source
- Site-specific N loading rates that are protective of groundwater
- Expected time delay until surface changes show up in wells
- Identification of locations best suited to N removal
- Expected impacts of proposed changes to nutrient management
- Compliance scenarios

USGS

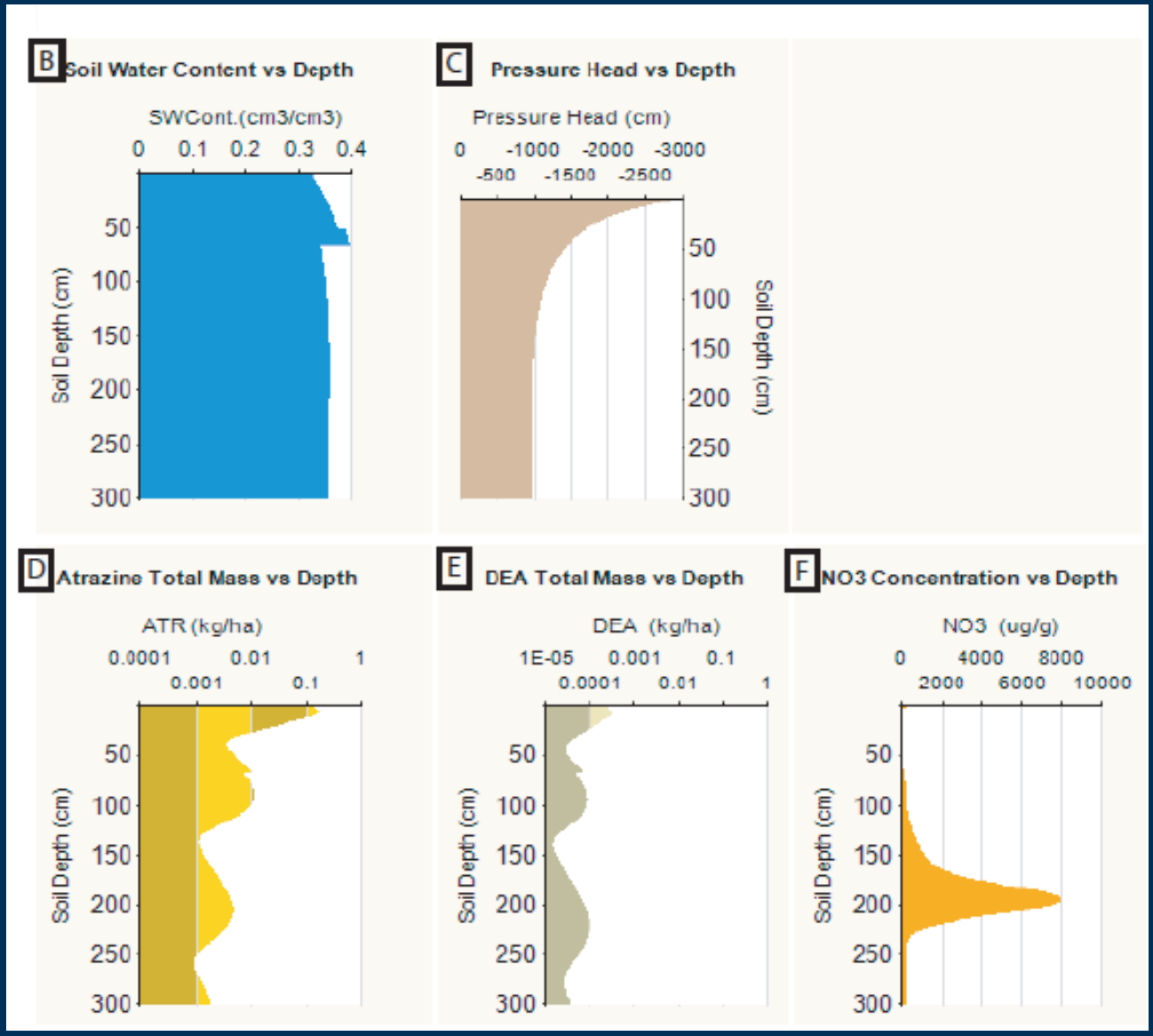
How do nutrients get from land surface to the water table?

Process-Based Groundwater Vulnerability Assessment (P-GWAVA)

- Mechanistic, not statistical model
- Uses USDA model (RZWQM) for nutrient transport and reactions in the vadose zone
- Uses NRCS (SSURGO) soil property data to estimate model input parameters
- Attenuates applied nutrients before delivery to groundwater

USGS

- **P-GWAVA generates nutrient profiles based on land use and soil type**

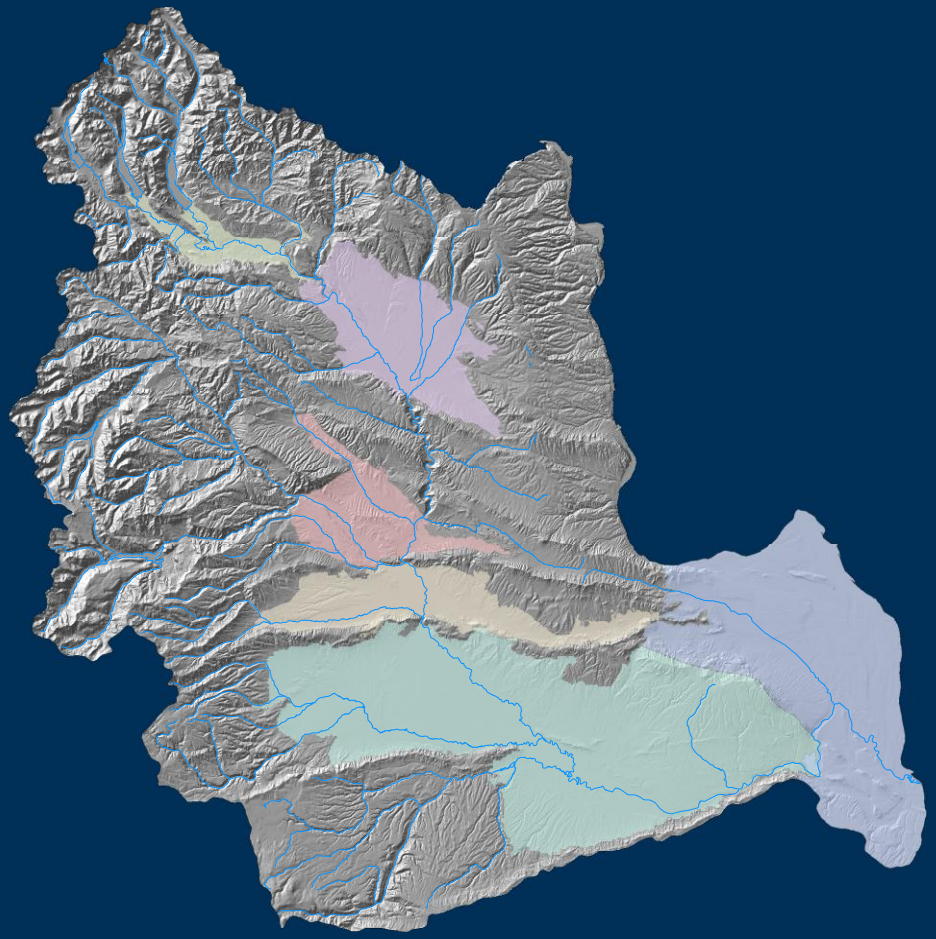


USGS

How do nutrient plumes move in groundwater?

Existing Yakima groundwater model, converted to MT3D

- 1,000 x 1,000-ft cells
- 4.6 million active cells
- 5,575 cubic miles of aquifer material
- 48 hydrogeologic units
- 24 model layers
- Simulation Period: 1960-2001
- 1-month time steps (504 stress periods)



USGS

- **MT3D conversion of Yakima model**
  - **Simulates reactive contaminant transport in groundwater**
  - **Generates groundwater concentration plumes and evolves them over time**
  - **Includes irrigation rate, groundwater pumping, and streamflow impacts on subsurface flow**
  - **Particle tracking results already finished**

USGS

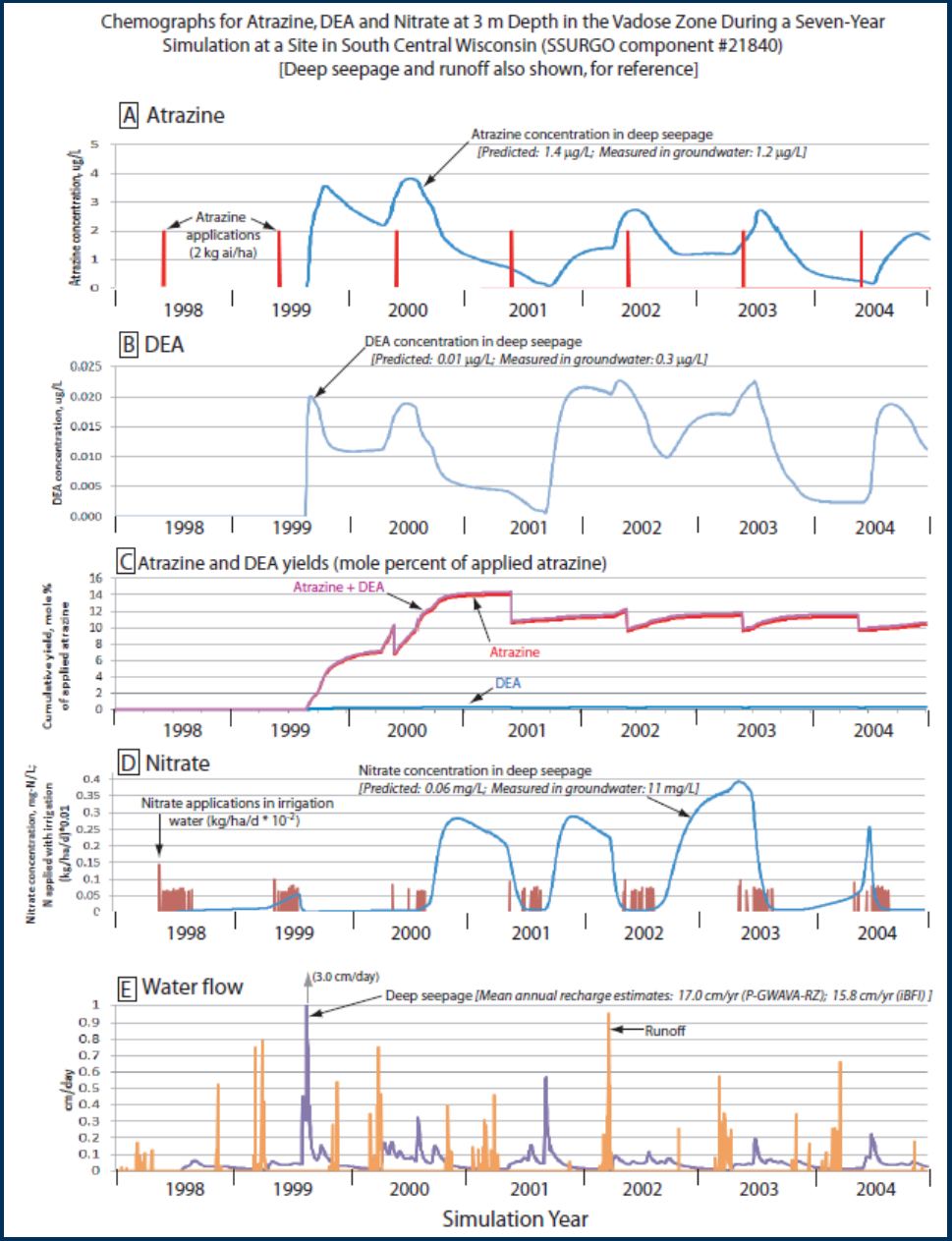
What is the time scale of connection between land application and drinking water well?

- Vadose zone transport plus groundwater transport time
- Requires both models
- Typically measured in decades, not months

USGS

- **P-GWAVA simulations in vadose zone can be calibrated to GWMA soil sampling results**

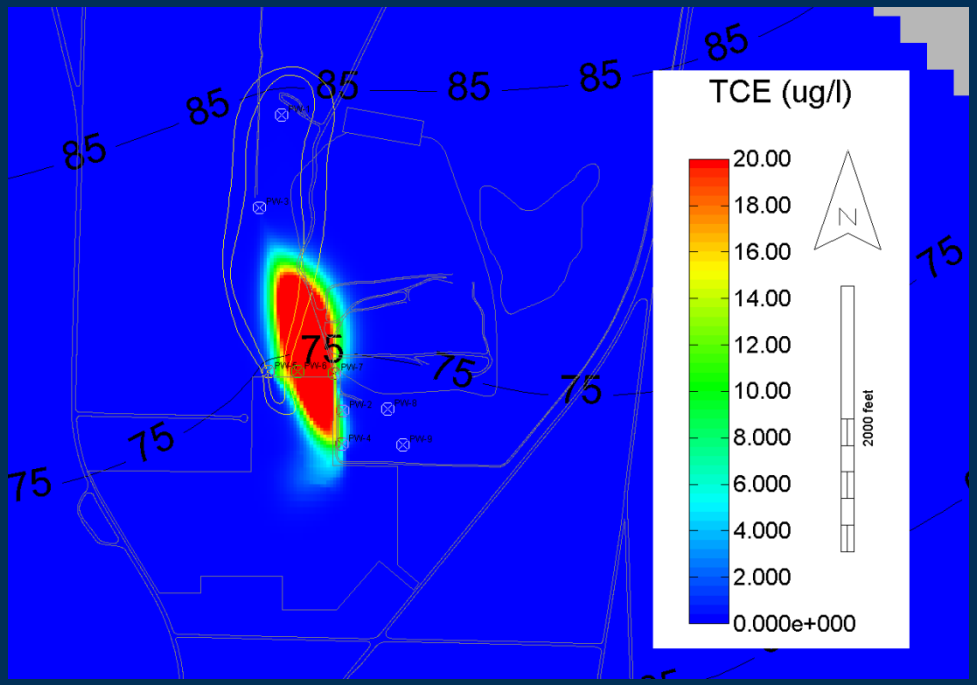
- **MT3D simulations in groundwater can be calibrated to GWMA nitrate assessment results**



How will nutrient concentrations change over time under alternative futures?

Loading rates and management practices: P-GWAVA

Groundwater plumes: MT3D



USGS

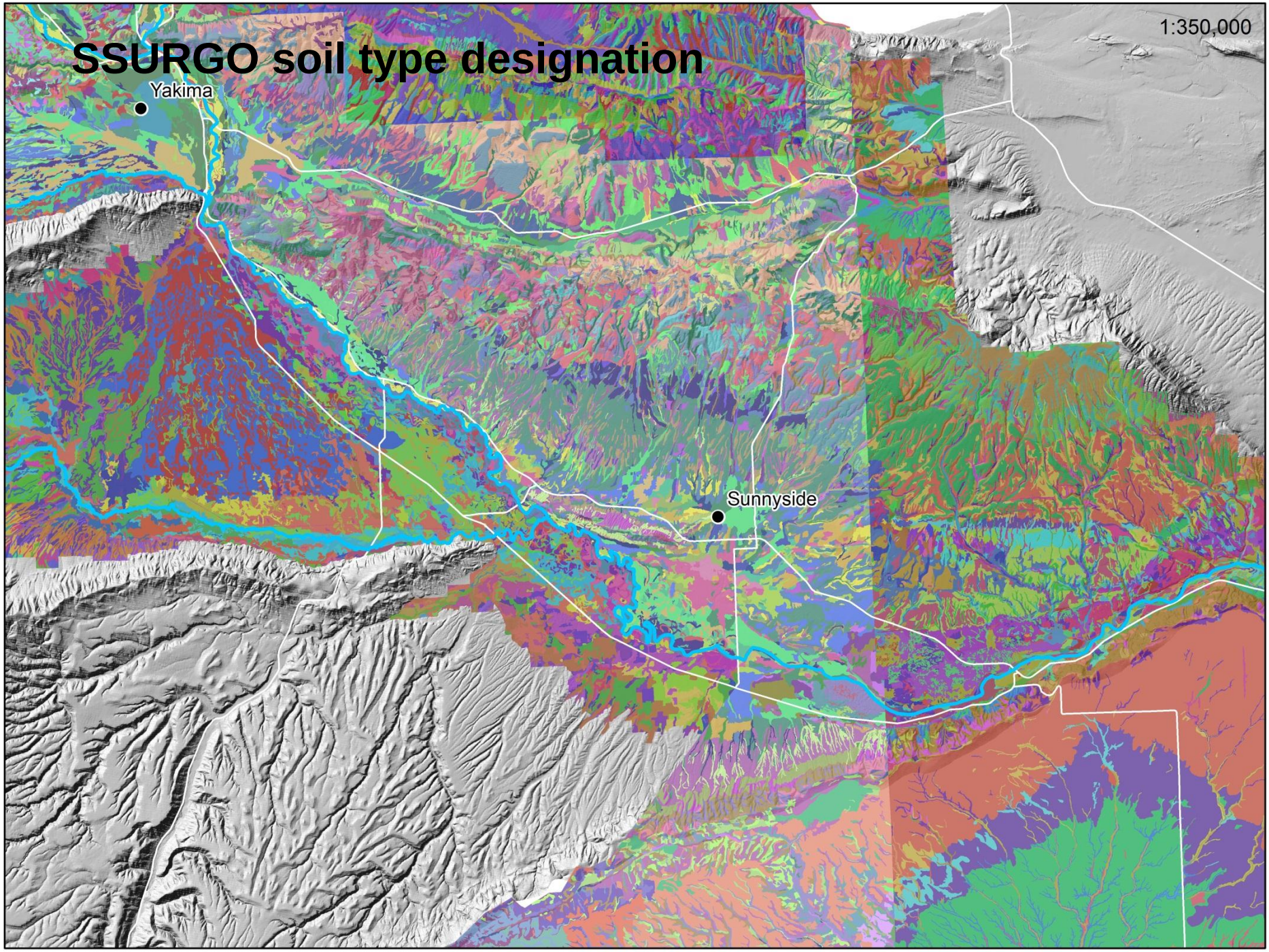
Proposed Work

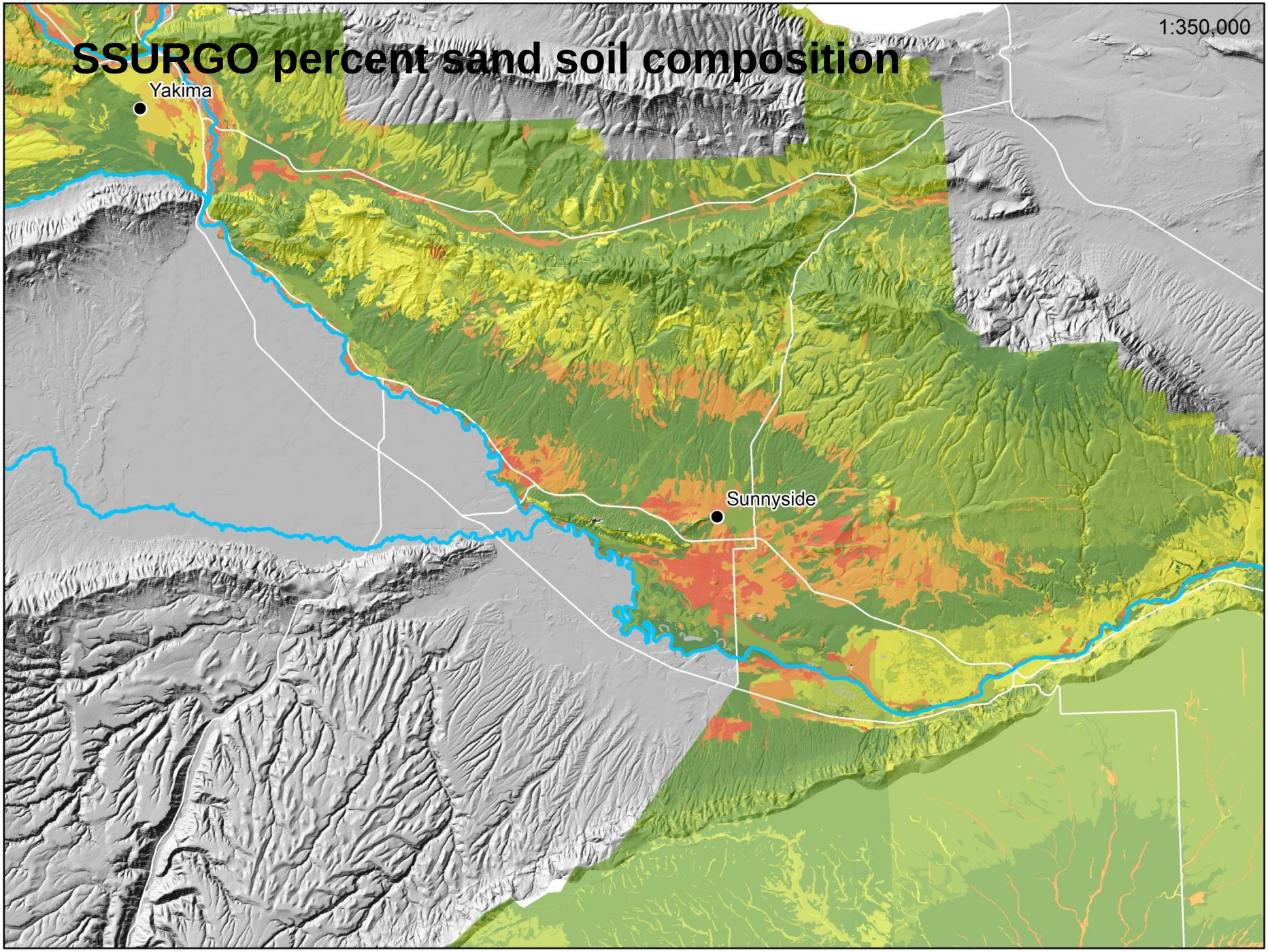
- Specify N loading rates at land surface
- Convert P-GWAVA from a site-specific to a basin-wide model
- Convert Yakima groundwater model to MT3D
- Link P-GWAVA loading rates to MT3D input rates
- Calibrate combined transport model to the GWMA's nitrate assessment

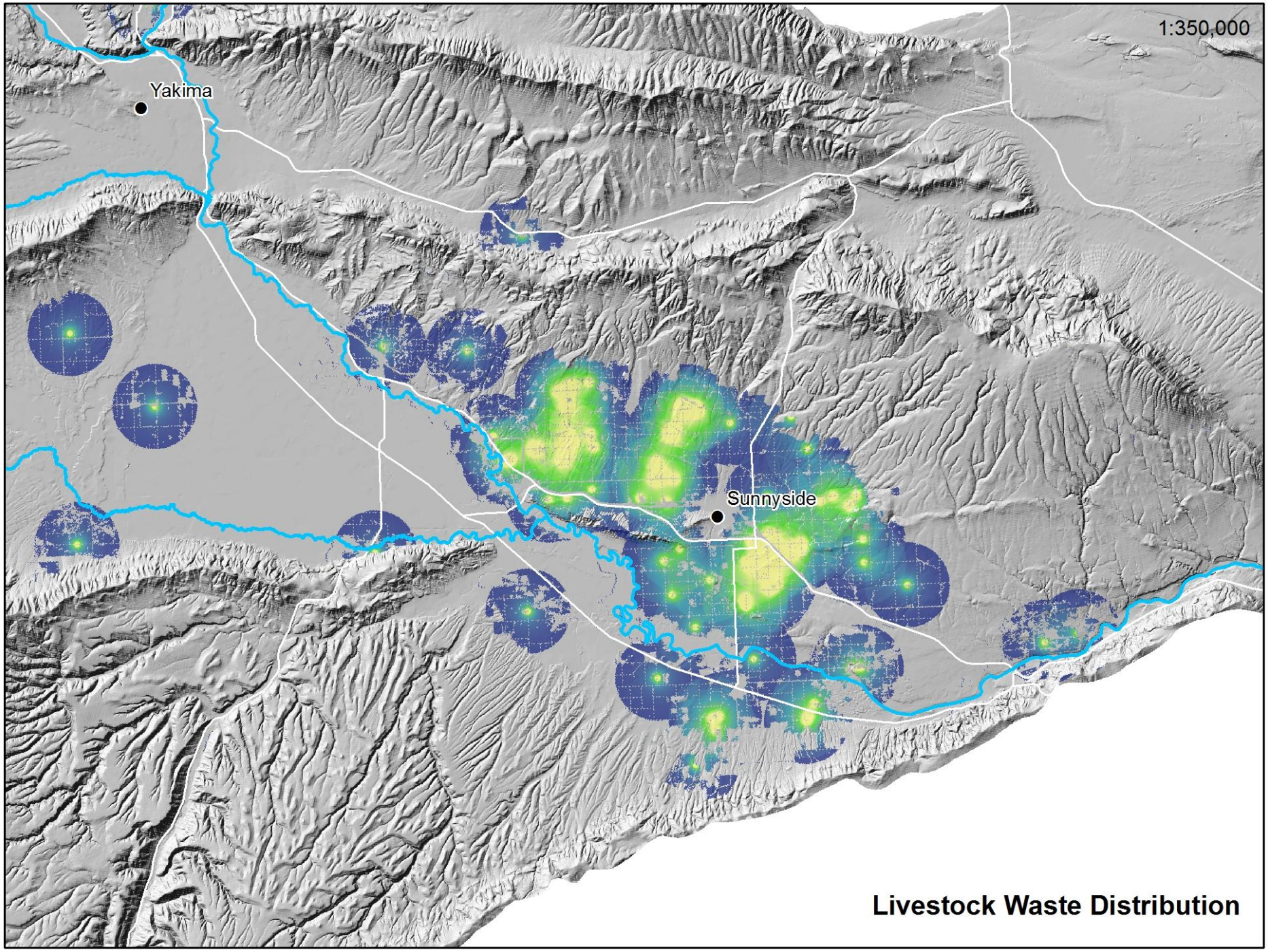
USGS

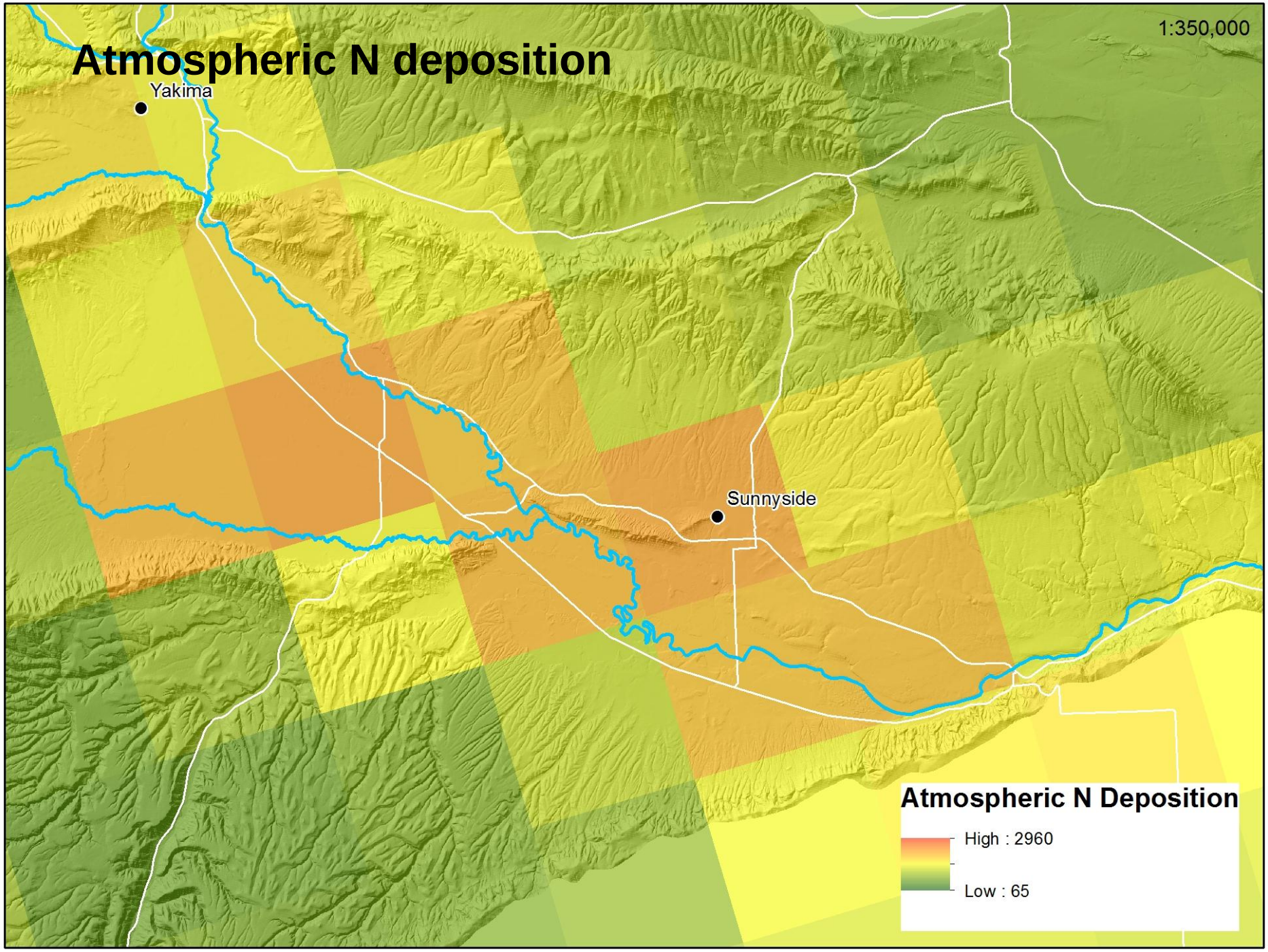
Available datasets

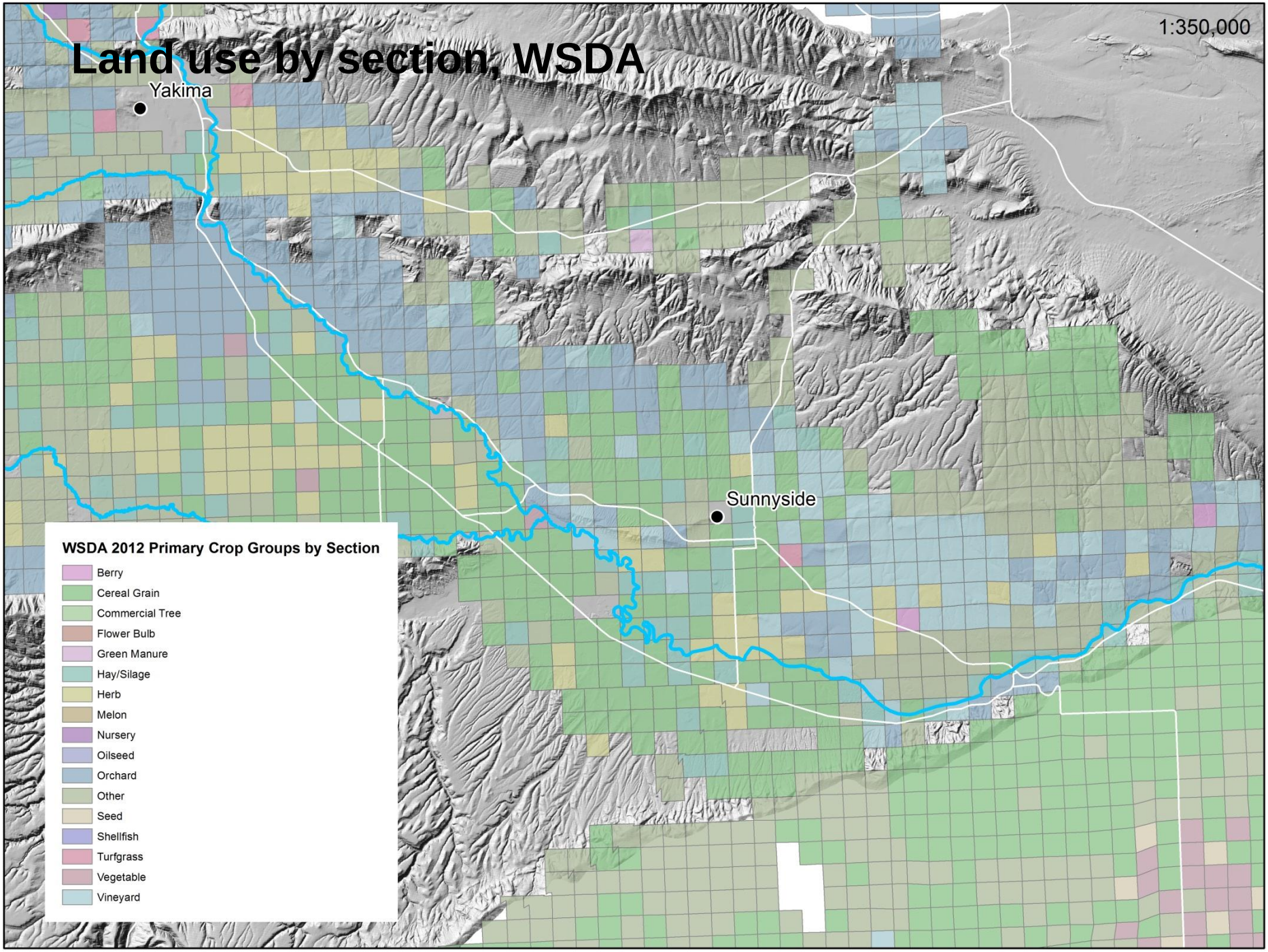
USGS

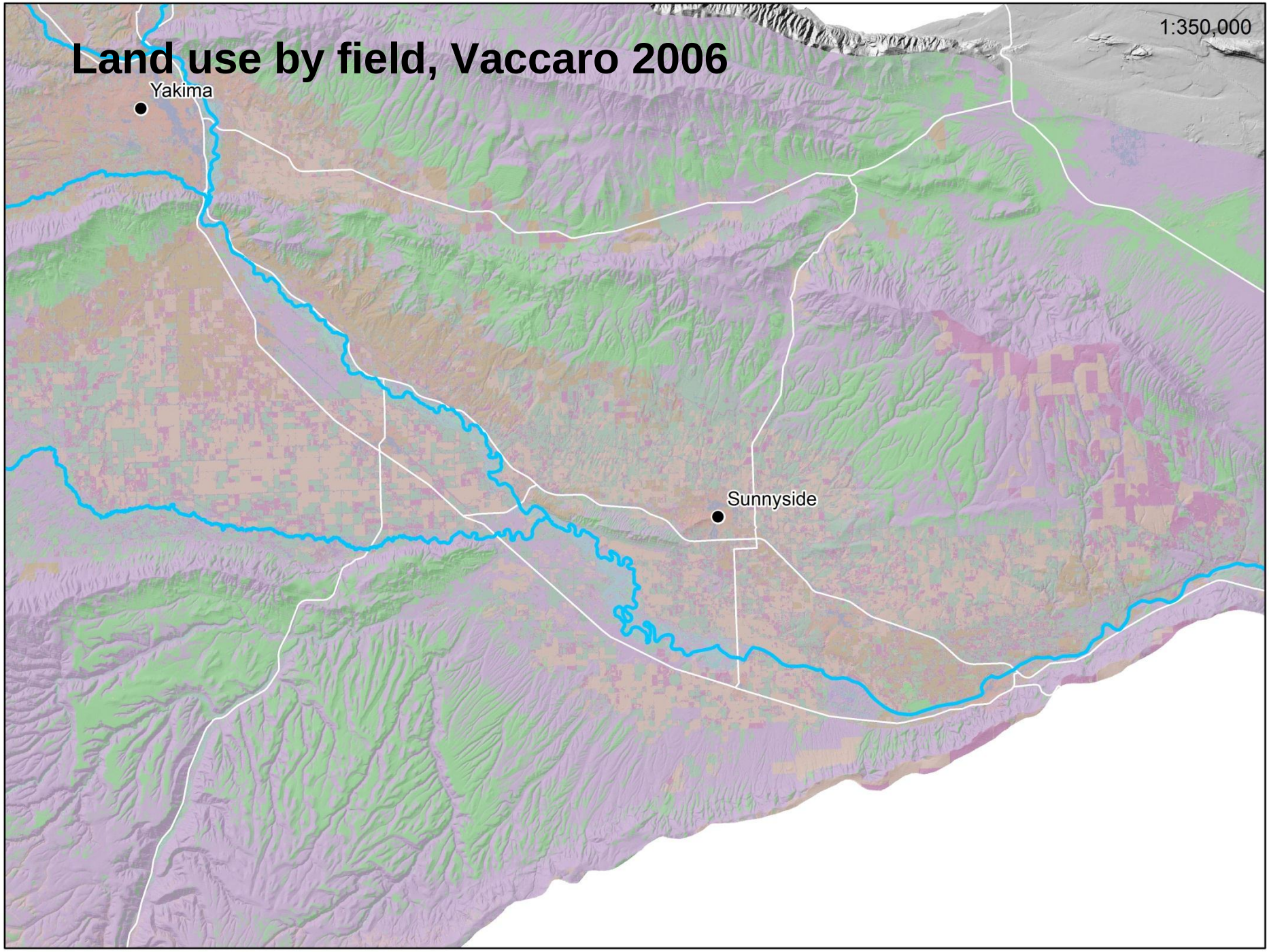

SSURGO soil type designation
Yakima
Sunnyside
1:350,000


SSURGO percent sand soil composition
1:350,000
Yakima
Sunnyside


1:350,000
Yakima
Sunnyside
Livestock Waste Distribution


Atmospheric N deposition
1:350,000
Yakima
Sunnyside
Atmospheric N Deposition
High : 2960
Low : 65


Land use by section, WSDA
1:350,000
Yakima
Sunnyside
WSDA 2012 Primary Crop Groups by Section
Berry
Cereal Grain
Commercial Tree
Flower Bulb
Green Manure
Hay/Silage
Herb
Melon
Nursery
Oilseed
Orchard
Other
Seed
Shellfish
Turfgrass
Vegetable
Vineyard


Land use by field, Vaccaro 2006
1:350,000
Yakima
Sunnyside

Proposed Work

- Specify N loading rates at land surface
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- Link P-GWAVA loading rates to MT3D input rates
- Calibrate combined transport model to the GWMA's nitrate assessment

USGS

How USGS might help

- **Monitoring and Assessment - $417 unallocated**
  - Groundwater monitoring system
  - Database construction
- **Nutrient loading/Nitrogen budget - $50k unallocated**
  - Develop mass balance approach to N loading
- **Best Management Practices - $107k unallocated**
  - Evaluate BMPs for effectiveness
  - Address specific nitrate sources
- **Irrigation Water Management - $704k unallocated**
  - Develop management strategies specific to land use to reduce leaching of nitrate to groundwater

USGS

Project Logistics

- Showcase for new nutrient modeling technology
  - Increases likelihood of USGS matching funds
- Project duration 18 months to three years, depending on desired outcomes
- Will require working closely with the GWMA
- Should have cooperation of basin partners
  - Ecology
  - EPA
  - Dept. of Ag
  - Dept . of Health
  - Yakima County
  - Yakama Nation
  - Producers

USGS

GWMA objectives

- “reduce nitrate concentrations in groundwater below state drinking water standards”
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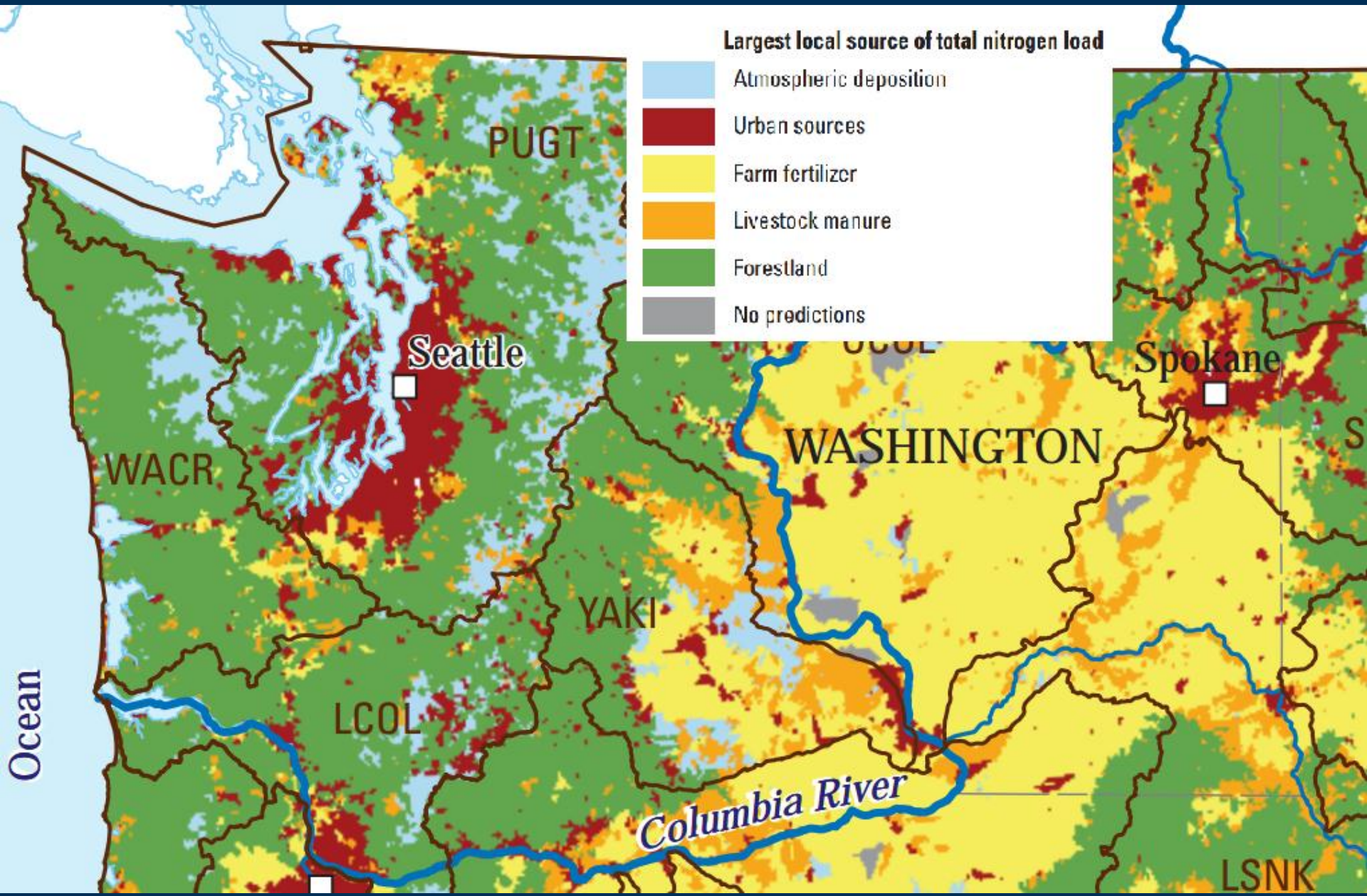
USGS


Largest local source of total nitrogen load
Atmospheric deposition
Urban sources
Farm fertilizer
Livestock manure
Forestland
No predictions
PUGT
Seattle
Spokane
WASHINGTON
WACR
YAKI
LCOL
LSNK
Columbia River
Ocean



USGS
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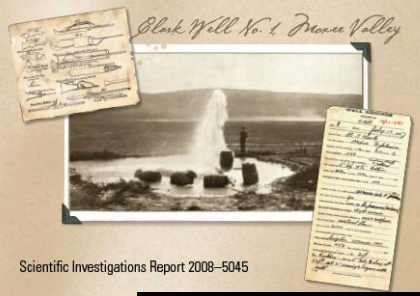
Prepared in cooperation with the Bureau of Reclamation, Washington State Department of Ecology, and the Yakama Nation

Extent and Depth to Top of Basalt and Interbed Hydrogeologic Units, Yakima River Basin Aquifer System, Washington



Scientific Investigations Report 2008–5045

U.S. Department of the Interior
U.S. Geological Survey

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Prepared in cooperation with the Bureau of Reclamation, Washington State Department of Ecology, and the Yakama Nation

Hydrogeologic Framework of Sedimentary Deposits in Six Structural Basins, Yakima River Basin, Washington



Scientific Investigations Report 2006–5116

U.S. Department of the Interior
U.S. Geological Survey

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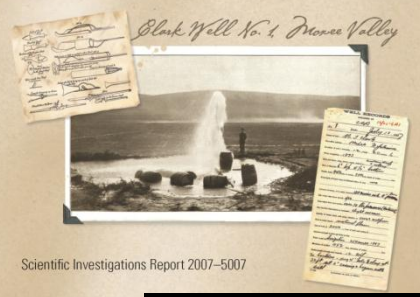
Prepared in cooperation with the Bureau of Reclamation, Yakama Nation, and the Washington State Department of Ecology

Estimates of Ground-Water Recharge to the Yakima River Basin Aquifer System, Washington, for Predevelopment and Current Land-Use and Land-Cover Conditions



Scientific Investigations Report 2007–5007

U.S. Department of the Interior
U.S. Geological Survey

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Prepared in cooperation with the Bureau of Reclamation, Washington State Department of Ecology, and the Yakama Nation

Estimates of Ground-Water Pumpage from the Yakima River Basin Aquifer System, Washington, 1960-2000



Scientific Investigations Report 2006–5205
Version 1.1, October 2007

U.S. Department of the Interior
U.S. Geological Survey

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Prepared in cooperation with the Bureau of Reclamation, Washington State Department of Ecology, and the Yakama Nation

Hydrogeologic Framework of the Yakima River Basin Aquifer System, Washington



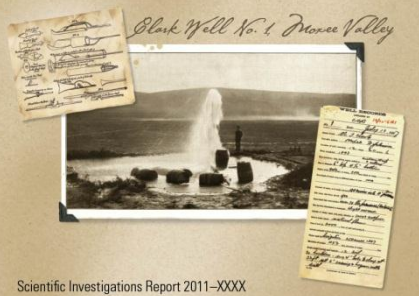
Scientific Investigations Report 2009–5152

U.S. Department of the Interior
U.S. Geological Survey

USGS
science for a changing world

Prepared in cooperation with the Bureau of Reclamation, Washington State Department of Ecology, and the Yakama Nation

River-Aquifer Exchanges in the Yakima River Basin, Washington



Scientific Investigations Report 2011–XXXX

U.S. Department of the Interior
U.S. Geological Survey

http://wa.water.usgs.gov/projects/yakimagw

A Few Computerized Models Suitable for Groundwater Modeling in the LYV GWMA

AIRPACT for Atmospheric Deposition

HYDRUS-1D for Vadose Zone Modeling

MODFLOW for Groundwater and Groundwater-Surface Water Interactions

P-GWAVA for transport of solutes in the sub-surface

RZWQM2 for biological process in various cropping systems

SPARROW for transport of contaminants from inland to larger water bodies

SSURGO mapping of soils throughout the nation

AIRPACT is a computerized system for predicting air quality (AQ) for the immediate future of one to three days for ID, OR and WA. AIRPACT predicts air quality by calculating the chemistry and physics of air pollutants as determined by pollutant emissions within the context of the background, natural air chemistry and predicted meteorology. Meteorology has a first order effect on air pollution, with variables such as wind speed, temperature and precipitation affecting dilution, chemical reaction rates and the removal of pollutants through rain-out, respectively.

Pollutant emissions are another first order determinate of air quality, along with meteorology, and are calculated referring to detailed spatial databases of land use, traffic volumes, industrial emissions and natural emissions from vegetation and soils, all adjusted as appropriate by date, time of day and predicted temperature and solar (uv) light intensity. AIRPACT's project name, the Air Information Report for Public Access and Community Tracking, reflects the goal of bringing meaningful information on the quality of the air (or the level of air pollutants) to the public from a variety of sources, including both model results and monitoring stations.

More Information at http://lar.wsu.edu/airpact/introduction.html

HYDRUS-1D may be used to analyze water and solute movement in unsaturated, partially saturated, or fully saturated porous media. The flow region itself may be composed of

nonuniform soils. Flow and transport can occur in the vertical, horizontal, or a generally inclined direction. The water flow part of the model can deal with (constant or time-varying) prescribed head and flux boundaries, boundaries controlled by atmospheric conditions, as well as free drainage boundary conditions. Soil surface boundary conditions may change during the simulation from prescribed flux to prescribed head type conditions (and vice versa).

More Information at https://www.ars.usda.gov/pacific-west-area/riverside-ca/us-salinity-laboratory/docs/hydrus-1d-model/

MODFLOW is the USGS's modular hydrologic model. MODFLOW is considered an international standard for simulating and predicting groundwater conditions and groundwater/surface-water interactions.

Originally developed and released solely as a groundwater-flow simulation code when first published in 1984, MODFLOW's modular structure has provided a robust framework for integration of additional simulation capabilities that build on and enhance its original scope. The family of MODFLOW-related programs now includes capabilities to simulate coupled groundwater/surface-water systems, solute transport, variable-density flow (including saltwater), aquifer-system compaction and land subsidence, parameter estimation, and groundwater management.

More information at https://water.usgs.gov/ogw/modflow/

P-GWAVA system uses computer simulations that account for a broader range of the hydrologic, physical, biological and chemical phenomena known to control the transport and fate of solutes in the subsurface than has been accounted for by any other vulnerability assessment over regional to national scales. Such phenomena include preferential transport and the influences of temperature, soil properties, and depth on the partitioning, transport, and transformation of pesticides in the subsurface. Published methods and detailed soil property data are used to estimate a wide range of model input parameters for each site, including surface albedo, surface crust permeability, soil water content, Brooks-Corey parameters, saturated hydraulic conductivity, macroporosity and sizes of microbial populations, as well as solute partition coefficients, reaction rates, and meso-micropore diffusion rates.

More information at https://pubs.er.usgs.gov/publication/sir20145189

Root Zone Water Quality Model 2 (RZWQM2) simulates major physical, chemical, and biological processes in an agricultural crop production system. RZWQM2 is a one-dimensional (vertical in the soil profile) process-based model that simulates the growth of the plant and the movement of water, nutrients and pesticides over, within and below the crop root zone of a unit area. It has a quasi-two-dimensional macropore/lateral flow. It responds to agricultural management practices including planting and harvest practices, tillage, pesticide, manure and chemical nutrient applications, and irrigation events. The model includes simulation of a tile drainage system. It has a Windows Interface (RZWQM2.EXE) with manages input and output for Projects and Scenarios and executes the science model (RZWQMrelease.exe).

More information at https://www.ars.usda.gov/plains-area/fort-collins-co/center-for-agricultural-resources-research/rangeland-resources-systems-research/docs/system/rzwqm/

SPARROW (SPAtially Referenced Regressions On Watershed attributes) models estimate the amount of a contaminant transported from inland watersheds to larger water bodies by linking monitoring data with information on watershed characteristics and contaminant sources. Explore relations between human activities, natural processes, and contaminant transport using interactive Mappers.

Modeling results can help managers determine how to reduce loads of contaminants and design protection strategies; design strategies to meet regulatory requirements; predict changes in water quality that might result from management actions; and identify gaps and priorities in monitoring.

More information at https://water.usgs.gov/nawqa/sparrow/#

SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. The information can be displayed in tables or as maps and is available for most areas in the United States and the Territories, Commonwealths, and Island Nations served by the USDA-NRCS. The information was gathered by walking over the land and observing the soil. Many soil samples were analyzed

in laboratories. The maps outline areas called map units. The map units describe soils and other components that have unique properties, interpretations, and productivity. The information was collected at scales ranging from 1:12,000 to 1:63,360. More details were gathered at a scale of 1:12,000 than at a scale of 1:63,360. The mapping is intended for natural resource planning and management by landowners, townships, and counties. Some knowledge of soils data and map scale is necessary to avoid misunderstandings.

More information at
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053627

Groundwater Studies by the Washington State Department of Ecology

Available at
https://fortress.wa.gov/ecy/publications/UIPages/PublicationList.aspx?IndexTypeName=Topic&NameValue=Groundwater&DocumentTypeName=Publication

1985:

- **Roza Irrigation District Ground Water Supply Study: Report for Yakima River Basin Water Enhancement Project**
- **Water in the Lower Yakima River Basin, Washington Hydrology of the Upper Yakima River Basin, Washington**

1988 - 1990:

- **Agricultural Chemicals Pilot Study Yakima County Study Area--Sampling and Analysis Plan**

1990 - 1991:

- Edaleen Dairy Lagoon Ground Water Quality Assessment February 1990 to February 1991
- Sequim-Dungeness Groundwater Quality Study
- Snohomish County Groundwater Characterization Study
- Portage Creek: Nonpoint Source Pollution Effects on Quality of the Water Resource

1992:

- **Gleed Agricultural Chemicals Ground Water Quality Assessment**
- Wellhead Protection Plan for City of Everson
- Blaine GWM Plan Final Hydrogeologic Report Volume I
- Blaine GWM Plan Final Hydrogeologic Report Volume II appendices
- Ground Water Quality Assessment: Whatcom County Dairy Lagoon #2 - Lynden, Washington
- Ground Water Quality Assessment: Sheridan Dairy Lagoon - Adna, Washington
- Report on the Geophysical Logging and TV Inspection of Blaine Wells No. 1 & No. 2
- Responsiveness Summary Amendment to Chapter 173-563 WAC Instream Resources Protection Program for the Main Stem Columbia River in Washington State and New Chapter 173-564 Water Resources Management Program for the Main Stem of the Snake River in WA state
- Redmond-Bear Creek GWM Plan Draft Hydrogeologic Characterization Report, Volume I, for Seattle-King County Health Department
- Summary of Ecology Lagoon Ground Water Assessments. Memorandum to Phil KauzLoric.

- Methods to Determine Wellhead Protection Areas for public supply wells in Clark County

1993:

- Lens Groundwater Study, Whatcom County
- **City of Grandview Class II Inspection, October 21-23, 1991**
- **Ground Water Quality Assessment: Hornby Dairy Lagoon, Sunnyside, Washington**
- **Black Rock - Moxee Valley Groundwater Study**
- Lower Issaquah Valley Wellhead Protection Plan, City of Issaquah Volume I
- Kitsap County Groundwater Management Plan Groundwater Issues Papers
- Chehalis River TMDL, Ground Water Reconnaissance and Estimated Inflows.
- Vashon GWMP, Updated Area Characterization and Data Analysis for Environmental Health Division, King County
- Vashon-Maury Island GWMA Tables, Appendices
- Quincy Agricultural Chemicals Ground Water Assessment

1994:

- Washington State Pesticide Monitoring Program: 1993 Surface Water Sampling Report
- Vadose Zone Monitoring at Tree Top Land Application Site - Selah
- Redmond-Bear Creek GWM Plan for Seattle-King County Health Department
- Effects of Leakage from Four Dairy Waste Storage Ponds on Ground Water Quality, Final Report
- Lummi Island Groundwater Study
- Ground Water Quality Survey near Edaleen Dairy, Whatcom County, Washington, January 1990 to April 1993
- Lummi Island Groundwater Study
- East Jefferson County Groundwater Characterization Study
- City of Westport and South Beach Area Groundwater Characterization Study

1995:

- Estimates of Ground-Water Contaminant Loading to the Colville River in the Vicinity of L-Bar Products
- Watershed Briefing Paper for the Upper and Lower Snake River Water Quality Management Area
- Pesticide Residues in the Walla Walla Surficial Aquifer - Pesticides in Ground Water Report #7
- Surface Water and Groundwater on Coastal Bluffs: A Guide for Puget Sound Property Owners
- Watershed Briefing Paper for the Nooksack Water Resource Inventory Area

- Guidance on Sampling and Data Analysis Methods

1996:

- City of Blaine Wellhead Protection Program
- Watershed Briefing Paper for the Lower Columbia Basin Watershed
- **Watershed Briefing Paper for the Upper and Lower Yakima Watersheds**
- Nooksack Watershed Surficial Aquifer Characterization
- City of Sumas Wellhead Protection Plan
- Ground Water Quality Characterization and Nitrate Investigation of the Glade Creek Watershed
- Relationship Between Ground Water and Surface Water in the Quilceda Creek Watershed
- Washington State Pesticide Monitoring Program: Pesticides in Washington State's Ground Water, A Summary Report, 1988-1995: Pesticides in Ground Water Report No. 9
- Pesticide Residues in the Skagit Delta Surficial Aquifer - Washington State Pesticide Monitoring Program
- City of Kent Wellhead Protection Program, Clark, Kent, and Armstrong Springs
- Issaquah Creek Valley Groundwater Management Plan Supplement, Draft
- A Report on Nitrate Contamination of Ground Water in the mid-Columbia Basin

1997:

- Ground Water in Washington State (Interagency Report)
- Island County Groundwater Nitrate Study
- City of Redmond Wellhead Protection Report
- City of Tumwater Wellhead Protection Program
- Pesticide Residues in the Kittitas Valley Surficial Aquifer
- Winter Soil Pore-Water Nitrate at the Deer Park Land Application Site 1995-96
- Mid-Columbia GWMA -- Quarterly Progress Summary

1998:

- Sumas-Blaine Surficial Aquifer Nitrate Characterization Washington State Pesticide Monitoring Program: 1995 Surface Water Sampling Report
- Chehalis River Watershed Surficial Aquifer Characterization
- Yelm Groundwater Baseline Sampling

1999:

- **Yakima Groundwater Study (OBSOLETE)**
- The Aquifer Vulnerability Project -- Nooksack Pilot Study Report
- Estimates of Nitrate-N Loading to South Puget Sound by Groundwater Discharge

- Groundwater Data Compilation for the Okanogan Watershed
- The Aquifer Vulnerability Project -- Nooksack Pilot Study Report
- Snohomish County Groundwater Management Plan
- Report on Groundwater Contamination that Affects Drinking Water in Washington State

2000:

- North Central Sumas-Blaine Surficial Aquifer Nitrate Characterization Project - June 1999
- Quality Assurance Project Plan: Characterizing Surface Water/Groundwater Interactions in the Muck Creek Watershed Pierce County, Washington
- Quality Assurance Project Plan: Lower Yakima River Water Quality Model and Evaluation of the USBR Columbia River Pump Exchange Project
- Quality Assurance Project Plan: Ambient Groundwater Monitoring in the Dungeness Watershed, Clallam County, Washington
- WDOT-Skokomish Site near Potlatch: Volume 2. Groundwater Mounding Analysis
- WDOT-Skokomish Site near Potlatch: Volume 1. Rapid Infiltration Hydrogeologic Study
- Smith Prairie Groundwater Quality Assessment
- Guidance Document for the Establishment of Critical Aquifer Recharge Area Ordinances

2001:

- Artificial Storage and Recovery of Ground Water: 2001 Report to the Legislature
- Assessment of Surface Water and Groundwater Interchange within the Muck Creek Watershed, Pierce County
- Relationship Between the Upper Dungeness River and the Bedrock Aquifer, Clallam County
- Groundwater Quantity Report for WRIA 01, Phase II
- Groundwater Resources Chapter Level 1 Technical Assessment
- Water Quality Chapter 8 Technical Assessment
- Quality Assurance Project Plan: Groundwater/Surface Water Interactions In the Sammamish River: a Preliminary Analysis.
- Spokane River/Aquifer Interaction Project Results, May - November 1999
- Technical Memorandum-Level 1 Technical Assessment Hydraulic Continuity Evaluation
- Quality Assurance Project Plan: Characterization of the Groundwater Discharge to Moses Lake, Washington

2002

- Groundwater Quantity Report for WRIA 01, Phase II

- Quality Assurance Project Plan: Monitoring for Nitrate Trends in the Central Sumas-Blaine Surficial Aquifer
- Quality Assurance Project Plan: Characterization of Groundwater Discharge to Lake Whatcom
- Surface Water-Ground Water Interactions Along the Dungeness River and Vertical Hydraulic Conductivity of Streambed Sediments, Clallam County, Washington, September 1999-July 2001
- A Comparison of Horizontal Hydraulic Conductivity Values Derived from Aquifer Test and Well Specific-Capacity Data for the Sequim-Dungeness Area
- Effects of Land Application of Manure on Groundwater at Two Dairies over the Sumas-Blaine Surficial Aquifer: Implications for Agronomic Rate Estimates
- Aquifer Vulnerability Analysis Using the Pesticide Root-Zone Model (PRZM2) -- Columbia Basin Irrigation Project Area
- Deschutes River Groundwater Inflow Study 2001 Final Report
- Nitrogen and Pesticide Contamination of GW in WRIA01, V1.3
- Chehalis Reservation 2001 GW Monitoring Report
- Chehalis Reservation Wellhead Protection Report
- Effects of Land Application of Dairy Manure and Wastewater on Groundwater Quality: Pre- and Post-Animal Waste Holding Pond Monitoring

2003:

- **Groundwater Quality in the Central Ahtanum Valley, Yakima County, March 2001 - December 2002**
- Quality Assurance Project Plan: Monitoring for Nitrate Trends in the Central Sumas-Blaine Surficial Aquifer
- Quality Assurance Project Plan: Characterization of Groundwater Discharge to Lake Whatcom
- Effects of Land Application of Manure on Groundwater at Two Dairies over the Sumas-Blaine Surficial Aquifer: Implications for Agronomic Rate Estimates
- Nitrogen and Pesticide Contamination of GW in WRIA01, V1.3
- Technical Memorandum (Task 8A) EF Lewis Ground Water and Surface Water Relationships
- Aquifer Storage and Recovery Evaluation Report
- Groundwater Quality in the Agnew and Carlsborg area, Clallam County, December 2000 - September 2002
- Groundwater/Surface Water Interactions in the Upper Sammamish River: A Preliminary Analysis
- Moses Lake Total Maximum Daily Load Groundwater Study

2004:

- Quality Assurance Project Plan: Groundwater, Soil, and Crop Nitrogen at a Field Where Dairy Waste is Used as Fertilizer in Whatcom County.

- City of Yelm Groundwater Monitoring Project
- Hudson Bay Aquifer Recharge Testing Annual Report 2004
- Groundwater Recharge Topic Paper, Derivation of the CARA Susceptibility Map
- Study of Phosphorus Sources in Groundwater Entering Lake Steilacoom
- Stillaguamish River Watershed Fecal Coliform, Dissolved Oxygen, pH, Mercury, and Arsenic Total Maximum Daily Load Study
- Dungeness Groundwater Modeling Evaluation of Full Buildout in Dungeness River Area
- Level 2 Technical Assessment Watershed Simulation Model, Little and Middle Spokane Watersheds
- Appendix D Phase II Watershed Assessment, Nitrate Concentration and Distribution Study
- Quality Assurance Project Plan: Groundwater Assessment Program Pilot Study, Phase 2

2005:

- **Quality Assurance Project Plan: Assessment of Ambient Groundwater Quality Conditions in the Surficial Unconsolidated Sedimentary Aquifer of the Moxee Valley, Yakima County, Washington**
- Washington State Groundwater Assessment Program: Hydrology and Quality of Groundwater in the Centralia-Chehalis Area Surficial Aquifer
- Hudson Bay Aquifer Recharge Testing Annual Report 2005
- Implementation Guidance for the Ground Water Quality Standards
- Aquifer Storage and Recovery Assessment, City of Kennewick
- Focus on: Montesano soil & groundwater investigation
- Surficial Aquifers and Approximate Depth to Water
- Assessment of Surface Water and Groundwater Interchange in the Walla Walla River Watershed
- Groundwater Data Summary for the Wenatchee River Watershed Total Maximum Daily Load Study
- Hydrogeologic Assessment of Tucannon River, Pataha and Asotin Creek Drainages
- Focus Sheet: Developing Ground Water Cleanup Standards under the Model Toxics Control Act
- Hydrogeologic Study of the Lower Dosewallips_Brinnon Area_WRIA 16 Final Report
- Critical Aquifer Recharge Areas: Guidance Document
- Lake Whatcom Total Maximum Daily Load Groundwater Study

2006:

- **Groundwater-Surface Water Interactions along the Naches and Tieton Rivers, Summer and Fall 2004**
- Lake Whatcom Total Maximum Daily Load Groundwater Study

- An Evaluation of a Piezometer-Based Constant Head Injection Test (CHIT) for use in Groundwater/Surface Water Interaction Studies

2007:

- **Ambient Groundwater Quality in the Moxee Valley Surficial Aquifer, Yakima County, January-June 2006**
- Quality Assurance Project Plan: Bertrand Creek and Meadowdale Areas (Whatcom County) Follow-Up Study of EDB and 1,2-DCP in Residential Wells. Addendum to Quality Assurance Project Plan: Groundwater, Soil, and Crop Nitrogen at a Field Where Dairy Waste is Used as Fertilizer in Whatcom County
- Technical Memorandum #8: Impacts of Climate Change on Groundwater Resources - A Literature Review
- City of Walla Walla Shallow Aquifer Recharge Feasibility Study
- Project Completion Report for Shallow Aquifer Recharge Testing, Hall-Wentland Site
- Webb Hill Biosolids Facility Hydrogeologic Investigation_Phase 1
- Ground-Water Flow Model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington and Bonner and Kootenai Counties, Idaho
- Hydrogeologic Framework and Water Budget of the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington and Bonner and Kootenai Counties, Idaho
- Report to Management: Groundwater Assessment Program Pilot Study
- Assessment of Surface Water / Groundwater Interactions and Associated Nutrient Fluxes in the Deschutes River and Percival Creek Watersheds, Thurston County
- Addendum to Quality Assurance Project Plan: Groundwater, Soil, and Crop Nitrogen at a Field Where Dairy Waste is Used as Fertilizer in Whatcom County

2008:

- Nitrate Trends in the Central Sumas-Blaine Surficial Aquifer
- Fecal Coliform and Nitrate Transport in Shallow GW Discharging to Streams, Nooksack Indian Tribe
- San Juan County Annual Groundwater Monitoring Report
- Interim Aquifer Protection Report, Eastsound, San Juan County
- Ground Water Level Field Monitoring Report-Phase II, Alpowa and Asotin Creek Basins
- Installation of Monitoring Wells and Staff Gages in Lower Dungeness Watershed-Technical Memo
- Quality Assurance Project Plan: High-resolution, Pore-water Sampling Near the Groundwater/Surface Water Interface
- Quality Assurance Project Plan: Groundwater-Surface Water Interactions Along Chumstick Creek and Mission Creek in WRIA 45, Chelan County, Washington
- Ambient Groundwater Monitoring Program and Data Quality Management Plan

- Addendum to Quality Assurance Project Plan: Type N Experimental Buffer Treatment Study: Addressing Buffer Effectiveness on Riparian Inputs, Water Quality, and Exports to Fish-Bearing Waters in Basaltic Lithologies

2009:

- Quality Assurance Project Plan: Effects of Conventional versus Minimum Tillage on Groundwater Nitrate at a Manured Grass Field
- Bertrand Fish trap Flow Depletion Model (Whatcom County)
- Columbia Basin GWMA Subsurface Mapping and Aquifer Assessment Project, Final Project Performance Report
- Focus on Upper Crab-Wilson Watershed
- QAPP Groundwater Level Gauging Program, Northern Lincoln County, ver_1 Draft
- Monitoring Riparian Buffer Functions to Reduce Non-Point Pollution in Pierce County, Clarks Creek, Puyallup
- Groundwater Level Declines in the Columbia River Basalt Group and their Relationship to Mechanisms for Groundwater Recharge: A Conceptual Groundwater System Model
- Memo: Groundwater Monitoring in Chumstick Creek Subwatershed
- Little Spokane River Groundwater Inventory & Mapping Report
- Cumulative Impact Analysis_Report_of Outdoor Water Use by Permit-Exempt Wells in the Chumstick and Mission Creek Subwatersheds
- Surface Water/Groundwater Exchange Along the East Fork Lewis River (Clark County), 2005
- Quality Assurance Project Plan: Sumas-Blaine Surficial Aquifer Long-Term Ambient Groundwater Monitoring

2010:

- **Lower Yakima Valley Groundwater Quality Preliminary Assessment and Recommendations Document**
- Concise Explanatory Statement: Chapter 173-539A WAC, Upper Kittitas Groundwater Rule
- Quality Assurance Project Plan: Puget Sound Groundwater Toxics Loading Analysis, Direct Discharge Pathway
- Little Spokane Groundwater Elevation and Stream Flow Monitoring Project
- Little Spokane Groundwater Elevation and Stream Flow Monitoring Project
- Groundwater Inventory and Mapping Project Lower Lake Roosevelt Watershed
- Preliminary Critical Aquifer Recharge Analysis Report Lower Lake Roosevelt Watershed
- Small Business Economic Impact Statement Chapter 173-539A WAC Water Resources Program for the Upper Kittitas Groundwater Area
- Preliminary Cost Benefit and Least Burdensome Analyses for Chapter 173-539A WAC: Upper Kittitas Groundwater Rule

- Rule Proposal Notice: Upper Kittitas Ground Water Rule, Chapter 173-539A WAC
- Technical Memo_Lake Spokane GW Loading Analysis_DRAFT
- Bertrand Fishtrap Flow Depletion Model
- Technical Memorandum Groundwater Time of Travel Contours_McCarteney Creek and Rattlesnake Springs
- Groundwater Elevation Monitoring Report_Exempt Well Water Use Phase II_2009

2011:

- North Whatcom Groundwater Update
- Quality Assurance Project Plan: Sumas-Blaine Aquifer Nitrate Contamination Summary
- North Whatcom Groundwater Update Quality Assurance Project Plan: Sumas-Blaine Aquifer Nitrate Contamination Summary
- EDB and 1,2-DCP in Domestic Groundwater Supplies, Follow-Up Investigation: Bertrand Creek Area (Whatcom County)
- Sumas-Blaine Aquifer Long-Term Groundwater Quality Monitoring Network, 2009 Annual Report
- Groundwater Level Gauging Project: Lower Lake Roosevelt Watershed (WRIA 53),
- Mission Creek Subwatershed Hydro-Geologic Monitoring Report
- Chumstick Creek Subwatershed Hydro-Geologic Monitoring Report
- Little Spokane Groundwater Elevation and Stream Flow Monitoring Project, Tech. Memo - 2011 Project Update
- 2011 Swale Creek Subbasin Water Level Monitoring Summary, WRIA 30
- Control of Toxic Chemicals in Puget Sound: Evaluation of Loading of Toxic Chemicals to Puget Sound by Direct Groundwater Discharge

2012:

- Quality Assurance Project Plan Little Squalicum Creek Estuary Soil and Groundwater Characterization
- Addendum to Quality Assurance Project Plan Sumas-Blaine Surficial Aquifer Long - Term Ambient Groundwater Monitoring
- **Yakima River Basin Integrated Water Resource Management Plan**
- Surface Water/Groundwater Interactions and Near-Stream Groundwater Quality along Burnt Bridge Creek, Clark County
-

2013:

- Focus on: The Ground Water Permit Exemption
- WRIA 1 Groundwater Data Assessment (Whatcom County)
- Little Squalicum Creek Estuary Soil and Groundwater Characterization (Whatcom County)
- Surface-Water/Groundwater Interactions and Near-Stream Groundwater Quality, Lacamas Creek, Clark County

2014:

- Nitrogen Dynamics at a Manured Grass Field Overlying the Sumas-Blaine Aquifer in Whatcom County
- **Focus on Water Availability: Lower Yakima Watershed, WRIA 37**
- Spreadsheet Models for Determining the Influence of Land Applications of Fertilizer on Underlying Groundwater Nitrate Concentrations

2015

- Relationship between Land Use and Nitrate Concentrations in Washington State Department of Ecology Monitored Watersheds

2016

- Quality Assurance Project Plan Evaluation of Groundwater Quality and Discharge Conditions at the Terminus of Deep and Coulee Creeks (Spokane County)
- Manure and Groundwater Quality Literature Review
- Washington Nitrate Prioritization Project
- Predicted Impacts of Climate Change on Groundwater Resources of Washington State

2017

- Sumas-Blaine Aquifer Long-Term Groundwater Quality Monitoring, 2009-2016
- **Addendum to Quality Assurance Project Plan Yakima Railroad Area Groundwater Performance Monitoring**
- Economic Impact Analysis Final Concentrated Animal Feeding Operation General Permit

2018

- Preliminary Re-Evaluation of Discharges from Washington's Water Treatment Plants
- Quality Assurance Project Plan Sumas-Blaine Aquifer Nitrate Characterization, 2018

Yakima County – 17 studies

Whatcom County – 46 studies

ENVIRONMENTAL REPORT TRACKING SYSTEM
FOLLOW UP FORM – CHEAT SHEET

CALLER INFORMATION

Date 10/28/2016 **Time** Unknown	**Confidential** ☐
Name	Unknown
Address	
City/State	
Contact #	

INCIDENT INFORMATION (MAKE SELECTIONS)

Medium	**Material**	**Source**	**Cause**	**Quantity**
Ditch,	Dairy waste, Waste water.	Dairy,	Unknown	Unknown

WRIA/Sub-Basin	Yakima
Location/Address	
City/State	

Potentially Responsible Party	Klompe Dairy
Contact #	
Address	
Incident Date Unknown	**Time** Unknown

Incident Information
Caller states Wasteway runs through the Veldhuis Dairy – Wasteway clear on the Hornby Rd side and cloudy & manure on the Waneta Rd side. Caller states that the PRP is disposing of manure and possibly milk – the canal water is milky in color and dairy lagoon is empty.

FOLLOW-UP INFORMATION

ERTS # 668601
Investigator(s) Chery Sullivan, DNMP

Field Response ☐ **Telephone** ☒ **Referral** ☐ **Written Enforcement** ☐

Narrative (attach map if appropriate)
WSDA received ERTS 668601 on Friday, October 28, 2016. There is currently no WSDA staff in the Yakima office, however I did reach out to Laurie Crowe with the South Yakima Conservation District (SYCD), and the potentially responsible party on Friday. SYCD conducted a site visit with the potentially responsible party on October 31, 2017. No cloudy or milky water was observed in the waterways adjacent to Waneta Road. After the site investigation, Ruurd Veldhuis (the potentially responsible party) contacted me by phone to further discuss and address issues from the ERTS. Mr. Veldhuis stated that they had recently emptied the lagoon in question by transferring the liquid to a different lagoon. He also said that no manure applications had been made to the fields that could potentially drain to the water way in question since April 2016.

The anonymous complaint in ERTS 668601 received October 28, 2016, is substantially similar to ERTS 668166 received October 10, 2016. WSDA considers the complaint in ERTS 668601 as unfounded, and will do no further follow up.

DNMP – Implementation Progression (Timelines)

1998

Act establishing program requiring nutrient management plans to be developed, approved and certified, establishing NRCS practice standards as the default technical standards and requiring inspections. Compliance is performance based so field enforcement is tied to having a discharge.

1998-99

Conservation Commission established 20 minimum elements required for the plans to be approved. Elements included both infrastructure and management elements to protect both surface and groundwater.

1999- July 2002 CD and NRCS: Plan development and approval required

- Infrastructure investment by state and NRCS: State funding provided to conservation districts to develop the plans and for cost share to dairies to implement the plans. Implementation included construction or improvements of infrastructure for manure collection and storage in lagoons, concrete pads and curbing to contain contaminated water, gutters and downspouts to keep clean water clean, pumps and irrigation equipment.
- Planning and various calculations were done to balance and properly manage nutrient storage capacity and proper applications on land managed by the dairies. Generally, implementation of agronomic management practices was postponed while focus was on getting infrastructure in place.

1998-July 2002 Ecology inspections, compliance and CAFO permit

- Up to 7 inspectors located in Yakima, Lacey, Bellevue and Bellingham spent some part of their time on systematic inspections of dairies, identifying and documenting surface water quality issues from facilities and fields.
- Close to 100 dairies had documented discharges and were put under the Dairy General CAFO permit which required full implementation of their dairy nutrient management plan.
- As infrastructure improvements were constructed and most plans were completed.

July 2002-Dec. 2003 Plan certification (implementation) required

- Implementation requires ongoing facility management and agronomic applications. Districts and NRCS continued with infrastructure improvements and worked to some extent with operators on soil and manure testing, cropping, application methods and timing to ensure agronomic applications.
- Compliance continued to focus on surface water impacts.
- Ecology tracked plan approvals and certification.

July 2003

- Program shifted to WSDA with half the inspection resources (2 ½ inspectors).
- Initial program organization was slow but in place by spring 2004 and fully functional by July 2004.
    - WSDA led meetings and discussions of the Development and Oversight Committee (DOC) and sub-committees on state livestock and CAFO program elements, including compliance with water quality standards surface and ground, technical standards and regulatory requirements to meet EPA delegation requirements.

2004 WSDA implementation

- WSDA staff looked closely at records and discussed with operators the need to keep and use them. Inspectors identified need for operators to have good direction on soil and manure testing. They noted informally that maybe only 15% were keeping and using records to manage agronomic applications.

- Program determined that 2 ½ inspectors was insufficient to cover all of Puget Sound and Whatcom. Consequently staff coordinated with industry leaders and other stakeholders in order to get funding for additional Puget Sound inspector.
    - Ecology begins new CAFO permit development and includes groundwater monitoring, Ecology negotiated with stakeholders to drop monitoring wells from the permit, to include an element focused on lagoons for potential leaking and to increase emphasis on records under the permit. Ecology agreed to put more emphasis on groundwater in Whatcom and Yakima.
    - DOC meetings continued and draft legislation was developed expanding dairy act to all livestock Animal Feeding Operations, outlining CAFO program to be consistent with federal program and incorporating necessary authority for WSDA.

2005 WSDA program development

- Developed fact sheet for operators on soil and manure testing in cooperation with other technical staff from WSU, Ecology, NRCS and CDs.
- Program implementation issues raised by inspectors:
    1. Some plans were not very detailed, difficult for operators to use or did not seem to adequately address WQ issues at operations. Discussions with operators and CD planners did result in some improvements.
    2. Identified state limitation to require ongoing DNMP implementation once certification was achieved, and need to update plans as operations changed. Determined state did not have authority to write rules to improve situation.
    3. Lagoon management issues resulted in 'emergency' need for winter applications to protect integrity of lagoons.
    4. 3rd party applicators noted as not getting the same message on agronomic applications and field conditions. Did some communication with them on a case by case basis.
    5. Lack of authority to gain access to a dairy site if access was denied
- Fall 2005 – Lagoon sweeps started this and every fall to check lagoon management and capacity going into winter, primarily in North Puget Sound counties.
- Groundwater nitrate issues in Lower Yakima were raised through complaints on condition of some private wells. WSDA organized some meetings among Ecology, WSDA and local Health with minimal outcomes for homeowner involved.
    - DOC legislative compromise negotiated out but smaller targeted bill was passed
    - EPA CAFO rule court decision limited permits to facilities with actual discharges

2006 Expanded technical assistance role

- Initiated 'Inter-agency Livestock Technical Assistance Committee' with cross agency representation. Over two years group assisted Ecology in identifying process to evaluate CAFO lagoons for possible leakage, developed a Technical Assistance Referral process and form for WSDA to use with Conservation Districts and further discussed soil and manure testing and use of data to make management decisions on crop applications.
- Soil test data use: Due to variability in soil testing results, determination was to look at data from at least 3 years to get sense of trend. Soil test trigger numbers were set at: 45ppm N as needing attention to reduce levels, used 30 ppm as a level of concern; 100 ppm P for Eastern WA and 120ppm P for Western WA as the level requiring attention. These levels became regular part of inspection discussions when records were reviewed.

- Expanded DOC discussed state livestock program and WSDA delegation in terms of the federal court decision. After starting all over with a new statute, decision was made to go forward with a split state program that had Ecology responsible for the permit and non-dairy AFOs and WSDA responsible for the dairy program

2007

- Staff noted seeing soil N and P levels dropping at some sites, comments made by some dairy operators that they realized they did not need to buy any or as much fertilizer

2008

- After a series of compliance actions related to poor management of silage, staff worked with other partners to develop a fact sheet on the WQ impacts of silage leachate and better management.
- Discussed with dairy industry the need for record keeping in order to ensure operators have the tools to make agronomic applications.
- WSDA began discussions with Ecology on updating the MOU
  - Oct 2008 Yakima Herald series on groundwater prompted new discussions with dairy industry on groundwater protection and importance of records and agronomic applications
  - DOC sunset

2009

- Legislation passed amending statute to establish warrant authority to access dairies and all records and making it a violation of the statute to not keep records required to show agronomic applications.
- Fact sheet on new records requirement developed and mailed to all dairies.
- WSDA held livestock stakeholder meeting with some discussion regarding implementation of the split livestock program.
- New MOU with Ecology was finally completed and signed
- WSDA began developing records rule to define required records and establish a penalty matrix and worked with local state and federal technical staff on language and approach.
  - Meetings among state and local agencies and public held discussing the groundwater issues in Lower Yakima Valley.
  - WSDA volunteered to pull together initial overview of what was then known about the valley ground water and uses.
  - 3 years of annual reports from permitted CAFOs confirmed there were high nitrate levels at some dairy facilities
  - Ecology initiated effort to move dairy program back to Ecology (Natural Resource Reset)
- Changed program name from 'Livestock Nutrient' to 'Dairy Nutrient' to reflect statutory program focus on dairies
- Range rules to be used during public disclosure process were finalized and adopted as required by RCWs 43.17, 42.56, and 34.05.

2010 Program constraints, compliance issues and best management practices

- A summary of statutory constraints on program effectiveness was developed in preparation for legislative discussions
- Legislation amended statute to establish penalty for records violation and the Natural Resources Reset effort to move the program was dropped

- As a part of cross agency discussions regarding the dairy program and possible improvements, program enforcement actions were analyzed. Nine main categories of compliance issues were identified. Four related to field applications three related to facility infrastructure, one for animal access to surface water and one for problems with nutrient management plan. Applications made with improper field conditions were the single most common problem.
- After a series of compliance actions related to improperly managed filter strips, staff worked with other agency technical staff to develop a fact sheet on proper conditions and use to be effective for both surface and ground water protection.
- Worked with Ecology and NRCS on Bartelheimer lagoon failure in Snohomish Co.
- Worked with stakeholders on Samish River Watershed bacteria issues.
- Participated in various discussions regarding Best Management Practices to protect water quality triggered in part by Ecology's riparian manual
    - Ecology issued compliance order to several permitted dairies with high nitrates
    - Puget Sound funding by EPA to address nutrients and bacteria among other items – discussion among agencies on nutrient management
    - EPA carried out extensive groundwater and source sampling as part of effort to better inform groundwater protection efforts in Lower Yakima Valley

2011

- Expanded activity in Samish Watershed to include some non-dairy work to support Ecology and County in response to Governor's directive to make better progress.
- WSDA coordinated with Ecology on review of NRCS lagoon assessment tool developed partly in response to Bartelheimer failure and partly due to aging of early lagoons. Later signed a grant contract with NRCS to use the tool to do lagoon assessments in Puget Sound. Assessment discussions included concerns over difficulty to evaluate groundwater impact of existing structures.
- Completed draft records and penalty rule revised after input from technical and dairy stakeholders but held back to resolve certain issues with Ecology regarding the penalty matrix
    - 3DT talks rise out of BMP discussions, coordination opportunities regarding Samish work, MOA development between Skagit CD and Ecology and communication issues around the Ecology and WSDA MOU

2012 Lagoon assessment focus

- Mar- Dec – Lagoon assessments conducted in North Puget Sound counties to field test lagoon assessment process for NRCS
- Sep-Dec - 3DT committee work to evaluate the technical and policy gaps to prevent negative impacts from land applications of manure (WSCC, ECY, WSDA)
- Oct – WAC 16-611 Nutrient Management finalized



December 11, 2017

David Bowen
WA State Dept. of Ecology
Central Washington Regional Office
1250 West Alder Street
Union Gap, WA 98903-0009

Dear Mr. Bowen,

Since 2012 the Lower Yakima Valley Groundwater Management Area (LYV GWMA) has wrestled with the problem of elevated nitrates in groundwater. Why? Because poor and not so poor people in the area spend over $1 million per year on bottled water. Their only source of drinking water is not safe. What a powerful statement of need.

The legislature saw this great need and appropriated $2.3 million for the GWMA program. But . . . at the same time . . . certain opportunists and a few bureaucratic entrepreneurs saw a golden opportunity. There was money to be made for those with the right connections.

At the end of five years, who has benefited and who has lost ground due to ongoing pollution and the LYV GWMA? Here are some facts.

In 2011 Yakima County told policy makers what the GWMA would accomplish. The GWMA would demonstrate improved water quality within five years. In 2012 the advisory committee agreed upon certain necessary, supporting tasks.

- The GWMA needed a system of monitoring wells in order to analyze whether water quality is improving. Those wells have still not been drilled, although the GWMA has spent over $240,000 on planning the system.
- The GWMA needed data from deep soil sampling in order to study the movement of nitrates from the land surface to the aquifer. At a cost of $1,400 per site the GWMA took samples down to six feet on 175 fields. That data has not yet been analyzed or even shared with the public.

- The GWMA contracted with the Yakima Health District to sample domestic wells and to survey well owners. The results of the questionnaire are still not available, even to members of the advisory committee.
- The GWMA paid a group of engineers to summarize all applicable rules and regulations. For $10,000 that group delivered an eight page document that a college freshman could have written in a few days using google.
- The GWMA paid a group of engineers $76,000 to compile and analyze a list of Best Management Practices designed to protect the groundwater. They cut and pasted work from another group's study. That work is not being used.
- The GWMA needed to determine how much people know about nitrates in groundwater. Students from Heritage University conducted a survey in 2013 that showed only half of the people in the area were aware of the problems. There is no follow up survey to tell us whether education and public outreach has been successful.

From the outset the GWMA advisory committee agreed that a Nitrogen Loading Assessment or Nitrogen Availability Assessment (NAA) was needed in order to identify the major sources of nitrate pollution. In order to address the problem the group needed to know, with reasonable certainty, what was causing it.

The Washington State Department of Agriculture and Yakima County collaborated on the NAA project with a delivery date of July, 2015. This gave the advisory committee plenty of time to analyze sources and propose targeted solutions. But . . . that delivery date was moved back to December 2015, and moved back again to 2016 and moved back again to whenever the authors cared to share.

Finally the document arrived in April 2017. There were some surprises.

- The authors ignored cropland that receives bio-solids
- The authors ignored drain fields for municipal and industrial waste water treatment
- The authors ignored leaching from composting operations
- The authors ignored nitrogen fixing from alfalfa
- The authors ignored the results from GWMA Deep Soil Sampling
- The authors ignored input from farmers on the GWMA Irrigated Agriculture Work Group
- The authors found that 77% of nitrate available for leaching on irrigated cropland came from orchards and vineyards

No kidding. For years the advisory committee had been talking about nitrate pollution from animal agriculture, a familiar, worldwide problem. But in the Yakima Valley, according to WSDA, the biggest culprit is all those polluting apples and grapes.

The NAA stated that on average an apple orchardist applies about 60 pounds of nitrogen per acre at the beginning of harvest. (This is not a large amount. Some crops receive over 250 lbs per acre.) The NAA calculated that on average, in the fall after a crop is harvested, there is an excess of 90 lbs of nitrogen per acre on apple orchards. This makes no sense. But this calculation led the WSDA to identify apple orchards as the largest contributor to the problem of nitrates in groundwater.

Local farmers on the GWMA Irrigated Agriculture Work Group had provided the WSDA with on the ground information. For the most part the WSDA ignored local farmers and relied on anonymous sources to develop a convoluted model that no thinking person believes. Members of the GWMA advisory committee pointed out problems to WSDA in April 2017. At the time of this writing, eight months later, WSDA and Yakima County have not made corrections to the study and have inputted the data into a GIS system that maps available nitrate for the target area. The GIS is available at http://arcg.is/1ie9mP

Last week Ecology gave the GWMA a one year extension to complete its work. This is a one time, last chance to get things right. The agencies and contractors who will complete the GWMA research and final plan must be held accountable for the accuracy and timeliness of their work.

There must be tools for enforcement. There must be a watchdog. The advisory committee was supposed to perform this function but agencies have arrogantly ignored members' questions and concerns. The Friends of Toppenish Creek respectfully ask Ecology to modify the amendment to Interagency Agreement, IAA No. C1200235, so that:

- Yakima County will provide a detailed balance sheet of GWMA debits and credits on a monthly basis to members of the advisory group.
- Yakima County will re-write the GWMA timeline using the list of tasks from the *GWMA Plan Timeline* that was submitted to Ecology in the 2015 First Quarter Report. Yakima County will report compliance with the new timeline to the advisory committee on a monthly basis.
- Failure to meet 80% of the benchmarks in the revised timeline for two consecutive months will require formal discussions with GWAC participation.
- Failure to meet 80% of the benchmarks in the revised timeline for three consecutive months will require revision and/or cancellation of the interlocal agreement and that revision and/or cancellation will require approval from the GWAC.
- The purpose built wells approved by the GWMA advisory committee will be drilled and in place by February 28, 2018. If there is insufficient funding to drill all 30 wells Yakima County will consult with the GWMA advisory committee regarding selection of the most important wells.

- Agencies that send staff to the GWMA meetings (Ecology, DOH, WSDA, EPA USGS, SYCD, SVID, YHD, Port of Sunnyside, Yakima County, and WSU) will provide documentation of their costs for time spent reviewing material, meeting time and travel. These reports will be due on April 15, 2018; July 15, 2018 and Dec. 31, 2018.
- Yakima County, Ecology and WSDA will re-write the Nitrogen Availability Assessment (NAA) and comply with the Scope of Work (SOW) as much as possible. This will be completed by February 28, 2018.
- Yakima County, Ecology and WSDA will provide documentation of staff time and costs for revising the NAA. This report will be due on March 15, 2018,
- Yakima County, Ecology and WSDA will document the input from growers and producers from the Irrigated Ag Work Group. WSDA will give that data equal or greater weight than the opinions of fertilizer salesmen and agronomists in the revision of the NAA. If necessary WSDA will meet again with the Irrigated Ag Work Group and verify the information.
- Yakima County, Ecology and WSDA will incorporate data from the GWMA Deep Soil Sampling into the NAA as required in the SOW.
- Experts who contribute to further data gathering and research analysis for the NAA and the GWMA plan will be clearly identified by name and credentials
- Those who supervise and/or conduct further research for the NAA and the GWMA plan will be clearly identified by name and credentials. There will be a clearly stated chain of command and confirmation of accountability for any work done after December 31, 2017.
- Those who write the GWMA plan will be clearly identified by name and credentials.
- Yakima County and agencies that participate in the writing of the GWMA plan will provide documentation of staff time and hourly rates for work on that document. This information will be shared with the GWMA advisory committee on a monthly basis.
- Members of the GWMA advisory committee will be allowed to challenge any supervisor, any expert or any staff person who does not possess the necessary expertise to perform a job or gives out false information. Such a challenge will be formally addressed by the GWAC. Decisions will require a formal vote by participating members.
- Ecology will find two new members for the advisory group to represent the Hispanic population of the Lower Yakima Valley and will consult with these representatives on the most effective ways to engage this population.
- Education and Public Outreach required to inform the public about the GWMA plan will be based on sound and clearly referenced principles of adult education.
- Names and credentials of staff and others who design and deliver the Education and Public Outreach component of the final GWMA plan will be clearly stated.

- Either in cooperation with the GWMA Funding Work Group or through a contract with a qualified expert, Yakima County will provide the advisory group with cost estimates for each of the proposed solutions to the Lower Yakima Valley groundwater nitrate problem.
- No solutions will be approved until the advisory committee has agreed upon the level of contribution from major sources, has evaluated the likely impact of proposed solutions, has received estimates of cost for implementation and has ensured that there are solutions targeting each of the major contributing factors.
- Any paid individual found responsible for failure to comply with the terms of any GWMA contract or interlocal agreement will provide the advisory committee with a rationale for the lack of compliance. If the committee finds the rationale to be unsatisfactory the responsible individual will be immediately removed from his/her position of authority in the GWMA work.

Thank you for your time and attention. We look forward to hearing from you at your earliest convenience.

Sincerely,

Jean Mendoza

Jean Mendoza

Executive Director, Friends of Toppenish Creek
3142 Signal Peak Road
White Swan, WA 98952

cc.

Maia Bellon, Ecology

Heather Bartlett, Ecology

Sage Park, Ecology

Rand Elliott, Yakima County

Vern Redifer, Yakima County

Governor Jay Inslee

Members of the Groundwater Advisor Committee

WA State Legislators

Yakima Herald Republic

Yakama Nation

Attachments:

Calculation of Nitrogen Balance for Apples in the Lower Yakima Valley

WSDA Irrigated Crops Mass Balance table from the LYV GWMA Nitrogen Availability Assessment

From: Jean Mendoza <jeanrmendoza@icloud.com>
Date: February 14, 2018 8:57:44 AM
To: gbahr@agr.wa.gov,"Redding, Melanie (ECY)" <mkim461@ecy.wa.gov>,Vern Redifer <vern.redifer@co.yakima.wa.us>,David Bowen <david.bowen@ecy.wa.gov>
Cc: cranes@yakama.com,esanchey@yakama.com,prigdon@yakama.com,janwhitefoot@gmail.com,Jim Dyjak <Dyjak@nwinfo.net>
Subject: GWMA Research

Good Morning Nitrogen Availability Assessment (NAA) Experts,

I have been reviewing research regarding water quality in Washington State and I came across a 2015 Technical Memorandum entitled *Relationship between Land Use and Nitrate Concentrations in Washington State Department of Ecology Monitored Watersheds* by Anthony Whiley from Ecology.

It appears that we missed a significant source of nitrogen loss in the *Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area.* According to Whiley's work approximately 218 tons of nitrate per year leaves the Deep Canyon sub basin in the Lower Yakima Valley and ends up in the surface waters of the Yakima River.

Since the NAA is a living document we can make adjustments to the data. How do we go about making this correction?

Thanks and best wishes.

Jean Mendoza

From: Jean Mendoza <jeanrmendoza@icloud.com>
Date: March 21, 2018 6:00:14 PM
To: Jim Davenport <jhdavenportllc@gmail.com>
Cc: Jim Dyjak <Dyjak@nwinfo.net>
Subject: GWMA

Hello Jim,

At the last GWMA meeting David Bowen said that the best way to introduce suggested legislative changes is to write a white paper. This would be too time consuming for me at this time but I have put together a suggested message to the Legislature and Governor that relates to Alternative Strategy 67.

Would you please share this with the GWAC at our next meeting?

Thanks and best wishes.
Jean Mendoza

Addressing a Regulatory Gap in the Washington State Dairy Nutrient Management Act: A Statement to the Legislature and the Governor from the Lower Yakima Valley Groundwater Management Area

Lower Yakima Valley dairies are significant contributors to the nitrate pollution that makes water from 12% to 20% of domestic wells in the area unsafe for human consumption.

A 2014 report from the Environmental Protection Agency (EPA) documented that 61% of domestic wells one mile down gradient from a LYV "dairy cluster" had water with nitrates > 10 mg nitrate N/L, the EPA standard for drinking water. Quarterly testing in one of the monitoring wells found nitrate levels at 166, 174,195 and 234 mg nitrate N/L. (EPA, 2014; EPA, 2106)

There are well-done case studies of infants who have developed blue baby syndrome in rural America. Some have died after drinking formula made with well water that had levels of nitrate below those found in the LYV. (Knobeloch et al, 2000; Ward, 2005)

Nitrates in LYV groundwater pose a serious environmental and public health problem. The State of Washington has the authority and the obligation to take all reasonable means to solve that problem.

One worthy option is to strengthen RCW 90.64, the WA Dairy Nutrient Management Act (DNMA), so that Washington dairies are not only required to develop Nutrient Management Plans (NMP's) but are also required to follow them.

This is important because not all dairies have followed their NMPs. Court documents from CARE versus Cow Palace reveal that large dairies in the LYV have ignored NMP guidelines and the result has been unacceptable levels of nitrate in soils and groundwater. Enforcement of the NMP guidelines by the EPA and the court is beginning to turn this around in one small area. (Tebbutt Law, 2018; EPA, 2014; EPA 2016)

The WSDA stated in a 2017 Report to the Governor and Legislature entitled *Implementation of Nutrient Management Training Program for Farmers and Manure Management Program Review:*

> ***There is no penalty for failure to follow or update an NMP.***
>
> *For an NMP to be certified as required, the elements described in the plan must be "being used as designed and intended," but there is no requirement that the plan be implemented once it is certified. The statute (Chapter 90.64 RCW) includes monitoring development and implementation of NMPs as a purpose for inspections, and it identifies the existence and implementation of NMP as criteria for prioritizing inspections, but not following an NMP is in itself not a violation of the statute, and there is no penalty for it.*
>
> *Also, facility infrastructure and on-farm management practices change, and land application acreage are often traded with other farmers, but NMPs are not required to be updated to reflect those changes. Expanded operations, reconfigured facilities and even changing weather patterns may affect a plan's effectiveness. An NMP that was effective for protecting water quality 5 years ago may not be effective today. Currently, a dairy is not required to update its NMP even if there are substantial changes in the operation. The statute only requires a plan to be updated after a discharge violation has occurred--if there is a discharge and the plan did not prevent it. However, there is no penalty for not updating it, even after a discharge.*
>
> *STRATEGY TO CONSIDER:*
>
> ***Require NMPs to be updated every 5 years and prior to operation expansion.***
>
> *Updating NMPs regularly keeps them more useful. The plans and farm conditions are more likely to be in synch, and the repeated process keeps attention on the plan. Updated plans will have to be implemented in order to be re-certified. Updating the NMP ahead of an expansion allows water quality protection measures to be integrated into the process of expansion, rather than be added on later, which could be more costly. It also reduces the risk of an operation having a discharge violation due to its expansion.*
>
> *However, updating and recertifying a plan every five years does not guarantee that the plan will be implemented between updates. Also the updates can be expected to significantly increase demands on conservation district resources. See C3, below. Prioritizing new plans and updates may become an issue. Some dairies may feel their opportunity to expand is impeded by the inability to get their NMP updated.*

Requires: *Statutory changes. Funding for conservation districts.* (WSDA, 2017)

The Lower Yakima Valley Groundwater Management Area plan supports these statutory changes to RCW 90.64. The LYV GWMA supports periodic updates to dairy NMPs and requiring Washington dairies to follow their NMPs with strong penalties for non-compliance.

We submit this request under the GWMA guidelines in WAC 173-100-100 (6)(a) that require:

(6) An implementation section comprised of:
(a) A detailed work plan for implementing each aspect of the groundwater management strategies as presented in the recommendations section. For each recommended management action, the parties responsible for initiating the action and a schedule for implementation shall be identified. Where possible, the implementation plan should include specifically worded statements such as model ordinances, recommended governmental policy statements, interagency agreements, proposed legislative changes, and proposed amendments to local comprehensive plans, coordinated water system plans, basin management programs, and others as appropriate;

Respectfully,

The Lower Yakima Valley Groundwater Management Area

References:

Environmental Protection Agency (2014) *Fact Sheet: Yakima Dairies Consent Order Update*. Available at https://www.epa.gov/sites/production/files/2017-12/documents/lower-yakima-valley-groundwater-fact-sheet-december-2014.pdf

Environmental Protection Agency (2016) *Fact Sheet: Yakima Dairies Consent Order Update.* Available at https://www.epa.gov/sites/production/files/2017-12/documents/lower-yakima-valley-groundwater-fact-sheet-june-2016.pdf

Knobeloch, L., Salna, B., Hogan, A., Postle, J., & Anderson, H. (2000). Blue babies and nitrate-contaminated well water. *Environmental health perspectives*, *108*(7), 675. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1638204/pdf/envhper00308-0137.pdf

Tebbutt Law (2018) *Documents in CARE and Center for Food Safety versus Cow Palace et al.* Available at http://charlietebbutt.com/cases.html

Ward, M. H. (2005). Workgroup report: drinking-water nitrate and health—recent findings and research needs. *Environmental health perspectives*, *113*(11), 1607. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1310926/

Washington State Department of Agriculture (2017) *Implementation of Nutrient Management Training for Farmers and Nutrient Management Program Review: Report to the Governor and*

Legislature. Available at https://app.leg.wa.gov/ReportsToTheLegislature/Home/GetPDF?fileName=634-DNMP2017LegReport_b2479af1-2fc9-4218-8200-1a0118e3063b.pdf

From: Jean Mendoza [mailto:jeanrmendoza@icloud.com]
Sent: Thursday, April 5, 2018 8:35 PM
To: agforensic@aol.com; durfeycc@gmail.com; nstarmgt@msn.com; kakaleena1@yahoo.com; plnewhouse@hotmail.com; cowdrs@embarqmail.com; dsimpson@pocketinet.com; jean.mendoza@wildblue.net; arkady1977@me.com; janwhitefoot@gmail.com; Dyjak@nwinfo.net; sageconsulting.sg@gmail.com; falyall@yahoo.com; Jason.sheehan@ymail.com; dan@skyridgefarms.com; cowinr@svid.org; lc@sycd.us; jnuhouse@gmail.com; johnv@portofsunnyside.com; rand.elliott@co.yakima.wa.us; vern.redifer@co.yakima.wa.us; Ibach, Ryan (DOHi) <ryan.ibach@co.yakima.wa.us>; peters_troy@wsu.edu; troy.peters@wsu.edu; Edmondson.Lucy@epa.gov; peak.nicholas@epa.gov; esanchey@yakama.com; ringt@yakama.com; cranes@yakama.com; Bahr, Gary (AGR) <GBahr@agr.wa.gov>; Cervantes, Andres (DOH) <Andres.Cervantes@DOH.WA.GOV>; Beale, Perry (AGR) <PBeale@agr.wa.gov>; Bowen, David (ECY) <dabo461@ECY.WA.GOV>; Park, Sage (ECY) <SUEB461@ECY.WA.GOV>; guerrasDELI@gmail.com; black_j@heritage.edu; jhdavenportllc@gmail.com; lgfendell@gmail.com; mbachman@usgs.gov; Redding, Melanie (ECY) <mkim461@ECY.WA.GOV>; Howe, Sheryl (DOH) <sheryl.howe@doh.wa.gov>; myers.holly@county.yakima.wa.us; Alexiades_A@heritage.edu; sbraden09@gmail.com
Subject: GWMA

Dear GWAC,

It takes a big man to admit that he is wrong, especially to a woman. Tonight five men told me that a sufficient GWMA problem statement is, “nitrate levels in the groundwater are too high.”

Here is what the law requires. See Section (2) below:

WAC 173-100-100

Groundwater management program content.

The program for each groundwater management area will be tailored to the specific conditions of the area. The following guidelines on program content are intended to serve as a general framework for the program, to be adapted to the particular needs of each area. Each program shall include, as appropriate, the following:

(1) An area characterization section comprised of:

(a) A delineation of the groundwater area, subarea or depth zone boundaries and the rationale for those boundaries;

(b) A map showing the jurisdictional boundaries of all state, local, tribal, and federal governments within the groundwater management area;

(c) Land and water use management authorities, policies, goals and responsibilities of state, local, tribal, and federal governments that may affect the area's groundwater quality and quantity;

(d) A general description of the locale, including a brief description of the topography, geology, climate, population, land use, water use and water resources;

(e) A description of the area's hydrogeology, including the delineation of aquifers, aquitards, hydrogeologic cross-sections, porosity and horizontal and vertical permeability estimates, direction and quantity of groundwater flow, water-table contour and potentiometric maps by aquifer, locations of wells, perennial streams and springs, the locations of aquifer recharge and discharge areas, and the distribution and quantity of natural and man-induced aquifer recharge and discharge;

(f) Characterization of the historical and existing groundwater quality;

(g) Estimates of the historical and current rates of groundwater use and purposes of such use within the area;

(h) Projections of groundwater supply needs and rates of withdrawal based upon alternative population and land use projections;

(i) References including sources of data, methods and accuracy of measurements, quality control used in data collection and measurement programs, and documentation for and construction details of any computer models used.

(2) A problem definition section that discusses land and water use activities potentially affecting the groundwater quality or quantity of the area. These activities may include but are not limited to:

- Commercial, municipal, and industrial discharges
- Underground or surface storage of harmful materials in containers susceptible to leakage
- Accidental spills
- Waste disposal, including liquid, solid, and hazardous waste
- Stormwater disposal
- Mining activities
- Application and storage of roadway deicing chemicals
- Agricultural activities
- Artificial recharge of the aquifer by injection wells, seepage ponds, land spreading, or irrigation
- Aquifer over-utilization causing seawater intrusion, other contamination, water table declines or depletion of surface waters
- Improperly constructed or abandoned wells
- Confined animal feeding activities

The discussion should define the extent of the groundwater problems caused or potentially caused by each activity, including effects which may extend across groundwater management area boundaries, supported by as much documentation as possible. The section should analyze historical trends in water quality in terms of their likely causes, document declining water table levels and other water use conflicts, establish the relationship between water withdrawal distribution and rates and water level changes within each aquifer or zone, and predict the likelihood of future problems and conflicts if no action is taken. The discussion should also identify land and water use management policies that affect groundwater quality and quantity in the area. Areas where insufficient data exists to define the nature and extent of existing or potential groundwater problems shall be documented.

(3) A section identifying water quantity and quality goals and objectives for the area which (a) recognize existing and future uses of the aquifer, (b) are in accordance with water quality standards of the department, the department of social and health services, and the federal environmental protection agency, and (c) recognize annual variations in aquifer recharge and other significant hydrogeologic factors;

(4) An alternatives section outlining various land and water use management strategies for reaching the program's goals and objectives that address each of the groundwater problems discussed in the problem definition section. If necessary, alternative data collection and analysis programs shall be defined to enable better characterization of the groundwater and potential quality and quantity problems. Each of the alternative strategies shall be evaluated in terms of feasibility, effectiveness, cost, time and difficulty to implement, and degree of consistency with local comprehensive plans and water management programs such as the coordinated water system plan, the water supply reservation program, and others. The alternative management strategies shall address water conservation, conflicts with existing water rights and minimum instream flow requirements, programs to resolve such conflicts, and long-term policies and construction practices necessary to protect existing water rights and subsequent facilities installed in accordance with the groundwater management area program and/or other water right procedures.

(5) A recommendations section containing those management strategies chosen from the alternatives section that are recommended for implementation. The rationale for choosing these strategies as opposed to the other alternatives identified shall be given;

(6) An implementation section comprised of:

(a) A detailed work plan for implementing each aspect of the groundwater management strategies as presented in the recommendations section. For each recommended management action, the parties responsible for initiating the action and a schedule for implementation shall be identified. Where possible, the implementation plan should include specifically worded statements such as model ordinances, recommended governmental policy statements, interagency agreements, proposed legislative changes, and proposed amendments to local comprehensive plans, coordinated water system plans, basin management programs, and others as appropriate;

(b) A monitoring system for evaluating the effectiveness of the program;

(c) A process for the periodic review and revision of the groundwater management program.

[Statutory Authority: RCW 90.44.400. WSR 86-02-004 (Order DE 85-24), § 173-100-100, filed 12/20/85.]

Thanks for taking this seriously. I respectfully ask for apologies.

Jean Mendoza

On Apr 06, 2018, at 08:56 AM, "Bowen, David (ECY)" <dabo461@ECY.WA.GOV> wrote:

Good morning Jean,

As a latecomer to the process I have had to make some assumptions. The following is my brief perspective based on what I have read, conversations, participation in the GWAC, and facilitating the Livestock/CAFO Work Group since March 2016.

I did read the WAC earlier this week and noted much of what you highlighted. The following is my perception of some of the activities the group has been working on trying to fulfill these elements in the WAC.

(2) A problem definition section that discusses land and water use activities potentially affecting the groundwater quality or quantity of the area. These activities may include but are not limited to: What I tried to say last night, obviously not very well so for that I do apologize, is that typically a problem statement is a short paragraph and the body of the document (in this WAC a portion of the document is described as the problem definition section) provides the discussion of activities potentially affecting the groundwater quality. Over the years Work Groups and GWAC meetings have been the forum for research and discussion of these issues, the Work Group findings were forwarded to Yakima County last Spring and were the basis of the current draft chapters out for review and the alternatives we have been discussing at GWAC meetings since late summer 2017. Additional chapters yet to come.

When I came on in March 2016 my impression was that the Nitrogen Availability Assessment, with its data limitations disclosed and final edits to be finalized, was envisioned to address the relevant portions of the following section: The discussion should define the extent of the groundwater problems caused or potentially caused by each activity, including effects which may extend across groundwater management area boundaries, supported by as much documentation as possible.

I think the GIS project, DSS, and ambient well monitoring projects are attempts to get at this section: The discussion should also identify land and water use management policies that affect groundwater quality and quantity in the area. Areas where insufficient data exists to define the nature and extent of existing or potential groundwater problems shall be documented.

The GWAC is currently working on finalizing this: (4) An alternatives section outlining various land and water use management strategies for reaching the program's goals and objectives that address each of the groundwater problems discussed in the problem definition section.

One person's understanding from my short time participating – I look forward to further discussion.

I'm glad you wrote because there is another topic I didn't feel I communicated clearly on and that was the discussion of the pie chart and acreage by land use table. I was asking to clarify what the pie chart actually represented. Given the data we have and acknowledging its limitations with final edits yet to come, my interpretation was the pie chart represented the potential nitrogen available at the surface. **Not** the sources of nitrogen in the groundwater. Its usefulness is in then applying the potential risk of that nitrate reaching the groundwater, the chart with land use by acreage helps to define that risk – I attached some notes I made to myself including the pie chart and graph I was referring to (I realize edits may change the attachment, it is from one point in time last Spring)

I appreciate everyone's participation and the opportunity to communicate regarding this important topic.

Sincerely,

David Bowen

Water Quality Section Manager

Department of Ecology

Central Region Office

Office: 509 457-7107

On Sat, Apr 28, 2018 at 6:55 AM, Jean Mendoza <jeanrmendoza@icloud.com> wrote:

Good Morning Jim & Chris,

I plan to attend the May 3 meeting and I have reviewed the agenda. In order to have a productive discussion we need more information. Can you help us with a few issues?

1. Regarding *Comments on Program Draft 2:* We have the second draft but we have not seen the comments that people submitted and we have not seen changes to the draft. Can you send out a Draft 3 and/or the comments that were submitted?
2. Regarding *Analysis of Alternatives/Recommendations:* At the March meeting you said that you would be asking the agencies and others for cost estimates for the various alternatives. Can you send those cost estimates ahead of time?
3. Regarding *Lead Entity: Whether? Who? What?* I personally do not know what the law says regarding the formation of a follow-up project. Can you tell us how the statutes address follow-up work? Has the GWMA leadership talked with anyone from the agencies or the legislature about potential programs? If so, what were the results from these discussions? Should we bring our own ideas for follow-up? What criteria can/should we use to guide development of future work?
4. Over the past few months I have sent two requests for addition of material to the agenda.
    - I sent an additional alternative that would give the WSDA DNMP authority to enforce nutrient management plans
    - I sent an initial analysis of the USGS domestic wells testing that showed much lower nitrate levels in wells within two miles of the Yakima River. I hope to send more analysis by Monday.

Will we be talking about these two topics?

5. Is anyone working on presentations of the GWMA plan to the public?
6. When will we address *Implementation* as required by WAC 173-100-100(6)?

Thanks so much. I look forward to hearing from you.

Jean Mendoza

From: James Davenport <jhdavenportllc@gmail.com>
Date: April 30, 2018 11:48:18 AM
To: Jean Mendoza <jeanrmendoza@icloud.com>,Vern Redifer <vern.redifer@co.yakima.wa.us>,Rand Elliott <rand.elliott@co.yakima.wa.us>,"Bowen, David (ECY)" <dabo461@ecy.wa.gov>
Subject: Re: GWMA_GWAC Agenda: Thurs., May 3 (Please RSVP)

Jean,

Please see my responses to your comments below:

1. Regarding *Comments on Program Draft 2:* We have the second draft but we have not seen the comments that people submitted and we have not seen changes to the draft. Can you send out a Draft 3 and/or the comments that were submitted? We have received comments from several members. I have made some editorial changes responding to those comments. My plan is to go to Draft 3 after I have received the data analysis from Vern, Ginny Stern, Matt Bachmann, WSDA (on final draft Nitrogen Availability Assessment), and the feedback on the material to be presented next week, and have written all that up into the draftprogram.
2. Regarding *Analysis of Alternatives/Recommendations:* At the March meeting you said that you would be asking the agencies and others for cost estimates for the various alternatives. Can you send those cost estimates ahead of time? I have collected cost estimates from several sources and will have them stated in the materials I am preparing for the meeting next week. My plan is to distribute my work and ask for feedback in the week following, then schedule the matter for discussion at the following meeting (May 17).
3. Regarding *Lead Entity: Whether? Who? What?* I personally do not know what the law says regarding the formation of a follow-up project. Can you tell us how the statutes address follow-up work? Has the GWMA leadership talked with anyone from the agencies or the legislature about potential programs? If so, what were the results from these discussions? Should we bring our own ideas for follow-up? What criteria can/should we use to guide development of future work? As I began to collect cost estimates for various suggested alternatives, I often heard that the estimate depends upon who the lead agency is going to be. Because the group has not discussed this, at least openly, it seemed timely to put this matter on the table for discussion. Vern and Rand agree. Your questions are fair to be asked at the meeting next week.

- 4.Over the past few months I have sent two requests for addition of material to the agenda.
    - I sent an additional alternative that would give the WSDA DNMP authority to enforce nutrient management plans
    - I sent an initial analysis of the USGS domestic wells testing that showed much lower nitrate levels in wells within two miles of the Yakima River. I hope to send more analysis by Monday.

Will we be talking about these two topics?

WSDA DNMP enforcement authority was discussed at length in the Regulatory Framework Work Group which you chaired. I do not think it will be raised again at the full GWAC, except as a suggested recommendation that that authority be altered.

I have just now received your work on evaluating the USGS domestic well and drain data. Thanks for your effort. My suggestion is that this should be forwarded to Matt Bachman for comment, and be presented at a Data Work Group session, then be presented to the GWAC. I will forward that work to Vern Redifer, Rand Elliott and David Bowen.

Is anyone working on presentations of the GWMA plan to the public? I have not heard of any such work at this time.

1. When will we address *Implementation* as required by WAC 173-100-100(6)? Not at least until we know the recommendations which are mentioned in that section. You do raise a good point, though, that we need to put that on our to-do list.

I hope this is helpful. I have copied a few others in this response so that we're all on the same wave length.

Jim

Hello Stuart,

You may be right. This is my problem, not yours. Over the past five years most men on the GWAC have treated me with courtesy and consideration. I am sincerely grateful.

Jean Mendoza

Hello David,

Thank you very much for your thoughtful response. I agree with most of your observations. Here are some comments.

1. The implication of changing a nitrogen loading assessment to a nitrogen availability assessment is that not all available nitrogen reaches the groundwater. No one has come forward to estimate which available nitrogen reaches the groundwater except for Dan DeGroot who says that all nitrogen in septic tanks will eventually reach the groundwater.

This leaves a big margin for error. How will we describe this gap in the final report? Will the GWAC have an opportunity to provide input or will this be added at the last minute with no time for discussion?

2. Regarding the NAA, there are a number of unresolved issues. I don't see how we can use it to formulate a *Problem Definition* until the GWAC agrees on a final document. I seriously disagree with some of the estimates. For example, if the amount of atmospheric deposition was calculated for the entire target area the total would be over twice as high.

If I represented animal agriculture, I would question some of the conclusions as well. For example, there is no correction for lagoons with synthetic liners. Some of these lined lagoons are very large and the NAA assumes that they leak a lot.

3. My <u>opinion</u> is that Yakima County only knows how to operate using a command and control strategy. By its very nature this method marginalizes groups like Friends of Toppenish Creek. After the options are narrowed to choices that are familiar and acceptable to the GWMA leadership we are allowed to present our ideas. People "do their job" by hearing a short summary of our concerns. Too often this is the end of the story.

It appears that others are being treated in a similarly dismissive manner. I agree with Frank Lyall that many people in agriculture have not been heard. Mr. Lyall and Mr. Simpson attended almost every meeting of the GWMA Irrigated Ag work group. When WSDA did their analysis of irrigated agriculture they ignored the many important observations that these two men and others made, over and over again.

Last Thursday, at the GWMA meeting Mr. Davenport told both Kathleen Rogers and Frank Lyall to hurry with their comments. Why?

4. Currently we have GWMA meetings in May and June to complete our work. Over half of the GWMA plan has not even been put on paper. This is a recipe for failure. If I were in charge, which I am not, I would hire a professional facilitator such as the Kittitas-Yakima Conflict Resolution Center to work intensively with the different stakeholders to find some compromise solutions. I truly believe that we have some common ground.

5. FOTC is committed to finding solutions within the guidelines of the Revised Code of Washington and the Washington Administrative Code. It is scary to think that some people believe they are above the law.

My Perception of WAC 173-100-100 requirements

1. We need an *Area Characterization* and the group needs to agree on a description of our community

2. We need a *Problem Definition Section* regarding nitrates in groundwater. We need to come to some kind of agreement on the major causes.

3. We need to agree on specific *Goals and Objectives* for improving the ground water quality. These are objective measurements that will tell us how much progress we are making.

4. We need to propose *Possible Solutions* based on our description of the causes.

5. We need to agree upon and select the most promising solutions.

6. We need to develop an *Implementation Section* that includes detailed work plans for each selected solution, a monitoring plan to evaluate program effectiveness and a process for periodic review and revision of the program.

Logically:

- 2 builds on 1
- 3 builds on 1 & 2
- 4 builds on 2 & 3
- 5 build on 1, 2, 3 & 4
- 6 builds on all others

(Charlie McKinney provided an overview of these requirements plus WAC 175-110 & WAC 173-100-120 to the GWAC on February 18, 2016.)

GWMA History Complying with WAC 173-100-100

WAC 173-100-100(1) *Area Characterization* – In the early stages of the GWMA we all agreed that Area Characterization was a necessary first step for defining and analyzing the problem of nitrates in groundwater. During the first quarter of 2013 Yakima County provided a Table of Contents for *Area Characterization*. In June 2013 Yakima County signed a contract with HDR/PgG to complete an Initial *Characterization*. During the second quarter of 2015 Yakima County presented a Table of Contents for the Lower Yakima Valley Groundwater Management Program that included an *Area Characterization*. Now, in April 2018, we are still editing a draft *Area Characterization*.

WAC 173-100-100(2) A *Problem Definition* Section. The plan was to use a Network of Monitoring Wells, Deep Soil Sampling and a Nitrogen Loading Assessment to accomplish this.

Unfortunately the monitoring wells have not yet been drilled. I don't know what more the GWAC could have done. We evaluated all the plans for monitoring wells and approved the proposals in a timely manner.

The Data Work Group has just begun to study the DSS. There is valid data but it only applies to the fields in the DSS database. There are only enough fields to draw conclusions for triticale, silage corn and perhaps alfalfa. The DSS cannot be applied to the entire GWMA target area.

Initially we were told that the NLA would be complete in July 2015, then in December 2015, then in December 2016. WSDA and Yakima County finally delivered a draft document in April 2017 and it was no longer a Nitrogen Loading Assessment. Several groups, including FOTC, submitted comments and WSDA responded in the fall of 2017. We still do not have a revision of the Nitrogen Availability Assessment so there has been no opportunity for the GWAC to discuss and agree upon the major causes of elevated nitrates in the groundwater.

No one has written a *Problem Definition* Section for the GWMA plan and it appears that this might be added after alternative solutions have already been selected. We could end up with multiple solutions that are pretty much irrelevant to the problem.

WAC 173-100-100(3) *Water Quantity and Quality Goals and Objectives* – At the November 21, 2012 GWMA meeting we were supposed to finalize *Goals and Objectives* in the GWMA Work Plan. There was uncertainty and the decision was postponed. At the December 14,

2012 GWMA meeting proposed *Goals and Objectives* were retained in draft form. This was to be a "living document" with ongoing evaluation and revision. The GWMA Work Plan was approved in February, 2013

During the first Quarter of 2015 the GWAC studied a new GWMA Timeline that built upon the GWMA Work Plan. According to my reading there were over 200 tasks. Only 84 have been completed to date.

We have one overarching goal – *to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards* and we have no plan for measuring success or failure. We have proposed objectives from the GWMA Request for Identification and there are draft strategies from the GWMA Work Plan. See Attachment.

WAC 173-100-100(4) *Alternatives Section* – Yakima County compiled a list of around 260 potential *Alternative Solutions* in mid-2017 and the GWAC discussed these solutions throughout the second and third quarters of 2017. We now have a list of 85 potential master strategies that were more or less agreed upon without the benefit of a problem definition, source prioritization or cost estimates. In April, 2018 with three months to go, we are still waiting for a revised Nitrogen Availability Assessment and for cost estimates.

WAC 173-100-100(5) *Recommendations Section* – It could be argued that the GWAC has already begun selecting recommended solutions without going through the required steps listed in the WAC.

WAC 173-100-100(6) *Implementation Section* – It could be argued that the GWAC has already begun implementation plans for some preferred alternative solutions. It can also be demonstrated that plans for monitoring and evaluation have not even been discussed.

Time is running out. It is not my intent to force feed this information to the GWAC, but we have a big job left to do.

Thanks

Jean Mendoza

Attachment – Goals & Objectives from the GWMA Work Plan

WATER QUALITY GOALS AND OBJECTIVES: The only available goals and objectives are found in the 2012 GWMA Work Plan and the 2011 Request for Identification which is referenced in the Work Plan.

From the *GWMA Work Plan* (Pages 2-3)

Strategies used by the GWAC will include, but not be limited to, the following:

- Compile recently established nitrate mitigation studies and BMPs from other similar studies including GWMAs
- Compile existing soil profile samples developed for nitrate uptake purposes and augment along with current research to determine nitrate level loading
- Perform deep soil samples to determine nitrate levels and extent of deep nitrate migration
- Provide in season sampling of plant tissue of soils to evaluate timing and application efficiency (the amount applied to the amount used by the crop)
- Identify geographic areas vulnerable to nitrate leaching (Leaching Vulnerability Index)
- Identify geographic areas of higher concern
- Identify sources of elevated nitrate levels
- Identify impacted aquifer or aquifer zones
- Provide GWMA baseline conditions and long term monitoring of same
- Estimate nutrient loading budget across the GWMA boundaries
- Identify information gaps and data acquisition needs

The GWMA Program will also recommend projects such as:

- Develop nutrient management guidelines (i.e., reduce the amount of nitrogen fertilizer through optimal timing, placement, and rate of fertilizer application) applicable to Lower Valley hydrology and soil conditions
- Develop irrigation water management guidelines specific to the land use (e.g., livestock, irrigated agriculture, domestic use)
- Develop bulk manure and fertilizer handling and storage guidelines
- Develop wellhead protection plans
- Facilitate implementation of nitrate mangement strategies specific to the farm local conditions
- Provide best management strategies for voluntary implementation

The GWMA Program will identify methods for evaluating the effectiveness of each strategy and methods for evaluating progress I implementing the projects. Quantitative measures

are required to evaluate the baseline and progress and success of the action plan (downward nitrate trend for different sectors). Some of the potential specific goals used to guide implementation of nitrate management strategies are as follows:

1. Trends in nitrate levels and extent of deep nitrate migration

2. Trends in the adoption/implementation of BMPs

3. Trends in the level of public awareness of the causes and health implications of high nitrate levels in groundwater

From the *Request for Identification*

6.1 GWMA Goal

The primary long-term goal of the GWMA is to reduce concentrations of nitrate in groundwater to below Washington State drinking water standards. Reductions in nitrogen loading will be demonstrated within 5 years. Progress towards identifying and reducing the sources of groundwater contamination will be evaluated in 2013 and shared with the public. Specific objectives are listed below.

6.2 Proposed Objectives

Objectives have been divided into six categories: Data and Monitoring, Problem Identification, Measures to Reduce Groundwater Contamination, Education, Drinking Water Systems, and General Objectives. Input from the GWAC and citizen input will be used to refine and prioritize objectives. In general, refinement of objectives in each category will begin with an updated assessment of the current status of work. For instance, pending work includes publication of EPA sampling data and evaluations.

Data and Monitoring

- Collect and incorporate existing nitrate and nitrogen data into a shared data management system or data sharing site to improve understanding of the sources and extent of contamination
- Establish a monitoring program to identify sources of nitrate contamination and their relative importance
- Establish and conduct long-term groundwater quality monitoring program and evaluate progress

Problem Identification

- Characterize the nature and extent of nitrate concentrations in Lower Yakima Valley groundwater
- Identify and rank the sources of elevated nitrate in groundwater, with site-specific characteristics developed for "hot spots" as appropriate
- Identify and describe activities contributing to groundwater contamination based on scientific data and evaluation. Scientific and other data will be shared among the partners to facilitate development of effective programs and strategies

Measures to Reduce Groundwater Contamination

- Develop effective and coordinated best management practices (BMPs) to address specific nitrate sources.
- Develop strategies for implementing best management practices such as technical assistance, education, ordinances and coordination with other regulatory and non-regulatory programs
- Support enforcement of new and existing laws and ordinances

Education

- Establish educational programs to promote the protection of groundwater quality and provide a forum for stakeholders to discuss nitrate reduction methods and improvement of groundwater quality. This will include culturally-appropriate education and outreach
- Establish a clearinghouse for pertinent public health, environmental, and business information
- Educate private well owners on water quality testing methods, frequencies, interpretation of results, and funding sources

Drinking Water Systems

- Provide water quality and hydrogeologic data to assess needs and methods of expanding public water supplies, and provide a forum for initiation of these plans
- Consider options to encourage appropriate expansion of public water supplies to areas that are currently dealing with contaminated private supplies
- Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications

General

- Pollution prevention will be a guiding principle for all work done by the GWMA
- Participation by the Yakama Nation will be requested and encouraged in a way that is consistent with their sovereignty

- Participating agencies will maintain their regulatory authority using their own discretion as appropriate. They will also seek opportunities to coordinate actions and address regulatory gaps
- The GWMA will seek sustainable funding sources to carry out its mission.

Note: At the November 21, 2013 GWMA meeting Kathleen Rogers asked what is being done to help people with contaminated wells. Vern Redifer replied that Yakima County had successfully secured $150,000 from the DOH Clean Drinking Water Program.

GWMA: Reasons to Reject the May 2018 Voting on Proposed GWMA Solutions – A Minority Report

May 18, 2019
Jean Mendoza for Friends of Toppenish Creek

In Brief

1. The current set of proposed solutions to groundwater pollution was ranked by voting. In violation of GWMA guidelines there was no effort to achieve consensus.

2. Many potential solutions, as written, are so vague that they are meaningless.

3. There is no provision for measurement of success or program evaluation. This is required by law.

4. The potential solutions are not prioritized based on the relative contribution from each nitrate source.

5. Many proposed solutions simply recommend a continuation of policies that have been in place for decades.

6. Public health has been ignored.

7. Outreach to the large population that speaks English less than well has been abandoned.

8. The most recent selection of recommended solutions was done by secret ballot. This is a violation of the Open Public Meetings Act.

Background & Justification

1. When the GWMA was formed in 2011-2012 we agreed to operate on consensus. This means "general agreement". There are proposed solutions in this list that we have never discussed in an open meeting. We had no opportunity to ask what the authors meant or to weigh the pros and cons. We did not discuss these solutions in light of cost information. For some reason the GWMA leadership abandoned consensus seeking and adopted voting to select recommendations.

In the most recent May list, Yakima County added six new potential solutions that were not previously suggested to the GWAC. In February of 2018 FOTC asked to add a new potential solution. At first Yakima County ignored our suggestion. Then they rejected it.

FOTC sent questions to the GWMA leadership regarding the proposed solutions prior to the May 17 meeting. Our letter is attached. No one replied.

Here are further relevant and unanswered questions regarding the proposed solutions.

Administrative #3 says: Monitor changes occurring in agricultural operations. Evaluate whether those changes positively affect improvement in groundwater quality.

Which changes will SYCD and WSDA monitor? How will they gather the data? The GWMA experience has shown that SYCD and WSDA have difficulties engaging certain groups of farmers. How will the agencies address this problem? The estimated cost is $150,000. Is this a total or annual appropriation?

Administrative #6 says: *Adopt and Implement an Adaptive Management Plan.* We have not discussed an Adaptive Management Plan. What, exactly, are we approving here?

Administrative #14 says: Require facility process improvements in waste treatment and food processing plants to reduce nitrogen and total discharge volume.

Please elaborate. What changes are we asking from the waste treatment and food processing plants? How much will this reduce nitrogen in the discharge?

Administrative #15 says: Study the relationship between nitrogen emissions and atmospheric deposition of reactive nitrogen. Develop a model that predicts what percentage of emissions return to the GWMA area as atmospheric deposition.

- Feasible, but inconsequential
- Effective, has deminimus impact on problem
- Cost disproportionate to benefit

Unlike most other proposed solutions, there are some very negative comments attached to Administrative Solution #15. Who made these determinations? Please justify them. What are the estimated costs? According to the WSDA Nitrogen Availability Assessment up to 1,076,637 # of nitrogen is added to the GWMA target area every year from atmospheric deposition. According to FOTC estimates, based

on WSDA and SYCD data, approximately 21,707,250 # of nitrogen is emitted to the atmosphere every year from animal agriculture in the lower valley. These are emissions before application to the fields. It is difficult to classify this as insignificant.

Administrative # 17 says: Revise WAC 246-203-130 (keeping of animals)

What specific changes to the law are proposed here?

Administrative #16 says: Design and implement pilot studies focusing on innovative farm techniques which reduce nitrogen loading to crops and monitor results.

$25,000 is not very much for pilot studies. What specific study or studies do you have in mind?

Administrative #20 says: Estimate emissions of reactive nitrogen

- Not Feasible CAA Not Willing
- "big and expensive"

Please define "big and expensive". Did anyone ask Ecology for a cost estimate? FOTC has already done this study using the available research. We have shared our work with the GWAC. We are simply asking for further refinement and validation.

Administrative #23 says: Require new developments outside towns to address potential impacts on groundwater quality

What exactly would new developments be required to do to address potential impacts on groundwater quality? Don't private homeowners already have to conduct a "perc" test before building a septic system?

Data Collection #3 says: Collect data from Ambient Groundwater Monitoring Wells - $20,000.
With 30 purpose built wells this equates to $667 per year per well for sampling. How many samples per year? There is no money for data analysis and no plan for data analysis.

Data Collection #4 says: Monitor nitrate concentrations of irrigation water at head gates - $30,000.
If there are 30 head gates this equates to $1,000 per year per head gate.

Data Collection #7 says: Assess Nitrogen Loading. Building from the WSDA's Nitrogen Availability Assessment, develop a Nitrogen Loading Assessment for all agricultural, residential and commercial properties, using newly collected data.

In 2015 the estimated cost for a Nitrogen Loading Assessment was $57,000. Now the estimated cost is $1,250,000. Which estimate is correct? What will the agencies do for a million plus dollars?

Water #2 says: Create Irrigation Management Plans (similar to Nutrient Management Plans) for farms over a minimum size and provide financial assistance for implemented plans.

This solution requests $200,000 annually for WCC and $200,000 annually for SYCD with some monies for financial assistance and some for implemented plans. How much money is designated for the agencies and how much for financial assistance? What are proposed criteria for distribution of incentives?

Agriculture #5 says: Establish a multi-year deep soil sampling program. $250 K / year for 5 years to finance extensive deep soil sampling program;

How can we ensure that this deep soil sampling program will be done according to plans? How many fields per year? What depths? How will contracting be done? What is the projected cost per field? Will information be shared with the public? How will the SYCD ensure better representation of all crops, irrigation types and soil types?

2. Many potential solutions, as written, are so vague that they are meaningless. Some solutions simply write a blank check for a new, poorly defined, bureaucracy that may or may not act on our behalf.

For Example: Administrative #4 says: Establish a Lead Agency responsible for implementation and oversight of the LYV GWMA Groundwater Management Plan and acquisition of stable funding to support their activities.

The GWAC has not discussed what a lead agency would look like. We have not agreed on the role and function of a lead agency or the rules that would govern such an entity. No responsible person would agree to such a proposal without a clear understanding of the long term implications and likely outcomes.

WAC 173-100-100 requires:

(6) An implementation section comprised of:

(a) A detailed work plan for implementing each aspect of the groundwater management strategies as presented in the recommendations section. For each recommended management action, the parties responsible for initiating the action and a schedule for implementation shall be identified. Where possible, the implementation plan should include specifically worded statements such as model ordinances, recommended governmental policy statements, interagency agreements, proposed legislative changes, and proposed amendments to local comprehensive plans, coordinated water system plans, basin management programs, and others as appropriate;

3. The potential solutions, as written, have no provision for measurement of success or program evaluation. There is minimal monitoring. There is no clear plan for gathering and analyzing water quality data.

For Example: Data Collection #1 says: Establish time-based performance objectives against which well-monitoring data can be compared.

The GWMA is supposed to do this. Any plan that we propose is invalid without a clear description of how we will measure the successful implementation of our recommendations.

Jim Dyjak from the Concerned Citizens of the Yakima Reservation has repeatedly asked for solutions that provide comprehensive and reliable monitoring. The GWMA leadership always agrees with his statements in public. But there is no follow-through. There is no monitoring and evaluation plan in the list of proposed solutions.

Here are the only proposed solutions that even remotely relate to monitoring and evaluation:

Administrative #3: Monitor changes occurring in agricultural operations. Evaluate whether those changes positively affect improvement in groundwater quality.

Administrative #12: Analyze the trends of nitrate data contained within reports required by NPDES and SWD permits – currently being done.

Administrative #21: Establish a monitoring system for compliance with NRCS Standard 317 on new composting facilities at Washington dairies (phased in for existing facilities).

Data Collection #1: Establish time-based performance objectives against which well-monitoring data can be compared.

Data Collection #3: Collect data from Ambient Groundwater Monitoring Wells.

Data Collection #4: Monitor nitrate concentrations of irrigation water at head gates.

Data Collection #5: Contract with USGS to collect data from water well system per 2017

> **RCW 90.44.410** requires:
>
> (1) The groundwater area or sub-area management programs shall include:
>
> (b) A management program based on long-term monitoring and resource management
>
> (h) Identification of water quality objectives for the aquifer system which recognize existing and future uses of the aquifer and that are in accordance with department of ecology and department of social and health services drinking and surface water quality standards;
>
> (m) A process for the periodic review of the groundwater management program and monitoring of the implementation of the program.

4. The potential solutions, as written, do not identify the major causes of groundwater pollution. We have gathered data. We have done a poor job of analyzing the data. We have not agreed on the meaning of that data. The agencies responsible for incorporating our input into the research simply refuse to do so . . . and these are the agencies who want more funding. The proposed solutions are not based on our research.

For Example: Administrative #14 says: Require facility process improvements in waste treatment and food processing plants to reduce nitrogen and total discharge volume.
The Nitrogen Availability Assessment (NAA) that was delivered to the GWAC in April 2017 was supposed to address permitted nitrogen loading from land application sites. The NAA did not do this. The NAA has not been updated to address these concerns. We have no estimate of how much nitrogen is available from food processing plants, or other industrial sources. We do not know if this is a significant source.

WAC 173-100-100 requires:
(2) A problem definition section that discusses land and water use activities potentially affecting the groundwater quality or quantity of the area

The discussion should define the extent of the groundwater problems caused or potentially caused by each activity, including effects which may extend across groundwater management area boundaries, supported by as much documentation as possible.

Seven or 10.6% of the 66 proposed solutions address pollution from septic systems, but the NAA estimates that only 2% to 5% of the problem is due to septics.

Two or 3% of the proposed solutions address pollution from atmospheric deposition but the NAA estimates that 4.7% to 16.6% of the problem is due to atmospheric deposition.

Nineteen or 28.8% of the proposed solutions address pollution from irrigated agriculture but the NAA estimates that 62% to 76% of the problem is due to irrigated agriculture.

5. Many proposed solutions, as written, simply authorize a continuation of policies that have been in place for decades. These proposed solutions are no different from the recommendations of task forces that met in the 1990's.

Over 30 of the 66 proposed solutions simply tell agencies to do what they are already doing, or supposed to be doing. For example: Education # 1, 2, 5, 6, 7, 8, 9; Administrative # 2, 3, 7, 9, 10, 11, 12, 13, 16, 17, 18, 21, 22, 25; Data Collection & Monitoring 2, 3, 7; Water 2, 3; Research & Development # 1, 2, 3, 4, 5, 6, 7, 8, 10, 11; Agriculture # 1, 2, 3, 6.

As Mr. Dyjak noted on May 17, 2018: Educational Solution # 2, Publish and distribute homeowner guide on how to maintain septic systems, is already being done by the Yakima Health District, the WA Dept. of Health and Yakima County.

6. Public health has been ignored. Early in the GWMA program the Friends of Toppenish Creek and community representatives asked for research to describe the impact of nitrate pollution in the Lower Yakima Valley on public health. This request was rejected by Yakima County. Commissioner Rand Elliott stated that we would reduce nitrates in the drinking water and this would automatically improve public health. At that time the GWMA promised

improvement in nitrate levels within five years. Later the promise was revised to mean improvement in nitrate levels within five years of implementation of our plan. Now officials say that it may take decades to see a change. Our most recent round of well testing found unsafe nitrate levels in 20% of domestic wells. To date there is no change.

Nevertheless, there are only five proposed solutions that address public health and three of these proposed solutions are limited to regulation of composting operations. There is no proposed research to study the cost or health impact of elevated nitrates on the people who live in the GWMA target area. There are no proposed solutions to help people with contaminated wells, although we said we would do this.

The 2012 GWMA Work Plan says that we will:

> *Assist residents whose supplies have been contaminated to access safe and reliable water supplies, using culturally-appropriate communications.*

7. In spite of the fact that 70% to 80% of the population in the Lower Yakima Valley is Latino and a significant percentage speaks English less than well, these proposed solutions show that the GWMA leadership has given up any pretense of engaging that group. There are no proposed solutions that acknowledge the need to reach people in culturally appropriate ways.

8. The selection of recommended solutions to the problem of groundwater pollution is currently being done by secret ballot.

On May 4, 2018 Yakima County sent a document entitled *Draft Recommendations Voting Sheet* to members of the GWAC. There was an opportunity to score 66 proposed solutions on a scale of -3 to +3. Seventeen people responded.

At the May 17, 2018 GWMA meeting FOTC asked the GWMA leadership for the names of the 17 GWAC members who voted. The leadership declined to provide this information. The rationale was that this would avoid angry debate. FOTC stated that the GWMA proceedings fall under the WA State Open Public Meetings Act, RCW 42.30, which prohibits voting by secret ballot. The leadership noted that the information is available by public records request. This is not acting in good faith. It certainly makes more work for members who want accurate information and it

penalizes taxpayers who must pay for the work to respond to a public records request.

Surprisingly, the GWMA leadership asked the GWAC if the group wanted to go ahead and use the results of the voting. The majority of the members present said “yes” and the group continued as though the voting was legal. FOTC believes otherwise. There is nothing in the OPMA that authorizes a committee to take a vote to ignore the requirements of that rule.

WAC 42.30.120 (1) states:

> Each member of the governing body who attends a meeting of such governing body where action is taken in violation of any provision of this chapter applicable to him or her, with knowledge of the fact that the meeting is in violation thereof, shall be subject to personal liability in the form of a civil penalty in the amount of five hundred dollars for the first violation.

Respectfully submitted

Jean Mendoza

Friends of Toppenish Creek

Attachment 1.

May 7, 2018

Good Morning Jim,

I am studying the *GWAC Draft Recommendations – 5/03/2018.* I have some questions regarding proposed recommendation #7 under Agriculture. It says, "Make capital improvements", "Install liners in liquid waste storage lagoons. Install impervious surfaces beneath silage storage." The estimated cost is $10 million.

Can you send us the basis for the cost estimates?

Here is what I know at this time:

1. I did not find an estimate of the acreage used for silage in the GWMA target area
2. The Nitrogen Availability Assessment (NAA) estimates 210 acres of lagoons in the target area and this equates to 9,147,600 square feet of lagoons. If the $10 million was estimated to line all the LYV lagoons this would amount to about $1 per square foot.
3. If the $10 million was estimated on a per cow basis this would amount to about $100 per milk cow.
4. WSU has published a readable Power Point that covers a range of costs for lining manure lagoons at https://s3.wp.wsu.edu/uploads/sites/346/2017/06/Lagoon-Liner-case-study.pdf

    - WSU estimates cost between $15 per cow and $333 per cow
    - WSU estimates cost between $0.40 per square ft and $2.55 per square ft

It is important to know exactly what we are potentially recommending. Thanks for expanding and explaining.

Jean Mendoza

Note: Subsequent to this Minority Report the voting on the recommended alternative solutions was shared with the entire GWAC. This Minority Report has not been posted on the GWMA web site as required on page 5 of the GWMA Operating Guidelines - Available at http://www.yakimacounty.us/DocumentCenter/View/10038/2012_0920_GWAC_OperatingGuidelines_Final?bidId= JRM, Dec. 18, 2018

Unofficial Transcript: Testimony of Steve George before the House Committee on Agriculture and Natural Resources, November 19, 2015

My name is Steve George and I live in the Yakima area. I've been involved with the Lower Yakima Valley Groundwater Management Area since it began in 2012. I also do some environmental consulting for the dairy industry and I've been working for them for approximately fifteen years. My comments today are my own and do not represent any other individual or organization or members of the groundwater committee. And what I'm going to talk to you about today is some of the things we've been doing on our groundwater management area as I do sit on the oversight committee, and how it can and is relating to this permit, uh draft permit. So our groundwater advisory committee is made up of a diverse group of interests which is good. We are now in our third year of operations with a goal of completing a plan to address nitrates in the groundwater by 2017. Lead entity is Yakima County. Once this is done the implementation plan will be put into place that will include well water monitoring. The plan will include best practices that have been identified to reduce nitrates in groundwater. It may also include recommended regulatory changes to better implement this strategy if necessary. However, an overarching goal is to implement voluntary practices first as they have been shown to meet goals faster and be less expensive to implement.

It's not been an easy task to get our arms around this issue as its very complex and there are very many components. It has been difficult to identify the causes associated with the sources, how much they contribute and what the best remedy will be. This is because practices and demographics can change and make past data out of date. The last thing we want to do is implement something of a strategy that is not based on current practices. Three main sources have been identified as potential contributors in our GWMA area: agriculture, domestic and

municipal. We have sub committees of the main GWAC group working on the steps, working on the individual components, but today I'm only going to focus on the agricultural part. We have found using data from our own area gives us the best information. While the use of models can be helpful, unless they have local up to date data they are much too broad to be specific enough to address our local issues. We recently reviewed a newly released USGS model that is supposed to track nitrogen molecules. A review by our contract hydrologist that works with us on the GWMA project is that any use of that model . . . revealed that the model is much too broad to use for our GWMA efforts at this time. And input from the agency staff that have reviewed it supports this view.

Getting data from local farmers has been a challenge due to the regulatory environment and citizen lawsuits. I'm going to echo a little of what Jay Gordon said here. Because we live with it every day in the Yakima. That seems to be where a lot of the action is. And I have lived with this and watched these people have to deal with it. The recent EPA order against four local dairies that drove one out of business and the subsequent citizen lawsuit that was settled for millions of dollars for the remaining three has cause real anxiety as you can imagine. They are reluctant to have their farming operation information up for public review even though they thought they were operating under current practices. The fact that no farmer has been proven to purposefully operated outside of established farming guidelines has not prevented an overzealous regulatory agency from taking action nor did it prevent the citizen lawsuit and the core sample that I mentioned is what Jay just showed you. There are studies, other studies, that are also helpful and this is the one that Jay had the last slide on that was done in 2012 by the University of California and basically found that 96% of the nitrogen contamination had come from the farmed land. The one slide that Jay did not show you was that those tons were converted to percentages and the

livestock and corrals and manure storage lagoons contributed to less than 1%. Our own information that we collected this past summer from corrals and compost yards in the Yakima Valley appears to support this research that livestock areas present very limited contributions. Because there is little specific data available we are able to secure cooperator dairies that allows us to sample their pen and compost areas to gather our own data. We took approximately 100 samples from several sites up to seven feet in depth. These samples that I helped gather, I actually provided the backhoe that did the digging, show that nitrogen is not leaching to groundwater from pens or compost yards.

From the information above for the livestock areas which has been provided to DOE it is very disturbing to see that they are pursuing a mandatory permit on the livestock industry based on their perception that lagoons and livestock production areas are the main sources contributing nitrogen to groundwater. Our data and data from California does not support this position and DOE has not provided us with any documentation specific to a lagoon that is leaching nitrogen to groundwater even though we have made repeated requests similar to what Representative Dent asked. I don't think he got a satisfactory answer. I believe you will find that the largest AG contributor in the Yakima area has been the past cropping practices - past cropping practices! - leaving nitrogen legacy issues in the soil. It likely is not due to most current farming practices. This is because farming practices have changed dramatically in the past decade. The Roza Sunnyside Irrigation District's Board of Joint Control which has the vast majority of the irrigated land in our GWMA area received an environmental award for their extra ordinary efforts in reducing surface water runoff contamination within their districts. A big component of this work was the conversion of rill or furrow irrigation to drip and sprinkler – applied water – so there is no run off from the AG lands. These practices also have a positive effect on groundwater

contamination as well. Along with the conversion to drip and sprinkler irrigation fertilizer application is much more precise and is based on crop needs due to technologies that allow for better crop and soil testing and GPS tracking for applications.

These changes are not due to the formation of the GWMA, the draft NPDES permit or burdensome regulations but are due to economics, drought conditions and new technologies. They are also due to the fundamental belief by most farmers that production must be environmentally sustainable. Most farms must now be enrolled in some sort of stewardship program to market their crops. Forcing livestock producers to procure a permit to farm when they are clearly not the majority of the problem is discriminatory. Forcing livestock producers to create another manure management plan through regulation is repetitive and not based on current sound science. The DOE draft permit requirements would be running into what we are already working on in our GWMA area and current WSDA requirements for livestock producers. The regulatory approach is contrary to our voluntary approach and if enacted could actually slow down the process to aggressively work on nitrate contamination in our area. DOE staff are intricately involved with our GWMA process providing technical information and review. DOE has regulatory oversight for the GWMA and has a position on the oversight committee. It seems odd that the agency would be so supportive of our local efforts while pursuing a regulatory scheme at the same time that would. . appears to be subversive to our efforts. Better data combined with the implementation of technology is key to our success. Technology takes time to be developed and implemented. Unnecessary regulation is immediate and forces the regulated to have a very short term approach to comply that stifles innovation and does not allow for implementation of preferred alternatives. In summary I believe that our local GWMA effort is the best mechanism to address our local issues. Give us a chance to come up with local solutions

which we have put countless hours and a lot of tax payer money into. We are at the table. Let us do our work. We do not ask for more regulations and do not want them at this time. Thank you for allowing me to address the committee and I would entertain any questions.

One more quick point. I'd just like to make out. In the past testimony from the department staff they mentioned Darcy's Law as the prime candidate for coming up with their analysis of lagoons leak. The flaw with Darcy's Law is it's based on saturated conditions below lagoons. Our lagoons do not have saturated conditions below them and the other thing that is interesting is they noted that on a one acre pond or lagoon, their calculations are that it leaks a thousand gallons per day. So that's 365,000 gallons per year or 1.12 acre feet per year. I'm allowed in my irrigation district and so are the farmers that I represent, 3 acre feet of irrigation water. So I can apply 3 acre feet, I can fertilize my crops, I can apply 3 acre feet of water in that growing season which is a shorter time frame than the whole year that this scenario that the department came up with is putting 1.12, a third of the amount of water. If my 3 acre feet isn't pushing nitrates to groundwater, why would 1.12 acre feet be pushing nitrates to groundwater?

Thank you.

The official GWMA Plan states on page ix:

> *The diversity of the committee members' interests often made for contentious discussions, but the members were committed to resolving the issues and continued to participate, and were usually respectful.*

The Friends of Toppenish Creek have not felt respected during the past six years. We have endured a great deal of acrimony and, in our opinion, unfair treatment.

October 18, 2012 from the GWMA meeting summary:

> *Kevin Lindsey addressed the committee and asked that they take the EPA's report with a "grain of salt".*

Mr. Lindsey works for the dairy industry. He lives and works in the Tri Cities.

November 15, 2012

Members of the GWAC who support the dairy industry ask to have Helen Reddout removed from the committee due to a notice of intent to sue from the Community Association for the Restoration of the Environment which she heads. There was no regulatory justification for removing her and she remained.

November 27, 2012

Don Young, alternate for the Yakima Farm Bureau resigns in protest.

> *Young argued that the committee is stacked against dairy owners because it includes too many representatives of environmental organizations and government regulatory agencies.* (Yakima Herald Republic)

February 14, 2014

After Friends of Toppenish Creek advocates for Environmental Justice in the GWMA Work Plan Stuart Turner informs FOTC that:

You must understand that the base of EJ is simply not compatible with the stated Goals and Expectations the Legislature set forth when substantial sums of money were appropriated for this work.

March 14, 2014

Jean Mendoza from FOTC complains via e-mail to the GWAC and the media about lack of responsiveness from the Pacific Groundwater Group regarding questions about plans for monitoring wells.

Commissioner Elliott tells her:

We have agreed upon guidelines for this process and you have chosen to ignore them. If you are unable or unwilling to work within those guidelines, then I would ask you to consider whether or not you should continue to serve on the GWAC.

April 17, 2014

Phyllis Barney from the WA State Attorney General's office makes a presentation on Washington Water Law to the GWMA Regulatory Framework Group. FOTC asks whether we can invite an environmental attorney to the meeting. The Regulatory WG Chairman advises not in the interests of avoiding conflict. When the meeting begins an attorney for Darigold takes a seat at the table.

July 16, 2014

Landon Schilperoort from the South Yakima Conservation District posts a blog on the Yakima Herald Republic website in which he states:

This group "Friends of Toppenish Creek" Is one of the groups that is giving the GWMA in the lower valley a very hard time. These people want nothing more then to end agriculture in the yakima valley.

This is untrue. Mr. Schilperoort works for a publicly funded agency and lists those credentials in his blog. FOTC complains to no avail.

August 12, 2014

Mendoza from FOTC complains that the Data Work Group is not meeting regularly and her concerns about the Interim Final Groundwater Monitoring Plan are being ignored.

Kirk Cook from WSDA and the Chair of the Data Work Group comments to the GWMA leadership:

> *Really, I don't think we should be guided by what Jean wants or doesn't want.*

August 20, 2014

Helen Reddout and CARE withdraw from the GWMA. She states:

> *CARE has not and will not be attending GWMA meetings. We feel it is a waste of our time and the taxpayer's money. GWMA is an extension of the procrastination we have faced over the years; allowing the pollution of our land, air and water to continue.*
>
> *If, twenty years ago, the agencies sitting on this board had accepted their mandate to protect the environment and the people of the valley we would not be in the situation we face today. Each time the opportunity to correct the problem occurred agencies have caved into political pressure.*
>
> *CARE sees the same things happening at the GWMA meetings and wishes to resign from the board.*
>
> *Respectfully,*
>
> *Helen Reddout*
>
> *CARE President*

September 24, 2014

The EPA presents a first report from the "dairy cluster". Environmental groups on the GWAC are not informed of the meeting.

October 24, 2014

Commissioner Elliott, chairman of the GWAC, describes GWAC member Jan Whitefoot's position as:

"Her solution is to just have every dairy moved out of the county," (YHR)

Whitefoot notes the prohibition in the GWMA Operating Guidelines against characterizing other members' positions. She asks for a retraction.

> *"It's absolutely not true. We're against industrial feedlots, not family farms or cows on grass," Whitefoot said. "He said that to marginalize us, so that we sound extreme and he sounds like the good guy."* (YHR)

Commissioner Elliott refuses to retract his statement.

November 19, 2015

Steve George from the Yakima Farm Bureau testifies before the House Committee on Agriculture and Natural Resources. (Attachment 83) FOTC complains that he spoke for the GWMA and is not authorized to do so.

Stuart Turner responds:

> *Steve George can decide for himself how to respond to your inaccurate and defamatory allegations. Here is what I intend to do; I am providing you notice that after turning the other cheek for over 4 years, for you, the big ride is over. Your false and defamatory statements are intentional and harmful to me personally, but especially to me in a professional business sense. I depend on my rock solid reputation as a straight shooter with strong professional ethics to attract and retain my many clients. I am the primary care giver to my disabled wife, who has a progressive and degenerative disease which requires, even with insurance, out of pocket expenses equivalent to about 1/3 of my net revenue. I am also primary care give to my 91 year old mother, who has had two tumors removed since January, weighs 86# and is suffering from the onset of dementia. My ability to work and provide for these important family members has been threatened by you for the last time. I will gracefully give you the opportunity at the GWAC meeting on Thursday to publically renounce your false statements about me, or I will provide you the opportunity to explain all of this to a Superior Court Judge and Jury. You have an important decision to make between now and Thursday.*

October 7, 2017

FOTC states in a meeting of the GWAC that the South Yakima Conservation District has advised dairymen that it is acceptable to compost on bare ground.

Stuart Turner responds:

You have no credibility and zero objectivity on any issue relating to agriculture and animal ag in particular. It does not matter how much you read or what you cite. Your evil, deliberate LIE at the prior meeting summed up in your statement that SYCD "teaches farmers how to pollute" is a classic, recent example. However, your five year recidivist pattern of false, inflammatory statements, many of which are legally actionable, confirm your abject lack of respect for others, respect for the truth, objectivity, and ability to serve in any constructive capacity on this GWMA board, and I call here for your immediate resignation.

I am serving notice on you and the GWMA leadership your behavior has earned you the hook. Kindly take immediate leave of the GWAC by written notice.

The Friends of Toppenish Creek have submitted numerous analyses of GWMA data, including:

- Analysis of Data Gathered by Heritage University Students for the Lower Yakima Valley Ground Water Committee (Attachment 20)
- What will happen to the groundwater in the Lower Yakima Valley if we do nothing? (Attachment 21)
- Lower Yakima Valley Deep Soil Sampling Summary Analysis (Attachment 23)
- Analysis of Fields Planted in Triticale (Attachment 24)
- Analysis of Nitrate Pathways (Attachment 25)
- Costs Related to Elevated Nitrates in Groundwater (Attachment 26)
- Analysis of Domestic Wells – 2017 USGS Study (Attachment 28)
- Minority Opinion re *Comprehensive Nitrogen Loading Assessment for the Lower Yakima Valley Groundwater Management Area – Scope of Work and Budget* (Attachment 39)
- Significance of Nitrogen Emissions and Atmospheric Deposition for the Lower Yakima Valley – A Briefing (Attachment 70)
- GWMA: Reasons to Reject the May 2018 Voting on Proposed GWMA Solutions – A Minority Report (Attachment 82)

With the exception of *Lower Yakima Valley Deep Soil Sampling Summary Analysis* none of these contributions have been placed in the GWMA library, even though the Minority Reports should have been posted according to the GWMA Operating Guidelines.