Public Services

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VERN M. REDIFER, P.E., Director

February 27, 2018

David Bowen
Department of Ecology, Central Region Office
1250 West Alder Street
Union Gap, WA 98903

Re: **Lower Yakima Valley GWMA - 2017 Fourth Quarter Report (IAA No. C 1200235)**

Dear David:

Enclosed please find one (1) copy of Yakima County's fourth-quarter report as required under Attachment A, Statement of Work, Agreement No. C 1200235 between the State of Washington Department of Ecology and Yakima County.

This report addresses deliverables 1.1 and 2.2 as required under the agreement.

Deliverable 2.1, invoices, to be sent separately.

If you have any questions, please let me know.

Thank you.

Lisa H. Freund, Administrative Manager
Yakima County Public Services

enclosure

IAA No. C 1200235 – Fourth Quarter 2017 Report
Lower Yakima Valley GWMA
December 31, 2017

TASK 1 - ADMINISTRATIVE FUNCTIONS
DELIVERABLES

1.1 Meeting Records

For each meeting of the GWAC, submit a copy of the agenda, minutes, attendance and public meeting notice at the end of each quarter.

Attachment [A] includes the final GWAC meeting summaries of October 5, October 19, and November 2, 2017; and the draft meeting summary of December 7, 2017. None of the working groups held meetings in this quarter.

TASK 2 - PROGRAM FUNCTIONS
DELIVERABLES

2.2 Status Report

Submit written quarterly status reports summarizing GWAC plans, activities and work products, and describing any interlocal agreements or other contracts by the end of each quarter.

GWMA Program Development. The GWAC held four meetings in the fourth quarter to refine the Alternatives section of the draft program. In December, they reviewed the initial draft program chapters and were invited to submit comments.

The group also discussed the comments on, and Washington State Department of Agriculture (WSDA) responses to, the draft Nitrogen Availability Assessment (NAA), and received the first report out on the USGS well monitoring project. They reviewed the mapping data collected on Yakima County's Geographic Information System (GIS), and were invited to submit feedback and offer suggestions for additional mapping layers.

Alternative Land and Water Use Management Strategies for Reaching Program Goals and Objectives (WAC 173 100-100(4)). Background: A draft alternatives section, outlining various land and water use management strategies for reaching the program's goals and objectives, was compiled and introduced to the GWAC in June 2017. The 240-plus list reflected a compilation of recommendations by the working groups and included a separate literature review. At the end of the third quarter, the GWAC had agreed to keep 101 of the alternatives; 83 were eliminated, and 62 were consolidated with similar proposed alternatives. A total of 14 merited further discussion in the fourth quarter. (Note: as members suggested additional alternatives in the third quarter, the original list grew from 246 in June to 260 in September).

In October, the group completed its review of the alternatives. It was agreed that the next step would be to write cogent statements and combine duplicative alternatives. The list was reduced from 101 to 85 and presented to the GWAC in December.

For comparison, the October and December versions of the GWMA Strategies spreadsheet ("Comprehensive List of Blue Alternatives before 10.5.17 meeting" and "GWMA Strategies 12-1-17 JHD," respectively), are included as Attachment [B]

GWMA Draft Program

In December, four draft sections of the GWMA program were released to the GWAC. Sections included the Program Index, Characterization of the Area, Sources of Nitrate and the Regulatory Environment, and Yakima County's Role in Groundwater Quality Protection. At the December 7 meeting, the GWAC was provided with a program comment form and asked to provide feedback by January 31, 2018. It was further explained that the "Investigations and Analysis" section had not yet been written, as the final results from the USGS well-sampling and the final draft NAA had not been completed.

Attachment [C] includes the first four GWMA program chapters presented to the GWAC on December 7, 2017: Introduction (Draft V1); Characterization of the Area (Draft V1); Sources of Nitrate and the Regulatory Environment (Draft V1) and Yakima County's Role in Groundwater Quality Protection (Draft V1)

The GWAC member comment form is also included with Attachment [C]

NAA Comments and Responses

At its November 2 meeting, the GWAC began to work through the list of 90 comments and agency responses to the NAA. Following discussion on a number of the comments, the group was asked if they could at least agree, for purposes of the GWMA's final report containing findings and recommendations, on an NAA incorporating member comments and concerns as the best available information, with a disclaimer that some numbers may change as new data becomes available. No decision was reached.

The "2017_1102 Summary of NAA Comments" reviewed by the GWAC is included as Attachment [D]

USGS Well Monitoring Report

At the October 5 meeting, Matt Bachmann briefed the group on the preliminary findings of the USGS nitrate monitoring wells. The 160 wells had been divided into four networks of 40, starting with Network 1 at the western end of the GWMA, and progressing sequentially to Network 4 at the eastern end. The wells were roughly evenly distributed and sampled every two months beginning in April. With three exceptions, the wells were all "shallow." Notable findings included:

- Average nitrate concentration of 6.05 mg/L.
- Median nitrate concentration of 4.42 mg/L.
- 19.8 percent of values exceed 10 mg/L, with ~1 percent being in the 40 mg/L range.

Almost all the high wells were in Networks 3 and 4, although they were not clustered together, and two of the 40-plus mg/L wells were in Network 2.

Concentrations varied by season in predictable ways. The highest nitrates were in April, and the lowest in August. This was likely due to a combination of factors, such as changes in the growing season, temperature, and turbidity.

Data gathered at these wells would be shared with the individual well owners upon request. Individual identities were not disclosed to outside parties. The next round of sampling was scheduled for later in October, with another round scheduled for December.

GIS Mapping Feedback

At its October 19 meeting, the GWAC received a tour of the GIS applications which reflected what the group had learned to date about nitrates in the GWMA. The members were invited to view the different GIS layers for themselves and they were provided a web link for this purpose. They were encouraged to view the mapping layers to determine if there were any likely conclusions that could be drawn, and suggestions for useful changes/additions. As of this writing, the link to the GIS data was found at **http://arcg.is/1ie9mP**

The October 19 presentation map, identifying the GIS layers in the GWMA, is included as Attachment [E]

Ecology Agreement

The contract between Yakima County and the Department of Ecology called for the GWAC to have its work completed by December 2017. It was determined that an extension was needed to allow four items to be completed: 1) identify the GWAC's final recommended alternatives; 2) come to consensus, if possible, on the final draft Nitrogen Availability Assessment (NAA); 3) allow USGS to finish its well sampling, and 4) complete the GWMA program. It was further determined that no additional funding would be requested. The contract extension was discussed at the December 7 GWAC meeting and executed on January 2, 2018. The agreement will be included with the 2018 first quarter report.

Working Group Activities

No working groups met in the fourth quarter.

GWMA Website

The GWMA website continued to be updated in real time.

Contracts and Interlocal Agreements

No contracts were executed in the fourth quarter.

Attachment A

- Final GWAC meeting summary of October 5, 2017
- Final GWAC meeting summary of October 19, 2017
- Final GWAC meeting summary of November 2, 2017
- Draft GWAC meeting summary of December 7, 2017
- GWAC agenda and public meeting notice for October 5, 2017
- GWAC agenda and public meeting notices for October 19, 2017
- GWAC agenda and public meeting notices for November 2, 2017
- GWAC agenda and public meeting notices for December 7, 2017
- GWAC attendance roster record for October 5, October 19, November 2, and December 7, 2017
- There were no Working Group meetings

YAKIMA VALLEY GROUNDWATER MANAGEMENT AREA ADVISORY COMMITTEE (GWAC)

MEETING SUMMARY

Thursday, October 5, 2017 – 5:00 p.m. – 7:00 p.m.

Yakima County Road Maintenance Conference Room
1216 South 18th Street, Yakima, WA 98901

Note: This document is only a summary of issues and actions of this meeting. It is not intended to be a transcription of the meeting, but an overview of points raised and responses from Yakima County and Groundwater Advisory Committee members. It may not fully represent the ideas discussed or opinions given. Examination of this document cannot equal or replace attendance.

I. **Call to Order:** This meeting was called to order at 5:02 PM by Vern Redifer, Facilitator.

Member	Seat	Present	Absent
Stuart Turner	Agronomist, Turner and Co.,		✓
Chelsea Durfey			✓
Bud Rogers	Lower Valley Community Representative Position 1	✓	
Kathleen Rogers	Lower Valley Community Representative Position 1 (alternate)	✓	
Patricia Newhouse	Lower Valley Community Representative Position 2	✓	
Sue Wedam	Lower Valley Community Representative Position 2 (alternate)	✓	
Doug Simpson	Irrigated Crop Producer		✓
Jean Mendoza	Friends of Toppenish Creek	✓	
Eric Anderson	Friends of Toppenish Creek (alternate)		✓
Jan Whitefoot	Concerned Citizens of the Yakama Reservation		✓
Jim Dyjak	Concerned Citizens of the Yakama Reservation (alternate)		✓
Steve George	Yakima County Farm Bureau	✓	
Frank Lyall	Yakima County Farm Bureau (alternate)	✓	
Jason Sheehan	Yakima Dairy Federation	✓	
Dan DeGroot	Yakima Dairy Federation (alternate)	✓	
Ron Cowin	Roza-Sunnyside Joint Board of Control	✓	
	Roza-Sunnyside Joint Board of Control (alternate)		
Laurie Crowe	South Yakima Conservation District		✓

Rodney Heit	South Yakima Conservation District (alternate)	✓	
John Van Wingerden III	Port of Sunnyside		✓
Jay Decker	Port of Sunnyside (alternate)		✓
Rand Elliott	Yakima County Board of Commissioners	✓	
Vern Redifer	Yakima County Board of Commissioners (alternate)	✓	
Ryan Ibach	Yakima Health District	✓	
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center	✓	
Lucy Edmondson	U.S. Environmental Protection Agency	✓	
Nick Peak	U.S. Environmental Protection Agency (alternate)		✓
Elizabeth Sanchey	Yakama Nation		✓
Stuart Crane	Yakama Nation (alternate)	✓	
Gary Bahr	WA Department of Agriculture	✓	
Perry Beale	WA Department of Agriculture (alternate)		✓
Andy Cervantes	WA Department of Health		✓
Sheryl Howe	WA Department of Health (alternate)		✓
David Bowen	WA Department of Ecology		✓
Sage Park	WA Department of Ecology (alternate)	✓	
Lino Guerra	Hispanic Community Representative		✓
Rick Perez	Hispanic Community Representative (alternate)		✓
Jessica Black	Heritage University		✓
Matt Bachmann	USGS	✓	

Welcome, Meeting Overview and Introductions: Everyone introduced themselves. Vern reviewed the agenda. A member asked about the availability of digital recordings of GWAC meetings. Jean Mendoza informed the group that the recordings were filmed on YCTV cameras, and were available for purchase at YCTV for $5.00.

II. **USGS Well Monitoring Report:** Matt Bachmann briefed the group on the preliminary findings of the USGS nitrate monitoring wells. There were 160 wells that had been divided into four networks of 40, starting with Network 1 at the western end of the GWMA, and progressing sequentially to Network 4 at the eastern end. The wells were roughly evenly distributed and sampled every two months beginning in April. All were "shallow" wells, with the exception of three. Notable findings included:

- Average nitrate concentration of 6.05 mg/L.
- Median nitrate concentration of 4.42 mg/L.
- 19.8 percent of values exceed 10 mg/L, with ~1 percent being in the 40 mg/L range.

- Almost all of the high wells were in Networks 3 and 4, although they were not clustered together, and two of the 40-plus mg/L wells were in Network 2.
- Concentrations varied by season in predictable ways. The highest nitrates were in April, and the lowest in August. This was likely due to a combination of factors, such as changes in the growing season, temperature, and turbidity.

Data gathered at these wells would be shared with the individual well owners upon request. Individual identities were not disclosed to outside parties. The next round of sampling is scheduled to take place this month, with another round in December.

III. **Working Group Reports:** There were none. A member expressed concern that the Funding Working Group had not updated the GWAC on their activities. Vern recommended that members read the minutes from the Funding Group meetings, and that any GWAC member is welcome to attend. At present, no decisions had been made, since the list of alternatives had not been finalized, but there had been a lot of discussion about the successor agency that would take over and implement the GWMA's recommendations. Once all the recommendations were finalized, they would need to be ranked according to priority.

IV. **Alternative Land and Water Use Management Strategies for Reaching Program Goals and Objectives per WAC 173-100-100(4):**

The group agreed to keep these alternatives on the list for further review. (Green)

No. 98: Fund post-GWMA education and outreach through Conservation District. *The group added "to farmers" after the word "outreach."*

No. 219: Integrate use of animal waste and synthetic fertilizer, balancing nutrient application amounts so as to maximize crop production and full nitrogen uptake. *The group added "Make this a BMP" after the end of the sentence.*

Nos. 249 & 250: *Jean's original submissions on enforcing RCWs and WACs relating to Solid Waste Handling standards were broken down into the following categories:*

Solid Waste 1: Ask the Yakima Health District to issue permits for agricultural composting operations, to appropriately inspect composting operations, and to enforce regulations that protect public health and the environment, as required by state rules and regulations.

Solid Waste 2: Ask the Washington State Department of Ecology to review applications for, and issue exemptions to agricultural composting operations in a manner that protects public health and the environment, as required by state rules and regulations.

Solid Waste 4: Ask the Washington State Department of Ecology to provide assistance to local departments of health regarding the regulation of agricultural composting operations as required by state rules and regulations.

Solid Waste 5: Ask the Yakima Health District and Washington Department of Ecology to inspect, monitor, and regulate stockpiled manures as required by state rules and regulations.

The group either agreed these alternatives should be removed from the list, or were not able to reach consensus on them. (Red)

No. 46: Measure the effects of GWAC program on Yakima County economics.

No. 180: Treat manure supply in excess of that which can reasonably be applied as nutrient to agricultural lands as a waste product. Apply waste management strategies including land disposal at designated site, incineration, centralized waste-to-energy facility.

No. 212: Require irrigated agriculture nutrient management plans. Record the source and type of fertilizer and number of acres fertilized with each.

No. 214: Develop and implement Nutrient Management Plans (NMPs) for all producers (those that apply manure and those that apply synthetic fertilizer that include annual soil testing for phosphorus and nitrogen and which follow available guidance (i.e. Land Grant University) for developing appropriate land application rates for phosphorus and nitrogen. These NMPs can identify site specific conservation practices that are, or will be, implemented to minimize the transport of phosphorus or nitrogen to surface and ground waters. NMPs that are adaptive – adjusted based on annual soil test, the types of crops grown, and other site or field specific factors to allow producers to adjust their plans and practices as new information becomes available.

No. 220: Track nutrients and their application regardless of the end user, including commercial fertilizer.

No. 221: Keep track of synthetic fertilizer sales.

No. 259: Provide funding to gather data, evaluate, and address the environmental impact of agriculture.

EPA Submission 1: Require biannual pressure testing of underground pipes that transport liquid manure – either with cameras or pressure tested, and require repairs if they are not intact.

EPA Submission 2: Consistent with the NRCS' general recommendation, the use of lagoons should be avoided in watersheds with drinking water aquifers. Any new or existing lagoons in watersheds with drinking water aquifers should be equipped with engineered liners with a flexible membrane liner (FML) and a leak detection system.

Solid Waste 3: Ask the Washington State Department of Ecology to conduct waste stream analysis regarding agricultural composting operations as required by state rules and regulations.

The group agreed to revisit these alternatives at the next GWAC meeting. (Blue)

Nos. 257 & 258: Relating to enforcing the Washington State Clean Air Rule. These submissions will be rewritten in similar fashion to Nos. 249 & 250.

V. **Public Comment:** A member of the public was concerned that the group was not operating on a true consensus model.

VI. **Committee Business:** The September 21, 2017 meeting summary was approved as presented. The meeting adjourned at 7:12 PM.

VII. **Next Meeting:** October 19, 2017.

VIII. **Next Steps**: Alternatives related to enforcing the Washington State Clean Air Rule will be discussed at the next GWAC meeting.

LOWER YAKIMA VALLEY
GROUNDWATER ADVISORY COMMITTEE

Groundwater Management Area (GWMA):
The purpose of the GWMA is to reduce nitrate contamination concentrations in groundwater below state drinking water standards

YAKIMA VALLEY GROUNDWATER MANAGEMENT AREA ADVISORY COMMITTEE (GWAC)

MEETING SUMMARY

Thursday, October 19, 2017 – 5:00 p.m. – 7:00 p.m.

Yakima County Road Maintenance Conference Room
1216 South 18th Street, Yakima, WA 98901

Note: This document is only a summary of issues and actions of this meeting. It is not intended to be a transcription of the meeting, but an overview of points raised and responses from Yakima County and Groundwater Advisory Committee members. It may not fully represent the ideas discussed or opinions given. Examination of this document cannot equal or replace attendance.

I. Call to Order: This meeting was called to order at 5:01 PM by Vern Redifer, Facilitator.

Member	Seat	Present	Absent
Stuart Turner	Agronomist, Turner and Co.,	✓	
Chelsea Durfey			✓
Bud Rogers	Lower Valley Community Representative Position 1	✓	
Kathleen Rogers	Lower Valley Community Representative Position 1 (alternate)	✓	
Patricia Newhouse	Lower Valley Community Representative Position 2	✓	
Sue Wedam	Lower Valley Community Representative Position 2 (alternate)		✓
Doug Simpson	Irrigated Crop Producer		✓
Jean Mendoza	Friends of Toppenish Creek	✓	
Eric Anderson	Friends of Toppenish Creek (alternate)		✓
Jan Whitefoot	Concerned Citizens of the Yakama Reservation		✓
Jim Dyjak	Concerned Citizens of the Yakama Reservation (alternate)		✓
Steve George	Yakima County Farm Bureau	✓	
Frank Lyall	Yakima County Farm Bureau (alternate)		✓
Jason Sheehan	Yakima Dairy Federation	✓	
Dan DeGroot	Yakima Dairy Federation (alternate)	✓	
Ron Cowin	Roza-Sunnyside Joint Board of Control	✓	
Laurie Crowe	South Yakima Conservation District		✓
Rodney Heit	South Yakima Conservation District (alternate)		✓

John Van Wingerden III	Port of Sunnyside	✓	
Jay Decker	Port of Sunnyside (alternate)		✓
Rand Elliott	Yakima County Board of Commissioners		✓
Vern Redifer	Yakima County Board of Commissioners (alternate)	✓	
Ryan Ibach	Yakima Health District		✓
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center	✓	
Lucy Edmondson	U.S. Environmental Protection Agency	✓	
Nick Peak	U.S. Environmental Protection Agency (alternate)	✓	
Elizabeth Sanchey	Yakama Nation		✓
Stuart Crane	Yakama Nation (alternate)	✓	
Gary Bahr	WA Department of Agriculture		✓
Perry Beale	WA Department of Agriculture (alternate)	✓	
Andy Cervantes	WA Department of Health		✓
Sheryl Howe	WA Department of Health (alternate)		✓
David Bowen	WA Department of Ecology	✓	
Sage Park	WA Department of Ecology (alternate)	✓	
Lino Guerra	Hispanic Community Representative		✓
Rick Perez	Hispanic Community Representative (alternate)		✓
Jessica Black	Heritage University		✓
Matt Bachmann	USGS	✓	

II. Welcome, Meeting Overview and Introductions: Everyone introduced themselves. Vern provided an overview of the agenda – there were no additions. The group discussed progress on the plan and noted that despite Jim Davenport's absence Yakima County personnel continue to move forward with the work.

III. Complete the Discussion of Alternatives (last blue items): 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 (since it was not possible to provide them to the group prior to the meeting). Some of the alternatives were identical to each other but assigned responsibility to four different agencies – DOE, WSDA, EPA and YHD. David Bowen asked Jean if she had rewritten these to address and clarify the remaining blue alternatives. Jean said yes. A discussion ensued. Some of the members thought that there should be one lead agency rather than four. Some of the members also voiced concern about spending and/or requesting funding to obtain data on a relatively low contributor of nitrogen to the groundwater. Lucy Edmonson stated that she had recently

learned that the EPA was developing modelling tools through an evolving program called CMAQ that could be used to look at atmospheric deposition across the nation and how it effects air and groundwater. Lucy did not know the timing, however. Vern noted that the atmospheric deposition numbers he had calculated for the GWMA while working on the Nitrogen Availability Assessment were accurate when compared to the calculations for the Tulare Basin information. WSDA personnel performed their own calculations and compared them – they were accurate as well. 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.

Vern announced that the group had now completed their review of the suggested alternatives and added that the next step would be to try to write cogent statements to combine the duplicative alternatives and therefore collapse the list. 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.

IV. **Nitrogen Availability Assessment (Distribute Comments on Draft NAA):** Vern asked the group if they would be agreeable to postponing a discussion on the responses to the comments that had been made on the NAA. He was concerned that no one had had a chance to review the responses since they had not been provided previous to this evening's meeting. The group agreed to place this on the November 2 agenda.

V. **GIS Applications:** Vern gave the group a tour of the GIS applications which reflect what the group has learned to date about nitrates in the GWMA. He explained he would provide a link for everyone so they could access the web based application. This would allow everyone to try it and view different GIS layers for themselves. He also pointed out that the speed of the program would be proportionate to the internet connection. Vern went on to explain that any geographic components in Yakima County could be analyzed and gave the following examples: Where biosolids were permitted and or applied, locations of CAFO pens and compost areas, corrals and feed lots, hobby farms, all septic tanks including LOSS and COSS, residential lawns and crops. Also flow paths of groundwater from the USGS study, ground contours from surface topography, aerial photography, water elevation maps, and water quality testing done (not including the USGS testing until after December). He added that this information was totally updateable. In addition, the GIS layering provided the user the ability to click on any one of these items and the GIS web application would provide additional details like crop type, irrigation type, land size, loading rates by

type (RCIM, Irrigated Ag, etc., with applicable percentages of contribution per the NAA), field data, etc. Vern said that based on a comment in the NAA a new map was prepared including the number of septic tanks per square mile. A member asked about atmospheric deposition loading contributions and Vern reminded the group that atmospheric deposition had been included in the CAFO and Irrigated Ag portions of the NAA.

Vern encouraged members to look at this application in depth to see if there are likely conclusions that should be drawn, suggestions of useful changes/additions or if anything was missed. He emphasized that no member could hurt, break or ruin the web based application and that it was brand new technology that will continue to be added to as new information became available. A member asked if there was any way to take individual test sites and break them down further. Vern said yes this could be done for the 160 sites USGS is testing because well logs were required. Matt thought that the well logs might be scanned in as well. Also data reflecting test methods, who took the test and the depth of the test, etc., was available as well for other sample wells.

When asked what they thought members responded and said they felt the tool would be quite useful. Vern provided members with the address to access the information. It was http://arcg.is/1ie9mP. Vern indicated he would email to members a hyperlink to the site and added that the site would provide up-to-the-minute updates. Vern agreed to have Mike Martian (from GIS) put a print button on it too.

VI. **Committee Business:** The October 5, 2017 meeting summary was approved as presented.

VII. **Public Comment:** There was no public comment. The meeting adjourned at 6:55 PM.

VIII. **Next Meeting:** November 2, 2017.

IX. **Next Steps**: 1) Lucy Edmondson and Vern Redifer will rework the five alternatives Jean Mendoza proposed to reflect the GWMA's support of the EPA endeavor outlined by Lucy as it pertained to the LYV GWMA. 2) A discussion on the comments on the draft NAA will be placed on the November 2 agenda. 3) Vern will send the group a hyperlink to the web based application containing LYV GWMA GIS information previewed by the group.

X. **Meeting Summary** approved by the GWAC on _____.

YAKIMA VALLEY GROUNDWATER MANAGEMENT AREA ADVISORY COMMITTEE (GWAC)

MEETING SUMMARY

Thursday, November 2, 2017 – 5:00 p.m. – 7:00 p.m.

Yakima County Roads Maintenance Conference Room
1216 South 18th Street, Yakima, WA 98901

Note: This document is only a summary of issues and actions of this meeting. It is not intended to be a transcription of the meeting, but an overview of points raised and responses from Yakima County and Groundwater Advisory Committee members. It may not fully represent the ideas discussed or opinions given. Examination of this document cannot equal or replace attendance.

I. **Call to Order:** This meeting was called to order at 5:03 PM by Vern Redifer, Facilitator.

Member	Seat	Present	Absent
Stuart Turner	Agronomist, Turner and Co.,	✓	
Chelsea Durfey			✓
Bud Rogers	Lower Valley Community Representative Position 1	✓	
Kathleen Rogers	Lower Valley Community Representative Position 1 (alternate)	✓	
Patricia Newhouse	Lower Valley Community Representative Position 2		✓
Sue Wedam	Lower Valley Community Representative Position 2 (alternate)	✓	
Doug Simpson	Irrigated Crop Producer	✓	
Jean Mendoza	Friends of Toppenish Creek	✓	
Eric Anderson	Friends of Toppenish Creek (alternate)		✓
Jan Whitefoot	Concerned Citizens of the Yakama Reservation		✓
Jim Dyjak	Concerned Citizens of the Yakama Reservation (alternate)		✓
Steve George	Yakima County Farm Bureau	✓	
Frank Lyall	Yakima County Farm Bureau (alternate)	✓	
Jason Sheehan	Yakima Dairy Federation	✓	
Dan DeGroot	Yakima Dairy Federation (alternate)	✓	
Ron Cowin	Roza-Sunnyside Joint Board of Control	✓	
	Roza-Sunnyside Joint Board of Control (alternate)		
Laurie Crowe	South Yakima Conservation District	✓	

Rodney Heit	South Yakima Conservation District (alternate)		✓
John Van Wingerden III	Port of Sunnyside		✓
Rand Elliott	Yakima County Board of Commissioners	✓	
Vern Redifer	Yakima County Board of Commissioners (alternate)	✓	
Ryan Ibach	Yakima Health District)		✓
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center		✓
Lucy Edmondson	U.S. Environmental Protection Agency		✓
Nick Peak	U.S. Environmental Protection Agency (alternate)		✓
Elizabeth Sanchey	Yakama Nation		✓
Stuart Crane	Yakama Nation (alternate)	✓	
Gary Bahr	WA Department of Agriculture	✓	
Perry Beale	WA Department of Agriculture (alternate)		✓
Andy Cervantes	WA Department of Health	✓	
Sheryl Howe	WA Department of Health (alternate)		✓
David Bowen	WA Department of Ecology		✓
Sage Park	WA Department of Ecology (alternate)	✓	
Lino Guerra	Hispanic Community Representative		✓
Rick Perez	Hispanic Community Representative (alternate)		✓
Jessica Black	Heritage University		✓
Matt Bachmann	USGS		✓

II. Welcome, Meeting Overview and Introductions: Everyone introduced themselves. Vern reviewed the agenda – there were no additions. The group paused for a moment of silence.

III. Nitrogen Availability Assessment – Discuss Comments and Responses: Vern asked the group how they wanted to proceed through the list of 90 comments and agency responses – sequentially, or zeroing in on particular comments on which members placed a high priority. Gary stated he was fine starting at the beginning. The floor was opened for comments.

Comment 3: "Cross check CAFO and irrigated agriculture mass balance results by comparing manure available for land application to manure applications to cropland; this comparison was planned in the scope of work." A member agreed that better numbers were needed in this area, and mentioned a WSDA report on manure exports currently being worked on. He suggested that this could be turned into an annual event in order to more reliably quantify

the mass balance. Gary stated that he met recently with the Dairy Nutrient Management team as they are already collecting this data. The intent is to have the information circle back to the GWMA at some point.

Comment 1: "Report does not assess nitrogen loading to groundwater; the term 'nitrogen loading to groundwater' used in initial scope of work in description of calculation, document no longer titled 'Nitrogen Loading Assessment.'" The group discussed the decision to change the title of the report from "Loading Assessment" to "Availability Assessment." Vern and Gary, informed by technical advice from the Departments of Health and Ecology, felt the revision was necessary as they could not reliably quantify the amount of available nitrogen loading into groundwater. A member was unhappy with the process that led to this change, recalling earlier meetings in which others felt a loading assessment was possible, and money authorized for that purpose, with the title and scope being changed after the fact. She asked when the second draft of the NAA would be made available. Vern hoped it would be ready by the end of the year, but warned that the process for changing the report to incorporate every comment would take a long time, and suggested including the comments as recommendations for further study would be a preferable approach, although the decision would be up to the group.

Comment 7: "Pie chart inputs from irrigated agriculture are wrong. More specifics with irrigated agriculture comments." A member pointed out that the WSDA's response was simply "Comment noted," and asked if anyone had actually looked at reworking the pie charts. Her specific objection was that the low-level loading numbers for irrigated ag contained negative numbers. Gary stated that the pie charts only utilized the positive numbers, and the process was explained in the report. He would take another look and see if there was a different way to explain it. A discussion ensued on the reliability of the NAA's high-end nitrogen application estimates for irrigated agriculture. Some members felt these numbers would poison WSDA and WSU's relations with growers. Members who had worked on drafting the report acknowledged the numbers would never be perfect, but felt they had utilized the best information they had available. The decision to put out low, medium, and high ranges was made with the intent of preventing members of the public from latching on to one average number when the reality was more complex. After debating the propriety of this decision, Gary acceded to take the low and high-end estimates out of the next draft of the NAA.

Comment 22: "Fertilizer guide application rates should be used instead of survey data." A member noted that WSDA's response to this comment was that they would "review fertilizer guide recommendations and compare and contrast these recommendations with the survey data." The member was displeased that the NAA would still contain the survey data from consultants. Gary felt the survey data and the fertilizer guides were both reliable sources, although neither would paint a perfectly accurate picture of practices on the ground. The newer fertilizer guides reviewed by WSDA were around ten years old, and from extension services in Oregon and Idaho, but they were still useable. He stated that even relying on fertilizer guides, the overall numbers would still show irrigated ag as the largest available source of nitrogen in the GWMA.

Discussion ensued on the assumed percentage of soil organic matter conversion to nitrates. A member felt that assuming the same percentage for every field was inappropriate. Other members felt the deep soil sampling results did not provide a population sample large enough to draw statistically valid conclusions. Other members questioned how significant an issue this was since the range of percentages were between one and three percent. Gary responded that a one percent difference amounted to 20 pounds N/acre.

Comment 80: "The report does not include an analysis of Biosolids." While this comment was not identified by number in the discussion, the substance of it was brought up. Vern stated that an analysis of biosolids would be included in the next draft of the NAA.

The lack of analysis on compost was also raised. Gary stated that this was being looked into by WSDA.

Upon returning from a short break, Sage Park pointed out that the NAA is intended to be a living document, and asked what the group would be comfortable with moving forward. A member of the group responded that Vern and Gary had said member comments had been incorporated into the report and asked to see the second draft. Gary said that there is no second draft, but that the first draft had been reexamined since receiving member comments. Vern stated that the GWMA has to write a final report containing findings and recommendations, and it would be helpful in writing this report if the group could at least agree that an NAA incorporating member comments and concerns is the best available information, with a disclaimer that some numbers may change as new data becomes available. A member of the group stated she would not be able to sign off on such a statement of support due to the aforementioned concerns about soil organic matter

conversion. The group discussed the possibility of discarding one median number for organic matter and substituting a range, but no decisions were made.

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.

IV. Feedback on GIS Application: Vern asked the group if they had any quick feedback on the GIS application since the last meeting. A member asked if the nitrogen estimates used in the application were based on the NAA's data. Vern was pretty sure they were based on the NAA's median assessment, but that he would double-check that with GIS. He also stated that all the information in the application was updateable.

V. Committee Business: The October 19, 2017 meeting summary was approved as presented.

VI. Public Comment: 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. She urged the group to keep an eye on the bottom line. Another member expressed dismay that the first draft NAA had contained high and low estimates he felt were badly flawed. The meeting adjourned at 6:56 PM.

VII. Next Meeting: November 16, 2017.

VIII. Next Steps: 1) An updated summary of NAA comments and responses will be sent out to group members for their review. 2) Vern will double-check with GIS on whether the nitrogen application rates shown in the application are based on the NAA's median data. 3) Vern will send a link to the application to Melanie Redding.

IX. Meeting Summary approved by the GWAC on December 7, 2017.

YAKIMA VALLEY GROUNDWATER MANAGEMENT AREA ADVISORY COMMITTEE (GWAC)

MEETING SUMMARY

Thursday, December 7, 2017 – 5:00 p.m. – 7:00 p.m.

Yakima County Roads Maintenance Conference Room
1216 South 18th Street, WA 98901

Note: This document is only a summary of issues and actions of this meeting. It is not intended to be a transcription of the meeting, but an overview of points raised and responses from Yakima County and Groundwater Advisory Committee members. It may not fully represent the ideas discussed or opinions given. Examination of this document cannot equal or replace attendance.

I. **Call to Order:** This meeting was called to order at 5:08 PM by Vern Redifer, Facilitator.

Member	Seat	Present	Absent
Stuart Turner	Agronomist, Turner and Co.,		✓
Chelsea Durfey			✓
Bud Rogers	Lower Valley Community Representative Position 1	✓	
Kathleen Rogers	Lower Valley Community Representative Position 1 (alternate)		✓
Patricia Newhouse	Lower Valley Community Representative Position 2		✓
Sue Wedam	Lower Valley Community Representative Position 2 (alternate)	✓	
Doug Simpson	Irrigated Crop Producer		✓
Jean Mendoza	Friends of Toppenish Creek	✓	
Eric Anderson	Friends of Toppenish Creek (alternate)		✓
Jan Whitefoot	Concerned Citizens of the Yakama Reservation		✓
Jim Dyjak	Concerned Citizens of the Yakama Reservation (alternate)		✓
Steve George	Yakima County Farm Bureau		✓
Frank Lyall	Yakima County Farm Bureau (alternate)	✓	
Jason Sheehan	Yakima Dairy Federation		✓
Dan DeGroot	Yakima Dairy Federation (alternate)	✓	
Ron Cowin	Roza-Sunnyside Joint Board of Control		✓
	Roza-Sunnyside Joint Board of Control (alternate)		
Laurie Crowe	South Yakima Conservation District	✓	

Rodney Heit	South Yakima Conservation District (alternate)		
John Van Wingerden III	Port of Sunnyside	✓	
Rand Elliott	Yakima County Board of Commissioners	✓	
Vern Redifer	Yakima County Board of Commissioners (alternate)	✓	
Ryan Ibach	Yakima Health District)	✓	
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center		✓
Lucy Edmondson	U.S. Environmental Protection Agency	✓	
Nick Peak	U.S. Environmental Protection Agency (alternate)		✓
Elizabeth Sanchey	Yakama Nation		✓
Stuart Crane	Yakama Nation (alternate)	✓	
Bahr, Gary	WA Department of Agriculture	✓	
Beale, Perry	WA Department of Agriculture (alternate)		✓
Andy Cervantes	WA Department of Health	✓	
Sheryl Howe	WA Department of Health (alternate)		✓
David Bowen	WA Department of Ecology	✓	
Sage Park	WA Department of Ecology (alternate)		✓
Lino Guerra	Hispanic Community Representative		✓
Rick Perez	Hispanic Community Representative (alternate)		✓
Jessica Black	Heritage University		✓
Matt Bachmann	USGS	✓	

II. Welcome, Meeting Overview and Introductions: After the customary introductions, Vern reviewed the GWAC's timeline for completing its business. The contract between Yakima County and the Department of Ecology called for the GWAC to have its business wrapped up by the end of 2017. For a variety of reasons, this was no longer feasible. Vern and David Bowen had discussed an extension of the contract in conversations prior to the meeting. David added that Ecology would not be asking for any additional money to fund this extension. It would be paid for out of the existing GWMA budget. Items yet to be completed were 1) Nailing down the final recommended alternatives, 2) Coming to consensus, if possible, on a final draft Nitrogen Availability Assessment (NAA), 3) Letting USGS finish its well-sampling, and 4) Completion of the GWMA Program. Vern raised the question of how often the group might need to meet in 2018, but agreed to defer the question until the end of the meeting, after the group had heard some of the outstanding business.

III. Refinement of Alternatives: Jim referred the group to the last three items on Page 2 of the Draft GWMA Program's Table of Contents, which read: "Description of Alternative Actions

to Address the Problem", "Discussion of Pros and Cons of Alternative Actions", and "Recommended Actions." These terms came out of WAC 173-100-100. Jim had consolidated the list of green (group-approved) alternatives into a document about one-half to two-thirds the original length, with yellow (wait until later) items added in the "Details" section. On some future agenda, this list should be discussed, and a decision reached on final recommended alternatives. Jim felt this process may take until June.

IV. **GWMA Draft Program:** Jim drew members' attention to the completed first draft sections of the GWMA Program. An Excel spreadsheet for submitting comments would be made available to any group member who wanted one, with a goal of getting the editing done by March. The "Investigations and Analysis" section had not been written yet, as the final results from the USGS well-sampling and the final draft NAA had not been completed.

A member asked if anyone was working on the deep soil sampling and high-risk well questionnaires. She felt very uncomfortable looking at final alternatives without a full analysis of the data. Vern replied that Melanie Redding and Andy Cervantes were reviewing the data. Another member suggested that the alternatives the group had approved weren't dependent on data. Jim asked the group whether other alternatives could be submitted if data came in suggesting the need for them. Some members were wary of this approach without knowing what those alternatives might be. Others were more open to it. A member asked when the last USGS well tests would be ready, and Matt replied the results would be public by mid-February.

Jim asked if members had any initial reaction to the draft chapters. One member felt the "Area Characterization" was too general of an overview and needed more details. Another felt it was hard to follow with a lot of inconsistencies. Another member wanted to check with her agency on the descriptions of federal statutes contained in the "Sources of Nitrate and the Regulatory Environment" section. Another member felt there was a gap between the old history of the Lower Valley and the present day, when a great deal of nitrogen had been applied to the soil. Jim encouraged everyone with comments to request a Comments Form.

V. **GIS Mapping Feedback:** Vern directed the group to the GIS application unveiled at the October 19th GWAC meeting, available at http://arcg.is/1ie9mP. Before demonstrating some combinations of operational layers, he responded to some concerns that a group member who was not present at this meeting had raised with him earlier. The group

member had been concerned that the total acreage irrigated by the Roza Irrigation District and the Sunnyside Valley Irrigation District exceeded the number given in the NAA as the total GWMA acreage. Vern told the group that since Roza serves areas outside the GWMA, including Terrace Heights, the figure contained in the NAA was correct.

The first layers Vern showed the group were the "Nitrate mg/l", "Groundwater Flow", and "Altitude of Groundwater Levels." This combination of features showed the location of all well samples collected in the GWMA since 2000, juxtaposed against which direction the groundwater flowed. A member of the group was concerned that the map didn't contain any of the EPA sampling, including the dairy cluster. Vern replied that this information was confidential due to agreements signed by the EPA. Another member cautioned that the groundwater flow directions depicted on the map were only true for the shallow aquifer. Deeper basalt aquifers flow differently due to tilted layers and fissures within the basalt. While most of the wells sampled were likely also shallow wells, some of them might not be. He urged the group to keep this in mind while assessing the data.

The next layers were "ROSS Density per SqMi", "RCIM: ROSS", "RCIM: LOSS", and "RCIM: COSS." Individual septic systems were depicted by dots on the map, while the density was depicted on a grid, with individual square miles of the GWMA colored according to the EPA's recommended guidelines on safe septic density levels (Green = safe, Red = unsafe, Yellow = in between). A member asked whether the red squares represented the total loading of nitrogen or availability. Vern replied that they represented availability.

The next layer was labeled "Total Availability Grid," which overlaid diamond-shaped polygons over the GWMA. These contained all the available nitrogen sources added up, and broken down by category – RCIM, Irrigated Ag, CAFO, and Lagoons. The polygons were slanted into diamond shapes to account for the direction of groundwater flow as much as possible. A group member felt the design and information was good, but that the polygons should be made smaller. Verm said he would talk with County GIS about it. Another member singled out Polygon 192 near the south end of the GWMA, which was colored red and assumed a large amount of nitrogen available from a lagoon in the area. She felt that since these particular lagoons were lined, the number should be lower.

A member who had used the application mentioned that she had a hard time differentiating among crops in the "AG: 2015 WSDA Crop Type" feature, and asked if there was a way to click a box and single out certain crops. Vern said he would talk with GIS.

There were other features Vern had wanted to show the group, but with time running out, he opted to leave them for another meeting.

VI. **Committee Business:** The November 2, 2017 meeting summary was approved as presented. The group moved on to discuss future meetings for 2018, and decided to provisionally schedule two meetings each month from January to June, spaced two weeks apart, with the understanding that some meetings may be cancelled if there wasn't enough material to discuss.

VII. **Public Comment:** There was none. The meeting adjourned at 7:01 PM.

VIII. **Next Meeting:** January 4, 2018.

IX. **Next Steps**: 1) The GWAC Member Comment Form would be made available in Excel to any member who wanted one. 2) Vern would talk with GIS about making the "Total Availability Grid" polygons smaller, and adding the ability for users to single out crops in the "2015 WSDA Crop Type" feature.

X. **Meeting Summary** approved by the GWAC on _____.

Meeting Time and Location

Thursday, October 5, 2017 5:00 p.m. – 7:00 p.m.
Yakima County Road Maintenance Conference Room
1216 South 18th Street
Yakima, WA 98901

Agenda

Time	Topic	
5:00 – 5:10 p.m.	Welcome, Meeting Overview and Introductions: • Committee members • Others attending the meeting • Member Update	Vern Redifer, Facilitator
5:10 – 6:45 p.m.	Alternative Land and Water Use Management Strategies for Reaching Program Goals and Objectives per WAC 173-100-100(4) • Discuss Blue Items	Vern
6:45 – 6:50 p.m.	Approve the September 21, 2017 GWAC Meeting Summary	Vern
6:50 – 6:55 p.m.	Public Comment	
7:00 p.m.	Adjourn	

Committee Members

Stuart Turner, agronomist, Chelsea Durfey (alternate)	Turner and Co.
Bud Rogers, Kathleen Rogers (alternate)	Lower Valley Community Representative Position 1
Patricia Newhouse, Sue Wedam (alternate)	Lower Valley Community Representative Position 2
Doug Simpson	Irrigated Crop Producer
Dr. Jessica Black	Heritage University
Jean Mendoza, Eric Anderson (alternate)	Friends of Toppenish Creek
Jan Whitefoot, Jim Dyjak (alternate)	Concerned Citizens of the Yakama Reservation
Steve George, Frank Lyall (alternate)	Yakima County Farm Bureau
Jason Sheehan, Dan DeGroot (alternate)	Yakima Dairy Federation
Ron Cowin	Sunnyside-Roza Joint Board of Control
Laurie Crowe, Rodney Heit (alternate)	South Yakima Conservation District
John Van Wingerden, III, Jay Decker (alternate)	Port of Sunnyside
Rand Elliott, Vern Redifer (alternate)	Yakima County Commission
Ryan Ibach	Yakima Health District
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center
Lucy Edmondson, Nick Peak (alternate)	U.S. Environmental Protection Agency
Elizabeth Sanchey, Stuart Crane (alternate)	Yakama Nation
Gary Bahr (alternate)	Washington Department of Agriculture
Andy Cervantes, Sheryl Howe (alternate)	Washington Department of Health
David Bowen, Sage Park (alternate)	Washington Department of Ecology
Lino Guerra, Rick Perez (alternate)	Hispanic Community Representative
Matt Bachmann	U.S. Geological Survey

Committee Ground Rules:

- Come to committee meetings prepared
- Treat one another with civility
- Respect each other's perspectives
- Listen actively

- Participate actively
- Honor time frames
- Silence electronic devices during meetings
- Speak from interests, not positions.

2017 Meeting Dates:
(Red text reflects new meeting dates)

February 16
April 20
May 18
~~June 15~~
June 29

July 13
~~July 20~~
July 27
August 10
~~August 17~~
August 24

September 7
September 21
October 5 Yakima
October 19 Sunnyside
November 2 Yakima
November 16
Sunnyside
December 7 Yakima
December 21
Sunnyside

Groundwater Management Area (GWMA):
The purpose of the GWMA is to reduce nitrate contamination concentrations in groundwater below state drinking water

Meeting Materials:

Name	Date Provided	From
Meeting Agenda	9/28/2017	bobbie.brady@co.yakima.wa.us
2017_09_21 GWAC Meeting Draft Summary	9/28/2017	bobbie.brady@co.yakima.wa.us
2017_09_13 Funding Working Group Final Summary	9/28/2017	bobbie.brady@co.yakima.wa.us

Y0060

YAKIMA HERALD-REPUBLIC

INVOICE

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Date: **09/27/17**

Account #: **110536**
Company Name: **YAKIMA COUNTY SURFACE WATER MANAGEMENT**
Contact: **Tina Beck,AP**
Address: **128 NORTH 2ND STREET ROOM 408**
YAKIMA, WA 98901
Telephone: **(509) 574-2343** Fax:
Account Rep: **Simon Sizer - Legals - 398**
Phone #: **(509) 577-7740**
Email: **ssizer@yakimaherald.com**

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Yakima County Notice of Public Meeti

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Your Ad:

Yakima County

Notice of Public Meeting Lower Yakima Valley Groundwater Advisory Committee

NOTICE IS HEREBY GIVEN that Yakima County is holding a public meeting of the Lower Yakima Valley Groundwater Advisory Committee on **Thursday, October 5, 2017, at the Yakima County Road Maintenance Conference Room, 1216 South 18th Street, Yakima, WA 98901** pursuant to Chapter 173-100-080 WAC Ground Water Management Areas and Programs.

For Additional Information To learn more about the Lower Yakima Valley Groundwater Management Area, the Groundwater Advisory Committee, and its goals and objectives, please see the Lower Yakima Valley Groundwater Management Area on the County webpage at: http://www.yakimacounty.us/gwma/

For more information about the meeting, please contact Lisa Freund, Yakima County Public Services Administrative Manager at 574-2300.

If you are a person with a disability who needs any accommodation in order to participate in this program, you may be entitled to receive certain assistance at no cost to you. Please contact the ADA Coordinator at Yakima County no later than forty-eight (48) hours prior to the date service is needed.

Yakima County ADA Coordinator
128 N. 2nd Street, Room B27
Yakima, WA 98901
(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this **Thursday, September 21, 2017**

(762602) September 27, 2017

YAKIMA HERALD-REPUBLIC

Affidavit of Publication

STATE OF WASHINGTON,)
)
COUNTY OF YAKIMA)

Danielle Rogers, being first duly sworn on oath deposes and says that she/he is the Accounting clerk of Yakima Herald-Republic, Inc., a daily newspaper. Said newspaper is a legal newspaper approved by the Superior Court of the State of Washington for Yakima County under an order made and entered on the 13th day of February, 1968, and it is now and has been for more than six months prior to the date of publication hereinafter referred to, published in the English language continually as a daily newspaper in Yakima, Yakima County, Washington. Said newspaper is now and has been during all of said time printed in an office maintained at the aforesaid place of publication of said newspaper.

That the annexed is a true copy of a:
Yakima County Notice of Public Meeti

it was published in regular issues (and not in supplement form) of said newspaper once each day and for a period of 1 times, the first insertion being on 09/27/2017 and the last insertion being on 09/27/2017

Yakima Herald-Republic 09/27/17
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and the such newspaper was regularly distributed to its subscribers during all of the said period. That the full amount of the fee charged for the foregoing publication is the sum of $112.64

Danielle Rogers

Accounting Clerk

LISA M DRIPPS NOTARY PUBLIC STATE OF WASHINGTON My Comm. Expires April 05, 2021

Sworn to before me this 27th day of, September 2017

Lisa M Dripps

Notary Public in and for the
State of Washington,
residing at Yakima

Yakima County

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Lower Yakima Valley
Groundwater Advisory
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Agenda

Time	Topic	
5:00 – 5:10 p.m.	Welcome, Meeting Overview and Introductions: • Committee members • Others attending the meeting	Vern Redifer, Facilitator
5:10 – 5:40 p.m.	• Complete the discussion of Alternatives (Last Blue Items)	Vern
5:40 – 6:00 p.m.	• Nitrogen Availability Assessment (Distribute Comments on Draft NAA)	Vern
6:00 – 6:45 p.m.	• GIS Applications	Vern
6:45 – 6:50 p.m.	• Approve the October 5, 2017 GWAC Meeting Summary	Vern
6:50 – 6:55 p.m.	• Public Comment	
7:00 p.m.	• Adjourn	

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October 5
October 19
November 2
November 16
December 7
December 21

Meeting Materials:

Name	Date Provided	From
2017_10_05_2017 GWAC Meeting Draft Summary	10/12/2017	lisa.freund@co.yakima.wa.us
Meeting Agenda	10/12/2017	lisa.freund@co.yakima.wa.us
No Working Groups have met since the last GWAC meeting on October 5, 2017	N/A	N/A

D0003

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Dated this Thursday, October 5, 2017
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October 11, 2017

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County of Yakima

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Yakima County Public Services
FC3463-100-120 10/19 Mtg

published in regular issues (and not in supplemental forms) of said newspaper once each week for a period of 1 consecutive issue(s) commencing 10/11/17 and ending on 10/11/17, 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 $52.50, amount has been paid in full, at the rate of $7.50 per column inch per insertion.

Subscribed and sworn to before me 10/11/17

Notary Public in and for the State of Washington

030110-00000

DEBBIE GUERRERO NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES JUNE 17, 2020

Y0060

YAKIMA HERALD-REPUBLIC

INVOICE

114 N. 4th Street PO Box 9668 Yakima, WA 98909

Date: **10/11/17**

Account #: **110536**
Company Name: YAKIMA COUNTY SURFACE WATER MANAGEMENT
Contact: Tina Beck,AP
Address: 128 NORTH 2ND STREET ROOM 408
YAKIMA, WA 98901
Telephone: (509) 574-2343 Fax:
Account Rep: Simon Sizer - Legals - 398
Phone #: (509) 577-7740
Email: ssizer@yakimaherald.com

WRTF# 729745
10/31/17

Advertising The Yakima Herald-Republic:
Yakima County Notice of Public Meeti

Ad ID:	**766788**
Class:	**6021**
Run Dates:	**10/11/17 to 10/11/17**
# of Inserts:	**2**
Total Inches:	**8.0**
Cost:	**$112.64**
Paid Amount:	**$0.00**
Amount Due:	**$112.64**

S/b 100-120

Funding Control FC3463-200-200 4410

Authorized By CHH

Date Authorized 10/16/17

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OCT 13 2017
PS ACCOUNT

Your Ad:

Yakima County

Notice of Public Meeting Lower Yakima Valley Groundwater Advisory Committee

NOTICE IS HEREBY GIVEN that Yakima County is holding a public meeting of the Lower Yakima Valley Groundwater Advisory Committee on Thursday, October 19, 2017, at 5:00 PM at Yakima County Road Maintenance Conference Room, 1216 South 18th Street, Yakima, WA 98901, pursuant to Chapter 173-100-080 WAC Ground Water Management Areas and Programs.

For Additional Information To learn more about the Lower Yakima Valley Groundwater Management Area, *the Groundwater Advisory* Committee, and its goals and objectives, please see the Lower Yakima Valley Groundwater Management Area on the County webpage at: http://www.yakimacounty.us/gwma/

For more information about the meeting, please contact Lisa Freund, Yakima County Public Services Administrative Manager at 574-2300.

If you are a person with a disability who needs any accommodation in order to participate in this program, you may be entitled to receive certain assistance at no cost to you. Please contact the ADA Coordinator at Yakima County no later than forty-eight (48) hours prior to the date service is needed.

Yakima County ADA Coordinator
128 N. 2nd Street, Room B27
Yakima, WA 98901
(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this Thursday, October 5, 2017

(766788) October 11, 2017

YAKIMA HERALD-REPUBLIC

Affidavit of Publication

STATE OF WASHINGTON,)
)
COUNTY OF YAKIMA)

Danielle Rogers, being first duly sworn on oath deposes and says that she/he is the Accounting clerk of Yakima Herald-Republic, Inc., a daily newspaper. Said newspaper is a legal newspaper approved by the Superior Court of the State of Washington for Yakima County under an order made and entered on the 13th day of February, 1968, and it is now and has been for more than six months prior to the date of publication hereinafter referred to, published in the English language continually as a daily newspaper in Yakima, Yakima County, Washington. Said newspaper is now and has been during all of said time printed in an office maintained at the aforesaid place of publication of said newspaper.

That the annexed is a true copy of a:
Yakima County Notice of Public Meeti

it was published in regular issues (and not in supplement form) of said newspaper once each day and for a period of 1 times, the first insertion being on 10/11/2017 and the last insertion being on 10/11/2017

Yakima Herald-Republic 10/11/17
YakimaHerald.com 10/11/17

and the such newspaper was regularly distributed to its subscribers during all of the said period. That the full amount of the fee charged for the foregoing publication is the sum of $112.64

Danielle R

Accounting Clerk

Sworn to before me this 11th day of, October 2017

Lisa M. Dripps

Notary Public in and for the State of Washington, residing at Yakima

LISA M DRIPPS NOTARY PUBLIC STATE OF WASHINGTON My Comm. Expires April 05, 2021

Yakima County

Notice of Public Meeting
Lower Yakima Valley
Groundwater Advisory
Committee

NOTICE IS HEREBY GIVEN that Yakima County is holding a public meeting of the Lower Yakima Valley Groundwater Advisory Committee on **Thursday, October 19, 2017, at 5:00 PM at Yakima County Road Maintenance Conference Room, 1216 South 18th Street, Yakima, WA 98901,** pursuant to Chapter 173-100-080 WAC Ground Water Management Areas and Programs.

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(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this **Thursday, October 5, 2017**

(766788) October 11, 2017

Courtesy of Yakima Herald-Republic

LOWER YAKIMA VALLEY

GROUNDWATER ADVISORY COMMITTEE

Groundwater Management Area (GWMA):
The purpose of the GWMA is to reduce nitrate contamination concentrations in groundwater below state drinking water standards

Meeting Time and Location

Thursday, November 2, 2017, 5:00 p.m. – 7:00 p.m.

Yakima County Road Maintenance Conference Room
1216 South 18th Street
Yakima, WA 98901

Agenda

Time	Topic	
5:00 – 5:10 p.m.	Welcome, Meeting Overview and Introductions: • Committee members • Others attending the meeting	Vern Redifer, Facilitator
5:10 – 6:00 p.m.	• Nitrogen Availability Assessment Discuss Comments on Draft NAA	Vern
6:00 – 6:45 p.m.	• Feedback on GIS Application for GWMA	Vern
6:45 –6:50 p.m.	• Approve the October 19, 2017 GWAC Meeting Summary	Vern
6:50 –6:55 p.m.	• Public Comment	Vern
7:00 p.m.	• Adjourn	

Committee Members

Stuart Turner, agronomist, Chelsea Durfey (alternate)	Turner and Co.
Bud Rogers, Kathleen Rogers (alternate)	Lower Valley Community Representative Position 1
Patricia Newhouse, Sue Wedam (alternate)	Lower Valley Community Representative Position 2
Doug Simpson	Irrigated Crop Producer
Dr. Jessica Black	Heritage University
Jean Mendoza, Eric Anderson (alternate)	Friends of Toppenish Creek
Jan Whitefoot, Jim Dyjak (alternate)	Concerned Citizens of the Yakama Reservation
Steve George, Frank Lyall (alternate)	Yakima County Farm Bureau
Jason Sheehan, Dan DeGroot (alternate)	Yakima Dairy Federation
Ron Cowin	Sunnyside-Roza Joint Board of Control
Laurie Crowe, Rodney Heit (alternate)	South Yakima Conservation District
John Van Wingerden III, (alternate)	Port of Sunnyside
Rand Elliott, Vern Redifer (alternate)	Yakima County Commission
Ryan Ibach	Yakima Health District
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center
Lucy Edmondson, Nick Peak (alternate)	U.S. Environmental Protection Agency
Elizabeth Sanchey, Stuart Crane (alternate)	Yakama Nation
Gary Bahr, Perry Beale (alternate)	Washington Department of Agriculture
Andy Cervantes, Sheryl Howe (alternate)	Washington Department of Health
David Bowen, Sage Park (alternate)	Washington Department of Ecology
Lino Guerra, Rick Perez (alternate)	Hispanic Community Representative
Matt Bachmann	U.S. Geological Survey

Committee Ground Rules:

- Come to committee meetings prepared
- Treat one another with civility
- Respect each other's perspectives
- Listen actively
- Participate actively

- Honor time frames
- Silence electronic devices during meetings
- Speak from interests, not positions.

2017 Meeting Dates:
(Red text reflects new meeting dates)

February 16
April 20
May 18
~~June 15~~
June 29

July 13
~~July 20~~
July 27
August 10
~~August 17~~
August 24
September 7

September 21
October 5
October 19
November 2
November 16
December 7
December 21

Meeting Materials:

Name	Date Provided	From
2017_10_19_2017 GWAC Meeting Draft Summary	10/26/2017	bobbie.brady@co.yakima.wa.us
Meeting Agenda	10/26/2017	bobbie.brady@co.yakima.wa.us
WSDA NRAS and Yakima County Summary of Comments for the DRAFT Nitrogen Assessment Report	10/26/2017	bobbie.brady@co.yakima.wa.us
No Working Groups have met since the last GWAC meeting on October 19, 2017	N/A	N/A

D0003

DAILY SUN
P.O. Box 878 • 600 S. Sixth Street
Sunnyside, WA 98944
Phone (509) 837-4500
Fax (509) 837-6397

WE GLADLY ACCEPT

INVOICE

Billing Date 10/24/17
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Telephone 509-574-2300

Yakima County Public Services
128 N. 2nd St. 4th Floor
Yakima, WA 98901

LEGAL ADVERTISING INVOICE

Item Invoiced	StartDate	EndDate	Insertions
Yakima County Notice	10/25/17	10/25/17	1
Invoice #: 120 FC3463-100-120 11/2 Mtg.			

Total Due 52.50

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Thank you!

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Authorized By [signature]
Date Authorized 11/9/17

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OCT 30 2017
PS ACCOUNT

Affidavit of Publication

Yakima County
Notice of Public Meeting
Lower Yakima Valley
Groundwater Advisory
Committee

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128 N. 2nd Street, Room B27
Yakima, WA 98901
(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this Thursday, October 19,. 2017

PUBLISH: DAILY SUN NEWS
October 25, 2017

STATE OF WASHINGTON
ss.
County of Yakima

Roger Harnack, 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, and it is now and during all of said time printed in an office maintained at the afforesaid 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
Yakima County Public Services
FC3463-100-120 11/2 Mtg.

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Subscribed and sworn to before me 10/25/17

Notary Public in and for the State of Washington

030110-00000

DEBBIE GUERRERO NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES JUNE 17, 2020

YAKIMA HERALD-REPUBLIC

INVOICE

114 N. 4th Street PO Box 9668 Yakima, WA 98909

Date: **10/25/17**

Account #: **110536**
Company Name: **YAKIMA COUNTY SURFACE WATER MANAGEMENT**
Contact: **Tina Beck,AP**
Address: **128 NORTH 2ND STREET ROOM 408**
YAKIMA, WA 98901
Telephone: **(509) 574-2343** Fax:
Account Rep: **Simon Sizer - Legals - 398**
Phone #: **(509) 577-7740**
Email: **ssizer@yakimaherald.com**

Advertising The Yakima Herald-Republic:
Yakima County Notice of Public Meeti

Ad ID:	**769780**
Class:	**6021**
Run Dates:	**10/25/17 to 10/25/17**
# of Inserts:	**2**
Total Inches:	**8.125**
Cost:	**$116.16**
Paid Amount:	**$0.00**
Amount Due:	**$116.16**

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Funding Control FC 3463-100-120
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Date Authorized 11/2/17

Your Ad:

Yakima County

Notice of Public Meeting Lower Yakima Valley Groundwater Advisory Committee

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Yakima, WA 98901
(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this **Thursday, October 19, 2017**

(769780) October 25, 2017

YAKIMA HERALD-REPUBLIC

Affidavit of Publication

STATE OF WASHINGTON,)
)
COUNTY OF YAKIMA)

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Yakima Herald-Republic 10/25/17
YakimaHerald.com 10/25/17

and the such newspaper was regularly distributed to its subscribers during all of the said period. That the full amount of the fee charged for the foregoing publication is the sum of $116.16

Danielle Rogers

Accounting Clerk

LISA M DRIPPS NOTARY PUBLIC STATE OF WASHINGTON My Comm. Expires April 05, 2021

Sworn to before me this 25th day of, October 2017

Lisa M Dripps

Notary Public in and for the
State of Washington,
residing at Yakima

Yakima County

Notice of Public Meeting
Lower Yakima Valley
Groundwater Advisory
Committee

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(Washington Relay Services for deaf and hard of hearing)

Dated this **Thursday, October 19, 2017**

(769780) October 25, 2017

Courtesy of Yakima Herald-Republic

Meeting Time and Location

Thursday, December 7, 2017 5:00 p.m. – 7:00 p.m.

Yakima County Road Maintenance Conference Room
1216 South 18th Street
Yakima, WA 98901

Agenda

Time	Topic	
5:00 – 5:10 p.m.	Welcome, Meeting Overview and Introductions • Committee members • Others attending the meeting	Vern Redifer, Facilitator
5:10 – 5:20 p.m.	Refinement of Alternatives	Jim Davenport
5:20 – 5:40 p.m.	GWMA Draft Program • Distribution of initial chapters	Jim Davenport
5:40 – 6:25 p.m.	GIS Mapping Feedback	Vern
6:25 – 6:30 p.m.	Committee Business • Approve the November 2, 2017 GWAC Meeting Summary • Discuss future meeting dates	Vern
6:30 – 6:35 p.m.	Public Comment	
6:40 p.m.	Adjourn	

Committee Members

Stuart Turner, agronomist, Chelsea Durfey (alternate)	Turner and Co.
Bud Rogers, Kathleen Rogers (alternate)	Lower Valley Community Representative Position 1
Patricia Newhouse, Sue Wedam (alternate)	Lower Valley Community Representative Position 2
Doug Simpson	Irrigated Crop Producer
Dr. Jessica Black	Heritage University
Jean Mendoza, Eric Anderson (alternate)	Friends of Toppenish Creek
Jan Whitefoot, Jim Dyjak (alternate)	Concerned Citizens of the Yakama Reservation
Steve George, Frank Lyall (alternate)	Yakima County Farm Bureau
Jason Sheehan, Dan DeGroot (alternate)	Yakima Dairy Federation
Ron Cowin	Sunnyside-Roza Joint Board of Control
Laurie Crowe, Rodney Heit (alternate)	South Yakima Conservation District
John Van Wingerden III, (alternate)	Port of Sunnyside
Rand Elliott, Vern Redifer (alternate)	Yakima County Commission
Ryan Ibach	Yakima Health District
Dr. Troy Peters	WSU Irrigated Agriculture Research and Extension Center
Lucy Edmondson, Nick Peak (alternate)	U.S. Environmental Protection Agency
Elizabeth Sanchey, Stuart Crane (alternate)	Yakama Nation
Gary Bahr, Perry Beale (alternate)	Washington Department of Agriculture
Andy Cervantes, Sheryl Howe (alternate)	Washington Department of Health
David Bowen, Sage Park (alternate)	Washington Department of Ecology
Lino Guerra, Rick Perez (alternate)	Hispanic Community Representative
Matt Bachmann	U.S. Geological Survey

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(Red text reflects new meeting dates)

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July 27
August 10
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August 24
September 7

September 21
October 5
October 19
November 2
~~November 16~~ (Cancelled)
December 7
~~December 21~~ (Cancelled)

Meeting Materials:

Name	Date Provided	From
2017_11_2_2017 GWAC Meeting Draft Summary	12/4/2017	Lisa.freund@co.yakima.wa.us
Meeting Agenda	12/1/2017	Lisa.freund@co.yakima.wa.us
Draft program chapters (Version 1 Released to GWAC 12/1/2017): Introduction, Characterization of the Area, Sources of Nitrate and the Regulatory Environment, Yakima County's Role in Groundwater Quality Protection	12/1/2017	Lisa.freund@co.yakima.wa.us
Note: No Working Groups have met since the last GWAC meeting on November 2.	N/A	N/A

V0003

DAILY SUN
P.O. Box 878 • 600 S. Sixth Street
Sunnyside, WA 98944
Phone (509) 837-4500
Fax (509) 837-6397

WE GLADLY ACCEPT

INVOICE

Billing Date 11/29/17
Account Number 030110-00000
Telephone 509-574-2300

Yakima County Public Services
128 N. 2nd St. 4th Floor
Yakima, WA 98901

LEGAL ADVERTISING INVOICE

Item Invoiced	StartDate	EndDate	Insertions
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Invoice #: 125 FC3463-100-120 12/7 Mtg.			

Total Due 52.50

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YAKIMA COUNTY
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Affidavit of Publication

Yakima County Notice of Public Meeting
Lower Yakima Valley Groundwater Advisory Committee

NOTICE IS HEREBY GIVEN that Yakima County is holding a public meeting of the Lower Yakima Valley Groundwater Advisory Committee on Thursday, December 7, 2017, at 5:00 PM at the Yakima County Road Maintenance Conference Room, 1216 South 18th Street, Yakima, WA 98901 pursuant to Chapter 173-100-080 WAC Ground Water Management Areas and Programs.

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7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

PUBLISH: DAILY SUN NEWS
November 29, 2107

STATE OF WASHINGTON
ss.
County of Yakima

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Notary Public in and for the State of Washington

030110-00000

DEBBIE GUERRERO NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES JUNE 17, 2020

Y0060

YAKIMA HERALD-REPUBLIC

INVOICE

114 N. 4th Street PO Box 9668 Yakima, WA 98909

Date: **11/29/17**

Account #: **110536**
Company Name: **YAKIMA COUNTY SURFACE WATER MANAGEMENT**
Contact: **Tina Beck,AP**
Address: **128 NORTH 2ND STREET ROOM 408**
YAKIMA, WA 98901
Telephone: **(509) 574-2343** Fax:
Account Rep: **Simon Sizer - Legals - 398**
Phone #: **(509) 577-7740**
Email: **ssizer@yakimaherald.com**

Advertising The Yakima Herald-Republic:
Yakima County Notice of Public Meeti

Ad ID:	**777141**
Class:	**6021**
Run Dates:	**11/29/17 to 11/29/17**
# of Inserts:	**2**
Total Inches:	**8.125**
Cost:	**$116.16**
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Funding Control FC3463 — 100-120
Authorized By [signature]
Date Authorized 12/1/17

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YAKIMA COUNTY
PUBLIC WORKS ACCOUNTING

Your Ad:

Yakima County

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Yakima, WA 98901
(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this **Tuesday, November 21, 2017**

(777141) November 29, 2017

YAKIMA HERALD-REPUBLIC

Affidavit of Publication

STATE OF WASHINGTON,)
)
COUNTY OF YAKIMA)

Danielle Rogers, being first duly sworn on oath deposes and says that she/he is the Accounting clerk of Yakima Herald-Republic, Inc., a daily newspaper. Said newspaper is a legal newspaper approved by the Superior Court of the State of Washington for Yakima County under an order made and entered on the 13th day of February, 1968, and it is now and has been for more than six months prior to the date of publication hereinafter referred to, published in the English language continually as a daily newspaper in Yakima, Yakima County, Washington. Said newspaper is now and has been during all of said time printed in an office maintained at the aforesaid place of publication of said newspaper.

That the annexed is a true copy of a:
Yakima County Notice of Public Meeti

it was published in regular issues (and not in supplement form) of said newspaper once each day and for a period of 1 times, the first insertion being on 11/29/2017 and the last insertion being on 11/29/2017

Yakima Herald-Republic 11/29/17
YakimaHerald.com 11/29/17

and the such newspaper was regularly distributed to its subscribers during all of the said period. That the full amount of the fee charged for the foregoing publication is the sum of $116.16

Danielle Rogers

Accounting Clerk

LISA M DRIPPS NOTARY PUBLIC STATE OF WASHINGTON My Comm. Expires April 05, 2021

Sworn to before me this 29th day of, November 2017

Lisa M. Dripps

Notary Public in and for the
State of Washington,
residing at Yakima

Yakima County

Notice of Public Meeting
Lower Yakima Valley
Groundwater Advisory
Committee

NOTICE IS HEREBY GIVEN that Yakima County is holding a public meeting of the Lower Yakima Valley Groundwater Advisory Committee on **Thursday, December 7, 2017, at 5:00 PM at the Yakima County Road Maintenance Conference Room, 1216 South 18th Street, Yakima, WA 98901** pursuant to Chapter 173-100-080 WAC Ground Water Management Areas and Programs.

For Additional Information
To learn more about the Lower Yakima Valley Groundwater Management Area, the Groundwater Advisory Committee, and its goals and objectives, please see the Lower Yakima Valley Groundwater Management Area on the County webpage at: http://www.yakimacounty.us/gwma/

For more information about the meeting, please contact Lisa Freund, Yakima County Public Services Administrative Manager at 574-2300.

If you are a person with a disability who needs any accommodation in order to participate in this program, you may be entitled to receive certain assistance at no cost to you. Please contact the ADA Coordinator at Yakima County no later than forty-eight (48) hours prior to the date service is needed.

Yakima County ADA
Coordinator
128 N. 2nd Street, Room B27
Yakima, WA 98901
(509) 574-2210
7-1-1 or 1-800-833-6384
(Washington Relay Services for deaf and hard of hearing)

Dated this **Tuesday, November 21, 2017**

(777141) November 29, 2017

Courtesy of Yakima Herald-Republic

GWAC Attendance Roster

Member	5-Oct-2017	19-Oct-2017	2-Nov-2017	7-Dec-2017
Stuart Turner	Absent	Present	Present	Absent
Chelsea Durfey (alternate)	Absent	Absent	Absent	Absent
Bud Rogers	Present	Present	Present	Present
Kathleen Rogers (alternate)	Present	Present	Present	Absent
Patricia Newhouse	Present	Present	Absent	Absent
Sue Wedam (alternate)	Present	Absent	Present	Present
Doug Simpson	Absent	Absent	Present	Absent
Jean Mendoza	Present	Present	Present	Present
Eric Anderson (alternate)	Absent	Absent	Absent	Absent
Jan Whitefoot	Absent	Absent	Absent	Absent
Jim Dyjak (alternate)	Absent	Absent	Absent	Absent
Steve George	Present	Present	Present	Absent
Frank Lyall (alternate)	Present	Absent	Present	Present
Jason Sheehan	Present	Present	Present	Absent
Dan DeGroot (alternate)	Present	Present	Present	Present
Ron Cowin	Present	Present	Present	Absent
Laurie Crowe	Absent	Absent	Present	Present
Rodney Heit (alternate)	Present	Absent	Absent	Absent
John Van Wingerden	Absent	Present	Absent	Present
Jay Decker (alternate)	Absent	Absent	Absent	No longer the alternate
Rand Elliott	Present	Absent	Present	Present
Vern Redifer	Present	Present	Present	Present
Ryan Ibach	Present	Absent	Absent	Present
Dr. Troy Peters	Present	Present	Absent	Absent
Lucy Edmondson	Present	Present	Absent	Present
Peter Contreras/Nick Peak (alter	Absent	Present	Absent	Absent
Elizabeth Sanchey	Absent	Absent	Absent	Absent
Stuart Crane (alternate)	Present	Present	Present	Present
Gary Bahr	Present	Absent	Present	Present
Perry Beale (alternate)	Absent	Present	Absent	Absent
Andy Cervantes	Absent	Absent	Present	Present
Sheryl Howe (alternate)	Absent	Absent	Absent	Absent
David Bowen	Absent	Present	Absent	Present
Sage Park (alternate)	Present	Present	Present	Absent
Lino Guerra	Absent	Absent	Absent	Absent
Rick Perez (alternate)	Absent	Absent	Absent	Absent
Jessica Black	Absent	Absent	Absent	Absent
Matt Bachmann	Present	Present	Absent	Present

Attachment B

GWMA Strategies Spreadsheet – Comprehensive List of Blue Alternatives before 10-5-17 meeting

GWMA Strategies 12-1-17 JHD

sort	QUESTION	YES	NO	MAYBE	SOURCE	Sort1	Sort2	Sort3
1	Q1A - Pump, treat and reinject groundwater	0	14	0	WGD	Remediation	Treat	1
30	Q30A - Postpone decision on creation of an aquifer protection area till a later date when more information is known.	1	5	8	WGD	Admin/Lead	FUND	1
	Livestock							
36	Q36A - Create county ordinance limiting total number or density of cows or dairies (lid).	3	9	2	WGD	Admin/Lead	Reg - Zon	5
37	Q37A - Adopt a LYC GWMA or county-wide CAFO ordinance	3	6	4	L/C WG (no consensus in WG)	Admin/Lead	Reg - Zon	7
94	Q94A - Review and evaluate the WSDA Dairy Nutrient Management Program inspection "protocols" to assist in determining if additional resources should be allocated and identify any areas for improvement of the inspections themselves.	11	1	2	L/C WG	WSDA	DNMP	6
20	Q20A - Voluntary development and implementation of NMPs by operations not already required to hold permits or a DNMP as an effective means of environmental protection.	6	3	5	L/C WG	Admin/Lead	NMP	2.1
93	Q93A - Summarize the industry-wide DNMP reporting and provide information that would disclose to the public the amount of manure the CAFO's in the GWMA created and to whom it was delivered.	6	6	2	WGD	WSDA	DNMP	3
163	Q163A - Streamline current enforcement activities so as to improve customer service and protocols, increase clarity of process, escalate enforcement for facilities intentionally not following management practices (particularly repeat offenders), identify methods to discourage repeatedly unfounded complaints, and improve overall transparency.	9	1	4	L/C WG	Livestock	Regulation	15

	Require biannual pressure testing of underground pipes that transport liquid manure – using either with cameras or pressure tested, and require repairs if they are not intact.				EPA Div 10	Livestock	Regulation	
	Consistent with the NRCS' general recommendation, the use of lagoons should be avoided in watersheds with drinking water aquifers. Any new or existing lagoons in watersheds with drinking water aquifers should be equipped with engineered liners with a flexible membrane liner (FML) and a leak detection system.				EPA Div 10	Livestock	Regulation	
	If there are drinking water wells that have had a comprehensive site assessment and exceed the Maximum Contaminant Level (MCL) for nitrate, investigate the cause and consider sampling additional wells or use of groundwater monitoring wells, upgradient and downgradient, to assess whether the source of the nitrate.				EPA Div 10	Livestock	Regulation	
	SYCD							
97	**Q97A - Ask SYCD for projected plan to expand fiscal and administrative capacity**	3	6	5	Literature	SYCD	SYCD	6
98	**Q98A - Fund post GWMA education and outreach to farmers through Conservation District, Require farmer funding participation if cost/share is involved.**	7	3	4	WGD	SYCD	SYCD	5
100	**Q100A - Enhance engineering expertise (personnel) within Conservation District--none there or at local NRCS**	5	2	7	WGD	SYCD	SYCD	7
102	**Q102A - Recommend funding for Southern Yakima Conservation District update of Dairy Nutrient Management Plans**	8	4	2	WGD	SYCD	SYCD	3
162	**Q162A - Increase NRCS funding for assistance programs for nutrient management planning, engineering, cost share, and loan funds.**	8	3	3	L/C WG	Livestock	SYCD	2
	Irrigated Agriculture							

197	Q197A - 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.	9	1	4	WGD	Irrigated Ag	IM	8
212	Q212A - Require irrigated agriculture nutrient management plans. Record the source and type of fertilizer and number of acres fertilized with each.	8	1	5	WGD	Irrigated Ag	NMP	2.4
214	Q214A - Develop and implement Nutrient Management Plans (NMPs) for all producers (those that apply manure and those that apply synthetic fertilizer that include annual soil testing for phosphorus and nitrogen and which follow available guidance (i.e. Land Grant University) for developing appropriate land application rates for phosphorus and nitrogen. These NMPs can identify site specific conservation practices that are, or will be, implemented to minimize the transport of phosphorus or nitrogen to surface and ground waters. NMPs that are adaptive -- adjusted based on annual soil tests, the types of crops grown, and other site or field specific factors to allow producers to adjust their plans and practices as new information becomes available. Regulatory approach,	8	1	5	EPA Region 10	Irrigated Ag	NMP	2
219	Q219A - Integrate use of animal waste and synthetic fertilizer, balancing nutrient application amounts so as to maximize crop production and full nitrogen uptake.	8	3	3	Literature	Irrigated Ag	NMP	2.2
220	Q220A - Track nutrients and their application regardless of the end user, including commercial fertilizer.	5	2	7	L/C WG	Irrigated Ag	NMP	9
221	Q221A - Keep track of synthetic fertilizer sales.	5	4	5	WGD	Irrigated Ag	NMP	10
	Solid Waste							

180	Q180A - Treat manure supply in excess of that which can reasonably be applied as nutrient to agricultural lands as a waste product. Apply waste management strategies including land disposal at designated site, incineration, centralized waste-to-energy facility.	2	7	4	Literature	Livestock	Regulation	6
249	249 - Yakima Health District and Department of Ecology Enforce RCW 70.95.020, RCW 70.95.100, RCW 70.95.160, RCW 70.95.165, RCW 70.95.179, RCW 70.95.180, RCW 70.95.185, RCW 70.95.200, RCW 70.95.205, RCW 70.95.240, RCW 70.95.280, RCW 70.95.285, RCW 70.95.290, RCW 70.95.300, RCW 70.95.305, RCW 70.95.306, RCW 70.95.310, and RCW 70.95.315, related to composting. (Note - RCW Chapter 70.95 is titled "Solid Waste Management - Reduction and Recycling")				Jean Medoza	Atmosphere	Atmosphere	2
250	250 - Enforce WAC 173-350-010, WAC 173-350-040, WAC 173-350-200, WAC 173-350-220, WAC 173-350-225, WAC 173-350-230, WAC 173-350-320, WAC 173-350-330, WAC 173-350-500, WAC 173-350-700, WAC 173-350-710, and WAC 173-350-715 (Note - WAC Chapter 173-350 is titled (Solid Waste Handling Standards")				Jean Medoza	Atmosphere	Atmosphere	3
	Air Quality							
251	251 - Require WSDA to establish an air monitoring system for compliance with NRCS Standard 370 Atmospheric Resource Quality Management on Washington farms and to educate operations that do not comply with this standard.				Jean Medoza	Atmosphere	Atmosphere	4
257	257 - Enforce RCW 70.94.011, 70.94.040, RCW 70.94.141, RCW 70.94.151, RCW 70.94.152, RCW 70.94.153, RCW 70.94.154, RCW 70.94.161, RCW 70.94.181, RCW 70.94.331, RCW 70.94.380 (Note - RCW Chapter 70.94 is titled "Washington Clean Air Act")				Jean Medoza	Atmosphere	Atmosphere	10

258	258 - Enforce WAC 173-442-030, WAC 173-442-040, WAC 173-442-050, WAC 173-442-060, WAC 173-442-070, WAC 173-442-160, WAC 173-442-170, WAC 173-442-200, WAC 173-442-210, and WAC 173-442-220 (Note - WAC Chapter 173-442 is titled "Clean Air Rule")				Jean Medoza	DOE	Atmosphere	11
	Economics							
	Q259A - Increase dedicated Provide funding that requires Ecology to gather data, evaluate, and address the environmental impact of intensive, industrial agriculture				Jean Medoza	Research / Data Collection	NMP	
46	Q46A - Measure the effects of GWAC program on Yakima County economics.	5	4	5	WGD	Admin/Lead	Economics	1

sort	To Whom	Strategy	Details
Abandoned Wells			
	Legislature	Permit the repair or decommissioning of wells by general contractors, rather than exclusively by well-drillers, so as to diminish costs of decommissioning.	
	DOE, Yakima Health District	Develop a plan for finding and decommissioning abandoned wells in the next 12 months, using the LYVGWMA as a pilot project.	Educate the public regarding liability of an ill-secured well, and the importance of the integrity of wells, particularly those without a well log. Educate realtors and banking industry officials about disclosure of abandoned wells in property transfers. Compare Google Earth to GIS images to determine where building or usage changes indicate possible well usage changes. Focus first on hotspot high density areas in GWMA. Ground truth suspected problem wells. Offer incentives, for property owners to identify and properly abandon wells. Offer grant funding to Yakima Health District or professional engineers for well inspections and to assist in abandoned well decomissioning. Provide some form of protection for self-reporting of abandoned or improperly decommissioned wells.
Aquifer Protection			
	Yakima County	Postpone decision on creation of an aquifer protection area till a later date when more information is known.	
	Yakima County	Amend the list of prohibited uses under the Critical Aquifer Recharge Area ordinance 16C.09.070 (6) to include activities that would add nutrients to the soil column beyond those amounts that can be taken up within a reasonable time by plant materials. Or perhaps, activities inconsistent with NCRS Code 590	
	Yakima County	Develop educational materials that could be elected by instructors at 8-12 levels about aquifer protection, groundwater and best management practices.	
Atmosphere			
	DOE, Yakima Regional Clean Air Agency, WSDA	Estimate emissions of reactive nitrogen - gaseous nitrogen oxides (NO_x), ammonia (NH_3), nitrous oxide (N_2O), the anion nitrate, NO_3^- -from animal agriculture, manure and fertilizer applications in the Lower Yakima Valley. Use this to inform the nitrogen balance data base for the GWMA area and refine estimates of atmospheric deposition.	Use this to inform the nitrogen balance data base for the GWMA area and refine estimates of atmospheric deposition.
	DOE	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.	
	WSDA	Establish a monitoring system for compliance with NRCS Standard 317 on new composting facilities at Washington dairies (phased in for existing facilities).	
	WSDA, SYCD	Encourage prompt incorporation of manures and fertilizers after application to cropland where appropriate.	
	WSDA, SYCD	Discourage broadcast application of manures to cropland.	
	WSDA, SYCD	Encourage application of manures and fertilizers by surface banding.	Banding, "dribbling," "stripping" of liquid fertilizers, https://fluidfertilizer.org/wp-content/uploads/2016/05/22P14-18.pdf

Best Management Practices			
	GWMA, WSDA, SYCD	Inform farmers of those BMPs prioritized by Livestock/CAFO and Irrigated Agriculture Work Groups to reflect greatest effectiveness in nitrate reduction.	Focus implementation of BMPS based on information and data included in the Nitrogen Availability Assessment, Soil Sampling Program, Ambient Groundwater Monitoring Plan, USGS Reports, and other similar scientifically based publications. GWMA: Publish lists as appendices to GWMA Program. WSDA: Adopt regulations listing Lower Yakima Valley GWMA-specific BMPs; Determine who implements each BMP and who monitors it. Determine the time frame in which to measure/monitor each BMP. SYCD: provide farmer-specific consultation.
	Yakima Health District	Recommend against farming around a water well.	
Composting			
	Ecology, WSDA	Improve composting regulations	
	Yakima Health Districe	Issue permits for agricultural composting operations, to appropriately inspect composting operations and to enforce regulations that protect public health and the environment, as required by state rules and regs.	
	DOE, Yakima Health Districe	Inspect, monitor and regulate stockpiled manures.	
	Yakima Health District	Issue permits for agricultural composting operations, to appropriately inspect composting operations and to enforce regulations that protect public health and the environment, as required by state rules and regulations.	
	DOE	Review applications for and issue exemptions for agricultural composting operations in a manner that protects public health and the environment, as required by state rules and regs	
	DOE	Provide assistance to local departments of health regarding the regulation of agricultural composting operations	
Domestic Waste Management			
	Yakima Health District, Yakima County Building Department	Limit septic system developments where soil filtration rate is high, where housing density is already big, where nitrate concentration is already great downstream of the septic plume.	Recommendations for conditions on issuance of building permits.
	Yakima Health District, Yakima County Building Department	Study potential nitrate contamination attributable to improperly operated septic systems.	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.
	Yakima Health District	Publish and distribute homeowner guide on how to maintain septic systems	

	Yakima Health District	Consider the nitrate density element when approving proposed septic systems in order to reduce the nutrient nitrogen in domestic wastewater discharged from OSS.	Including those technologies verified by the U.S. EPA's Environmental Technology Verification Program: fixed film trickling filter biological treatment, media filter biological treatment, and submerged attached-growth biological treatment. Recommend use of anaerobic digestion in waste storage lagoons as a best management practice.
	WDOH	Determine, prior to issuing or reissuing LOSS permits, that all employee counts are regularly reported.	So that the LOSS will continue to operate as designed.
	Legislature	Require facility process improvements in waste treatment and food processing plants to reduce nitrogen and total discharge volume.	
	Legislature	Provide funding for municipalities to replace aging sewer system infrastructure and ensure proper system maintenance to reduce nitrate leaching.	
	Legislature	Make shallow (1, 2, 3 foot) soil testing reports prerequisites for funding, lending or building permits.	
	Legislature, Washington Conservation Commission	Fund SYCD, through State Conservation Commission budged, for projected educational, administrative, nutrient management planning, engineering, cost share, and lending activities.	
	EPA, DOE	Identify and support opportunities, including educational research institutions, for private, public, and industry investment in technology specific to addressing nitrate contamination in groundwater.	
	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.	
Funding			
	Legislature	Fund, DOE, WSDA, and Lead Agency activities put in place pursuant to these recommendations.	Prepare fiscal request for legislature.
	Legislature	Require Commodity Commissions to dedicate "check off" money for research and development in water quality technology and practices.	
Groundwater Quality Monitoring			
	Lead Agency, Yakima Health District, USGS	Implement an Ambient Groundwater Monitoring Plan	Monitoring well construction: Lead Agency; Monitoring well data collection: Yakima Health District, USGS. Study short-term seasonal variations in nitrate concentrations over next year or two--addresses how changes in nutrient application over the agricultural cycle affects things. Study long-term trends that develop over several years--to track whether the overall picture is getting better, whether changes recommended by GWMA are having impact.

	Lead Agency, Yakima Health District, USGS, EPA	Implement a Drinking Water Quality Monitoring Plan	Data collection, Yakima Health District, USGS. Study short-term seasonal variations in nitrate concentrations over next year or two--addressing how changes in nutrient application over the agricultural cycle affects things. Collect more information on wells known to have high nitrate concentrations, perhaps identifying whether the concentration is self-caused. Study long-term trends that develop over several years--to track whether the overall picture is getting better, whether changes recommended by GWMA are having impact. Where drinking water wells have had a comprehensive site assessment and exceed the Maximum Contaminant Level (MCL) for nitrate, Investigate the cause and consider sampling additional wells or use of groundwater monitoring wells, upgradient and downgradient, to assess the source of the nitrate.
	USGS	Use USGS particle tracking model to indicate where groundwater moves faster (permeability).	USGS Particle Tracking Model Overview--potentially combined with MT3D MODFLOW application to the vadose Zone
	DOE	Analyze the trends of nitrate data contained within reports required by NPDES and SWD permits.	
	Legislature, Ecology, Lead Agency, Yakima Health District, USGS	Establish or maintain ongoing, extended funding necessary for the Yakima County Department of Public Services and Yakima Health District to actively participate in water quality improvement, testing, monitoring, scientific data analysis, and infrastructure development.	Collect data to track water quality improvement progress and nutrients generated, applied, or exported within the LYV GWMA. Generate data through soil testing, Ambient Groundwater Monitoring Plan implementation - including purpose built and existing wells, sampling of liquid and solid waste to be field applied, composted, or exported, the CAFO General Permit, and tracking nutrients applied by non-dairy operations. Collect, analyze, and interpret data to track water quality improvement progress, nutrients imported, generated, applied, or exported, which will inform the implementation of an Adaptive Management Plan within the LYV GWMA.
	Irrigation Districts	Monitor nitrate concentrations of irrigation water at headgates.	Report nitrate concentrations annually to Department of Ecology
Irrigated Agriculture			
	WSDA, SYCD	Continue education and outreach to agriculture operators about impacts and practices related to compliance with relevant State and federal requirements for groundwater protection.	Consequences of too much irrigation. Technological improvements in irrigation that permit easier management of water. Descriptions of specific improved technology. Economic viability of technological advancements .
	WSU Extension Service	Update Appendices A and B of the Washington Irrigation Guide.	
	WSU Extension Service	Continue research of water management with application of agricultural nutrients.	Develop water sorption graph or chart. List volumes of water applied, soil types, infiltration rates, water holding capacity, absorption/compaction rates, depths to water, pre-season and post-season appropriate moisture levels, evapotranspiration rates.
	WSU, SYCD, WSDA	Encourage advanced irrigation management.	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.

	SYCD, WSDA	Create irrigation management plans (similar to nutrient management plans) for farms over a minimum size and provide financial assistance for implemented plans.	Use available techniques to determine how much and when irrigation is needed instead of irrigating according to a prearranged schedule. Analyze irrigation practices to discover whether frequency or volume creates greater propensity for leaching. Manage sprinkler systems so they do not drive nutrients past the root system. Improve micro-irrigation system design and operation. Schedule water and nitrogen application according to the need for optimal crop yields. Monitor the timing of application of fertilizers to fields and how much water was then applied.
	Western Plant Health Association	Update Western Fertilizer Handbook, Western Plant Health Association, Ninth Edition (2002)	
	Producers	Farmiing operations not already required to hold permits or a DNMP develop and implement Nutrient Management Plans .	Voluntary
	NRCS	Provide financial assistance for implementation of irrigation management plans.	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.
	Legislature	Provide funding to WSU for a mobile irrigation lab to assess the efficiency of current or advised irrigation practices, either through a singular lab or component parts.	Inform farmers of the relative propensity of wheel lines, center pivots, and drip lines to cause leaching and that fertilization and supplemental irrigation beyond the optimum rate will not necessarily produce better yields or higher profits without serious side effects.
	Producer	Use effective fertililzer application procedures for specific crop requirements.	Determine schedules, placement, rate and time of application and speed of release. Where possible, apply nitrogen to plant-specific root zone, rather than broadcast application. Refrain from tilling under herbaceous remnants of prior crops, reducing plant nitrogen contributions to soil column.
Irrigate Agriculture and Livestock			
	DOE, WSDA, Yakima County	Develop a post-GWAC agricultural producer education and outreach campaign	Provide education about concepts that people can understand. Create and maintain a central repository of public information online, informing producers of the nitrate issue, community impacts, and BMP's. Encourage commodity groups to provide education on water management and fertilizer use through regular meetings. Make presentations at trade shows, communicate with agricultural consultants who have positive relationships with farmers suggesting that they use BMP's. Inform producers of BMP's including increased funding for the DNMP assistance program. Broaden the pool of people GWMA is educating or communicating with. Improve the availability of technical assistance to develop nutrient management plans for all agricultural industries. Assist commodity groups to enhance efforts to bring information to GWMA-area members. Increase livestock operator awareness of the need for procedures for proper management of animal wastes and wastewater. Provide information on funding sources from industry, government, educational institutions, grants, industry associations, etc. . . Enlist advocacy groups/Farm Bureau/federations/associations to host workshops/informational meetings regarding GWMA goals and recommendations. Stimulate news coverage of progress in irrigation technology.
	Legislature, DOE, WSDA, Washington State DOH	Make grants and allocate cost share funding or other funding assistance to people Implementing environmental protection measures affecting groundwater quality.	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.
	WSU, SYCD, Producers	Apply nutrients at Agronomic Rate	Distribute Information to producers on what can happen with applied nitrogen, what should be applied and reasonable, agronomic rates of application. Develope technologies and provide information about improvements made in nutrient management and agronomic rate application of fertilizer by specific developing technologies.

	WSU, Producers	Integrate use of animal waste and synthetic fertilizer.	Research chemical integration of animal waste and synthetic ferlizers with objective of balancing nutrient application amounts in order to maximize crop production and full nitrogen updake.
	WSDA, SYCD	Monitor changes occurring in agricultural operations. Evaluate whether those changes positively affect improvement in groundwater quality.	Prepare report to Legislature and Department of Ecology.
	SYCD	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.	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.
Lead Agency/Administration/Adaptive Management			
	Lead Agency	Establish a Lead Agency reponsible for Implementation and oversight of the LYV GWMA Groundwater Management Plan and acquisition of stable funding to support their activities.	Administration of Groundwater Quality Program. Administer funds and distribute to other entities by subcontract. Maintain Yakima County's GWMA website. Maintain a GIS data base on the GWMA.
	Lead Agency	Establish performance objectives against which monitoring data can be compared.	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.
	Lead Agency	Assess groundwater contamination potential in localized areas	Make use of the available information on soils, geology, and groundwater in order to identify those areas that are the most vulnerable to immediate impact of contamination or can tolerate more nitrogen application. Overlay GIS density maps reflecting different sources of nitrogen in order to geographically indicate the total density from all sources. Identify areas with highly permeable and susceptible soils where fertilization and pesticide application should be most carefully managed. Identify areas that are closer to surface water, areas where recharge is faster or more frequent, or areas where shallow soils overlie soluble bedrock. Identify strategies upstream of sensitive areas to reduce contributions of nitrate sources.
	Lead Agency	Adopt and Implement an Adaptive Management Plan	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 availabley 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.
	Lead Agency	Perform an engineering study of water supply alternatives.	Possible alternatives: 1) Discontinue use of contaminated shallow wells. Build new 1,500 foot communiry wells. 2) Rebuild, repair or replace poorly constructed wells. 3) Construct a potable water line from nearby developed area into deadhead water stations at central rural location (permit potable water collection at deadhead water stations). 4) Offer incentives to drill deeper wells or connect households on private wells near community water systems to connect to a community water system. (Nitrate Treatment Pilot Program-June 2011).
	Lead Agency	Encourage municipalities within the GWMA to extend municipal sewer systems within urban growth areas and retire ROSS and LOSS.	
	Lead Agency	Encourage connection of residences within urban growth zones to sewer systems extended by municipalities.	

	Lead Agency, Yakima Health District	Encourage the development of group septage-management or treatment systems in areas outside urban growth zones where the density of residential development could exacerbate the effect of multiple OSS on groundwater quality.	
	Lead Agency	Perform an engineering study of locations outside urban growth areas where there is rural residential medium to high density OSS and the nitrate concentration is greater than the state water quality standard where community waste water systems could feasibly be constructed in lieu of individual on-site septic systems.	
	Lead Agency, Municipalities, Yakima Health District	Require new developments to address potential impacts on groundwater quality	Through permitting review of site plan criteria.
	Lead Agency	Develop an urban and hobby agriculturalist education and outreach campaign.	Provide information targeted to small farm/hobby farm/ranchettes about manure management. Publish public information about proper septic system construction and operation. Educate the public, particularly in towns, about lawn and garden nitrogen applications' contribution to nitrate concentrations.
Livestock/CAFO			
	Legislature	Amend the Dairy Nutrient Management Act to extend WSDA's authority to manure application on properties other than those owned by dairies, provide more complete disclosure of Nutrient Management Plans.	
	Washington Conservation Commission, WSDA	Document regulatory compliance for dairies within the GWMA that are completing and implementing Dairy Nutrient Management Plans (DNMP).	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.
	WSDA	Quantify the nutrient value and rate of release of nitrate from livestock waste under various Lower Yakima Valley conditions to become part of nutrient management guidelines.	
	WSDA	Provide underlying soils information to individual livestock operations	So that individual property owners can evaluate contamination potential.
	WSDA	Complete Technical Note 23 inspections on all waste storage ponds (lagoons) within the GWMA boundaries.	
	WSDA	Develop strategies for marketing the economic, fertilizer value, and soil enhancing properties of appropriate application of manure and other livestock wastes.	
	SYCD	Charge dairies for preparation of Dairy Nutrient Management Plans	
	SYCD	Establish a local forum for disseminating information and facilitating technical exchange regarding BMPs for livestock management and groundwater protection.	Prepare a fact sheet/develop outreach campaign to growers that explains agronomic rates, applying nutrients at the right time/right place/right amount. Endorse and distribute materials by all effective means that will educate the public about the facts related to all fertilizer types, including livestock waste and the science of groundwater protection.

	Washington Conservation Commission, WSU Extention	Provide additional funding for Yakima Valley education and outreach activities.	BMP implementation, irrigation water management, soil nutrient management and manure management and application.
	DOE, WSDA. Yakima County	Develop a post-GWAC agricultural producer education and outreach campaign	Provide education about concepts that people can understand. Create and maintain a central repository of public information online, informing producers of the nitrate issue, community impacts, and BMP's. Encourage commodity groups to provide education on water management and fertilizer use through regular meetings. Make presentations at trade shows, communicate with agricultural consultants who have positive relationships with farmers suggesting that they use BMP's. Inform producers of BMP's including increased funding for the DNMP assistance program. Broaden the pool of people GWMA is educating or communicating with. Improve the availability of technical assistance to develop nutrient management plans for all agricultural industries. Assist commodity groups to enhance efforts to bring information to GWMA-area members. Increase livestock operator awareness of the need for procedures for proper management of animal wastes and wastewater. Provide information on funding sources from industry, government, educational institutions, grants, industry associations, etc. . . Enlist advocacy groups/Farm Bureau/federations/associations to host workshops/informational meetings regarding GWMA goals and recommendations. Stimulate news coverage of progress in irrigation technology.
	WSDA	Develop a system to evaluate which farmers need assistance in understanding appropriate farming practices.	Clearly establish expectations, list problematic management practices, encourage voluntary compliance, develop peer encouragement system.
	USDOE, USDOA	Explore investment in animal and agricultural waste to energy technology	Explore state of technology, economic viability, return on investment
	Washington State DOH, Yakima Health District, Lead Agency	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)
	Producers	Make capital improvements	Install liners in liquid waste storage lagoons. Install impervious surfaces beneath silage storage.
Nitrogen Loading			

	WSDA, DOE, Lead Agency	Assess Nitogen 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. Hire a technical consultant to conduct a literature review to determine the most relevant information and accurate factors for use in the Nitrogen Loading Assessment. Periodically repeat the grower survey used in the Nitrogen Availability Assessment to compare against the currently established data. Collect data on how many acres in the GWMA are fertilized in various crops with manure and how many with commercial fertilizer. Update and monitor the percentage of acreage in various crops, particularly silage corn and field corn. Study effect of contribution of nitrogen from cover crops used to form mulch. Determine acreage for triticale. Discover commercial fertilizer tonnage for Yakima County and/or for GWMA. Explore how much nitrogen leaches into groundwater from drains and wasteways. Study atmospheric deposition more comprehensively. Understand the difference between plant uptake and plant removal of nitrogen. Ask the Environmental Protection Agency to use its Community Multi-scale Air Quality Modeling System (CMAQ model) -- or other tools -- to estimate emissions of reactive nitrogen - gaseous nitrogen oxides (NOx), ammonia (NH3), nitrous oxide (N2O), the anion nitrate, NO3- - from animal agriculture, manure and fertilizer applications in the Lower Yakima Valley. Use this to inform the nitrogen balance data base for the GWMA area and refine estimates of atmospheric deposition. Design and implement pilot studies focusing on innovative farm techniques which reduce nitrogen loading to crops and monitor results for future expansion of findings.
Regulations and Enforcement			
	EPA, DOE, WSDA	Streamline current regulatory enforcement activities	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.
	State Department of Health	Revise WAC 246-203-130 so that it includes specific and enforceable requirements designed to protect human health.	
	WSDA	Regulate synthetic fertilizer application and amount of water used together with regulation of manure application.	
Remediation			
	EPA, DOE, Producers	Pump-and-fertilize.	Use existing (or new) agricultural water wells to remove nitrate-contaminated groundwater and treat the water by using it to irrigate crops which will take up the nitrogen concentration in the irrigation water (presumes the existence of a proper nutrient management plan for the irrigated acreage).
No Action			
		Consider costs of health risks to families from nitrate exposures, costs incurred by growers and producers of various recommendations, costs of bottled water, costs to connect to public water or sewer systems, cost for WSDA to monitor DNMP, costs of soil sampling	

Attachment C

First four GWMA program chapters presented to the GWAC on December 7, 2017:

- Introduction (Draft V1)
- Characterization of the Area (Draft V1)
- Sources of Nitrate and the Regulatory Environment (Draft V1)
- Yakima County's Role in Groundwater Quality Protection (Draft V1)

GWAC member comment form

Includes the designation of the Lower Yakima Valley Groundwater Management Area, the work of the Groundwater Advisory Committee (GWAC), and the organization of the GWMA Program.

Introduction

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/L. Another 21% of wells tested were below this level but higher than 5 mg/L (reported in Ecology et al. 2010).

These numbers raised concerns due to the potential impact to human health (Ecology et al. 2010). Nitrate is considered an acute contaminant and may cause serious health conditions in vulnerable populations. If the condition is left untreated, death may result. In the Lower Yakima Valley, residents may be exposed to nitrate if they obtain their drinking water through a private or shared well—the typical source of drinking water for the 6100+ rural households not served by a public water system. Assuming 12% of private wells exceed the Safe Drinking Water Act Maximum Contaminant Level, up to 720 of those households were exposed to nitrate-contaminated groundwater.

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 (LYV GWMA), and in 2012 the Groundwater Advisory Committee (GWAC) was formed. The goal of the GWAC was to develop a GWMA Program to reduce nitrate levels in groundwater to below state standards. Its membership reflected the coordinative nature of the effort,

and included citizen representatives, representatives from Ecology, Washington State Department of Agriculture (WSDA), Washington State Department of Health (DOH), the US Environmental Protection Agency (EPA), the Yakama Nation, the Yakima Health District, and Lead Agency Yakima County.

To accomplish its work, the GWAC tasked itself with identifying the primary sources of nitrate contamination using scientific data, identifying or developing practices that would minimize nitrate concentration of groundwater; developing a plan that would recommend strategies for implementing improved practices and providing appropriate education and outreach on health risks and how to prevent exposure (GWAC talking points, approved February 2013).

Its objectives included data collection, monitoring and analysis; public education and outreach; problem identification; potential measures or practices for reducing groundwater contamination (GWAC talking points, approved February 2013).

At-Risk Populations and Public Education

As the GWAC began its work it was incumbent upon it to begin an immediate education and outreach program to reach out to at-risk populations and their families served by private or shared wells in the LYV GWMA. Infants, pregnant women, women who may become pregnant, and individuals with certain blood disorders are all considered at high risk from exposure to elevated or high levels of nitrate. Accordingly, an outreach program was implemented to inform these populations and their families of the health risks of high nitrate, how to protect themselves, and how to protect the groundwater that their drinking wells draw from. As Spanish is the primary language spoken in an estimated 60 percent of LYV GWMA households, a bilingual (Spanish/English) outreach program was implemented and ran concurrently with the GWMA Program development.

Meetings

The GWAC held its first meeting on June 5, 2012. Over the next five years it would meet more than 50 times to accomplish the work it had tasked itself. Its subcommittees, or working groups, were tasked with the research, investigation and proposed recommendations within their area of expertise – Data Collection, Livestock/CAFO, Irrigated Agriculture, Residential, Commercial, Industrial and Municipal (RCIM), Regulatory Framework, Education and Public Outreach, and

Funding. Working groups then brought their recommendations back to the GWAC for its consideration. The working groups would collectively hold over 200 meetings in the ensuing years.

Organization of the GWMA Program

The suggested content of a GWMA Program is defined by WAC 100-100. The Program laid out in the following pages generally follows this structure. The Area Characterization describes the Lower Yakima Valley and answers the questions: what does the area look like? What are the historic milestones that transformed a semi-arid desert into an agricultural oasis? Who lives here, and why? What are the consequences of land-use decisions and individual actions that have been made?

Ensuing chapters identify the GWAC's water quality goals and objectives, explore the regulatory environment, and Yakima County's role in groundwater quality protection. The narrative then turns to the heart of the GWAC's work: its investigation and analysis of the sources of nitrate, the pros and cons of various recommendations, and, finally, defining recommended actions at a variety of levels: legislative, state agencies, local government, and private individuals. It further defines how to implement the work—or how to get the job done.

Characterization of the Area

Includes boundary, topography, geology, hydrology and hydrogeology, and demographics, and historical and existing groundwater quality.

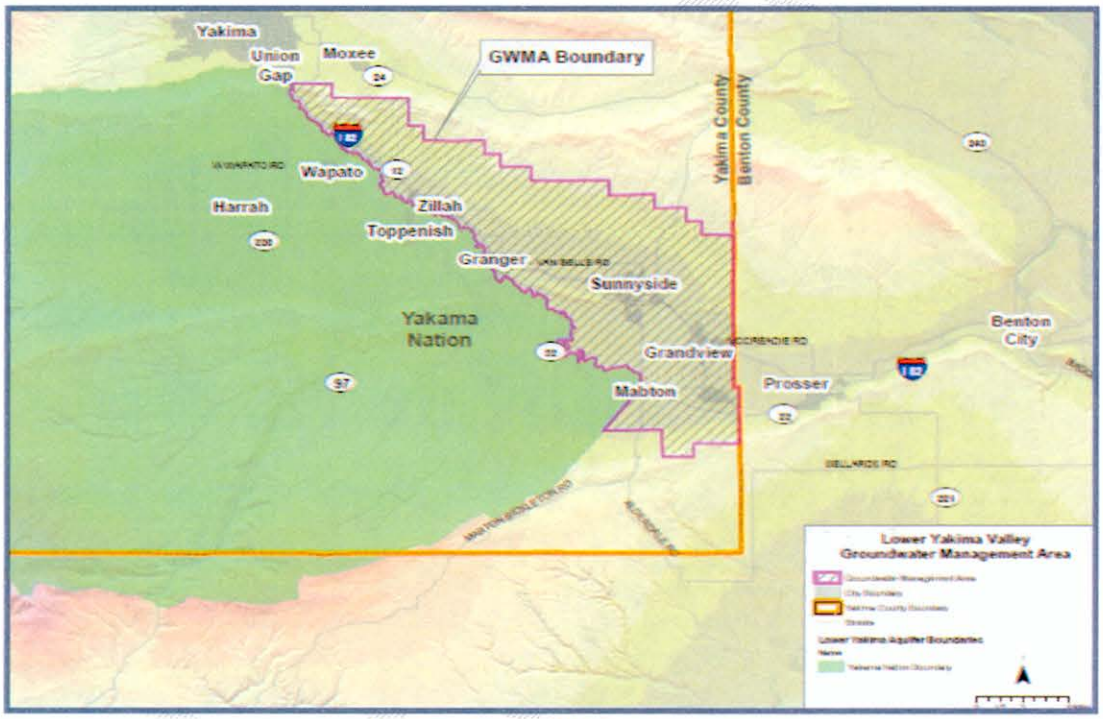


FIGURE 1 - GWMA BOUNDARY

The following characterization of the area is intended to describe the area as it currently exists. The data relates to the GWMA in particular, and Yakima County more generally. The reader should be cautious to pay attention to the geographic area to which the numbers apply.

Boundary of the Groundwater Management Area

The Lower Yakima Valley Groundwater Management Area (or LYV GWMA) is located within the Lower Yakima Valley, south of Union Gap, northeast of the Yakima River and west of the Yakima-

Benton County line. It lies in the southeastern portion of the Lower Yakima Valley. Its total area is 175,161 acres. The western boundary abuts the Toppenish Basin. The southern boundary is bordered by the Horse Heaven Hills. The northeastern boundary generally follows the northern flank of the Cold Creek Syncline.

The Groundwater Management Area addressed in this program is essentially the Eastern Study Area as identified within the *Preliminary Assessment*. It includes the non-reservation lands along the northeastern side of the Yakima River south of Union Gap and the southeast Yakima Valley downstream of the confluence of the Satus and Yakima Rivers. Approximately 60 percent of the valley population resides in this area. The Groundwater Management Area includes the incorporated communities of Zillah, Sunnyside, Granger, Grandview, and Mabton and the rural settlements of Buena and Outlook.

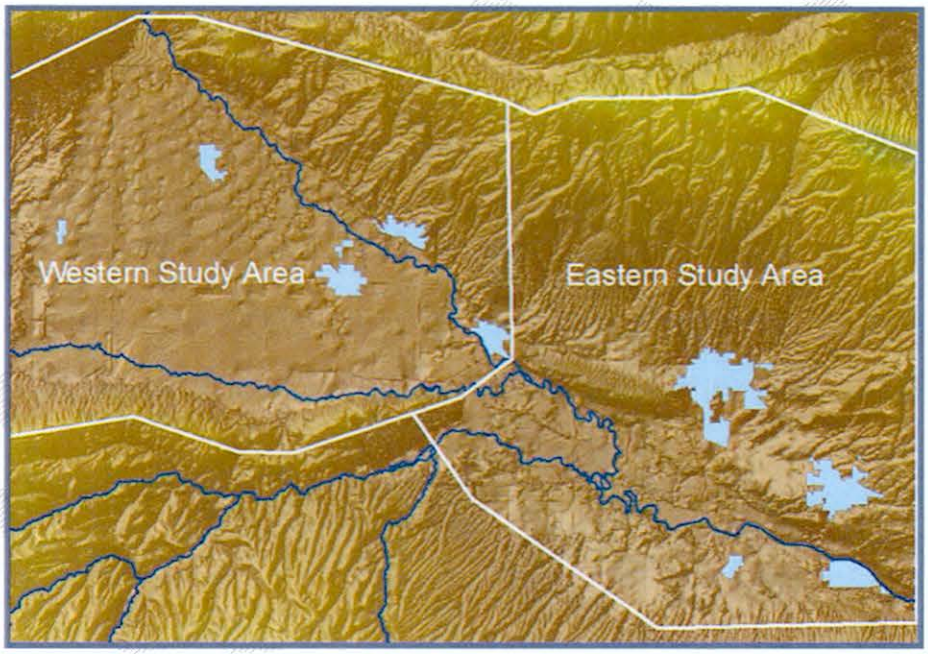


FIGURE 2 - AREAS OF PRELIMINARY ASSESSMENT

The *Preliminary Assessment* had subdivided the area into two portions. These reflected geographic, geological, and geopolitical constraints and corresponded to divisions reflected in the historical water quality data set.[1]

[1] These two subareas roughly mirror the areas designated as upper and lower study areas in the 2002 Valley Institute for Research and Education groundwater study, and correspond to the Toppenish and Benton basins referenced in other studies. Both areas cover approximately 368,600 acres within Yakima County.

The Western Study Area defined by the *Preliminary Assessment* generally consists of lands within and under the jurisdiction of the Yakama Nation.[2] The Yakama Nation elected not to participate in the deliberation of the Lower Yakima Valley Groundwater Advisory Committee, choosing to address nitrate levels independently, under the oversight of the Environmental Protection Agency.

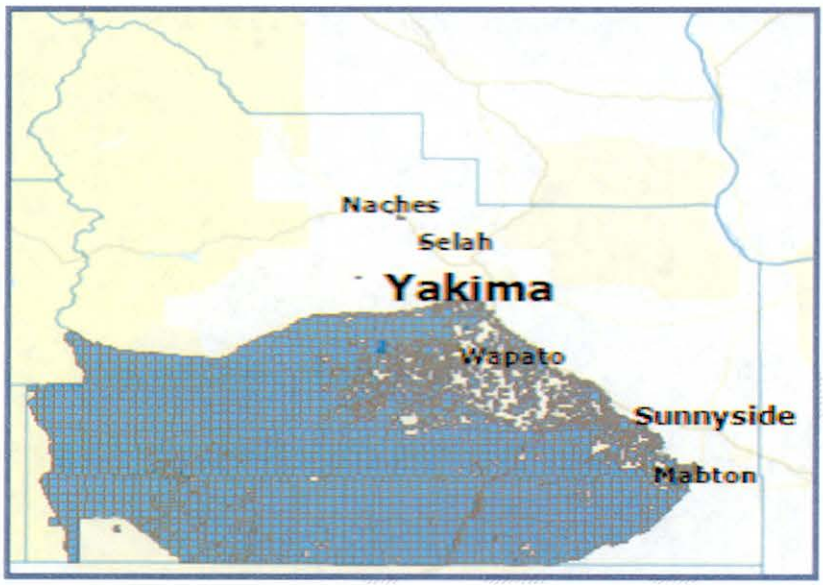


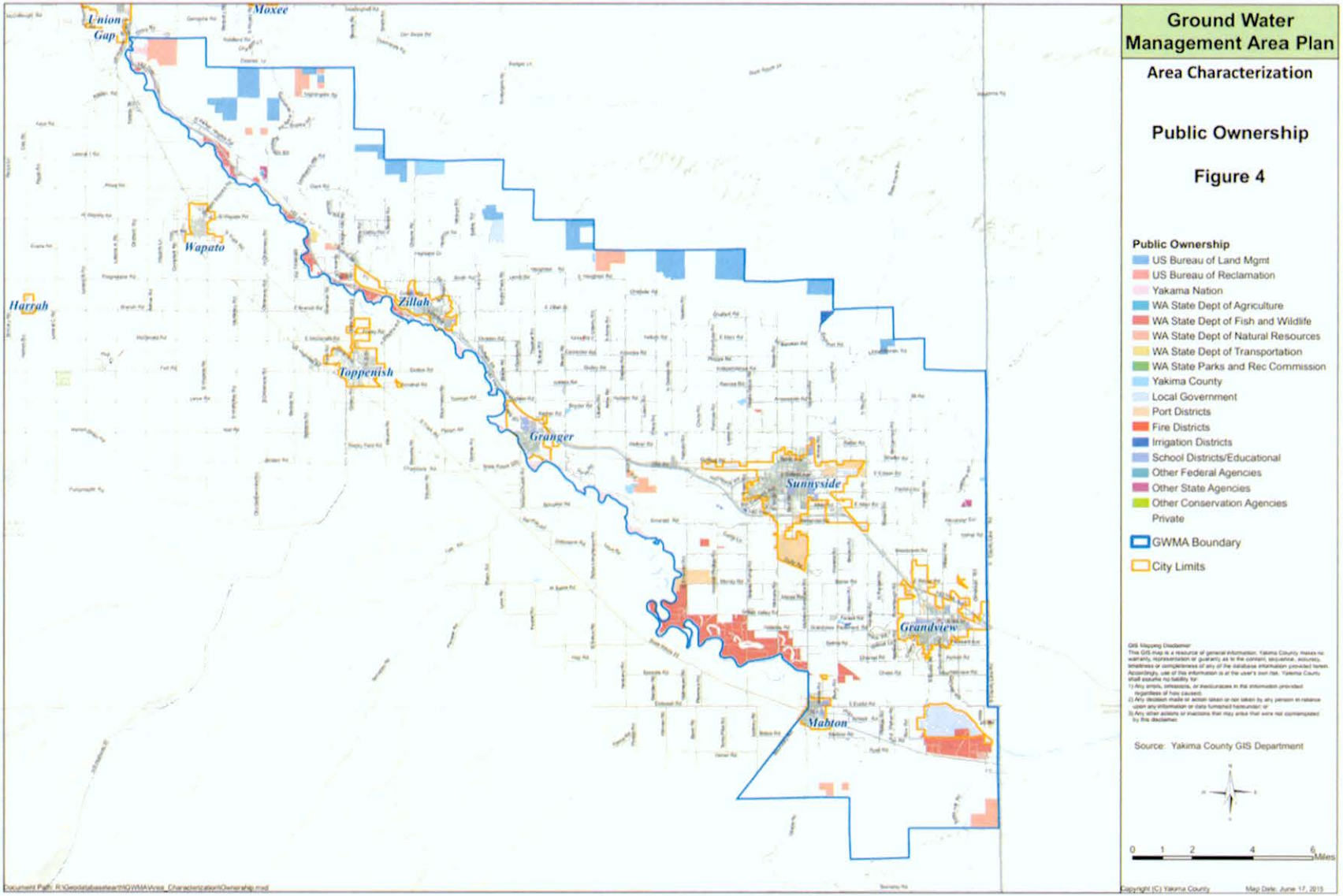
FIGURE 3 - YAKAMA INDIAN RESERVATION

Jurisdictional Boundaries: Federal, State, Local, Tribal

All the land within the GWMA is within the jurisdiction of Yakima County, with the exception of land within the municipalities of Zillah, Granger, Sunnyside, Grandview, and Mabton. While properties owned by the United States exist within the GWMA, they do not present relevant issue areas that relate to the nitrate problem addressed by this Program.

[2] Confederated Tribes and Bands of the Yakama Nation (Yakama Nation). The Yakama Indian Reservation, along the southwest side of the Yakima River and extends beyond Yakima County boundaries into the northern edge of Klickitat County and Southeastern corner of Lewis County. It covers an area of approximately 1.3 million acres. The Yakama Nation has nearly 9,000 enrolled members from 14 bands and tribes.

FIGURE 4 - JURISDICTIONAL BOUNDARIES AND PUBLIC OWNERSHIP



Land and Water Use Management Authorities: Federal, State, Local, Tribal

Land use within the GWMA is subject to the Yakima County Code. Surface and groundwater use within the GWMA is conducted pursuant to individual water rights recognized by the Washington State Department of Ecology (DOE).

Marker: Insert Jim's Text.

Land Use

Pursuant to the Yakima County Code (YCC), most of the land within the GWMA outside of urban growth areas is zoned agricultural. See Figure 5.

Land Use History

Situated on the dry side of the Cascade Mountains, the Lower Yakima Valley GWMA is wedged in between Rattlesnake Hill (too high for much nitrate application), and the Yakima River (the boundary of the Yakama Nation and Confederated Tribes).

We have attempted to use relevant data regarding agricultural production and other matters wherever we can, but since the GWMA is a recent creation, earlier years are often lacking data specific to this area. In some cases, this document relies on countywide figures. The reader should pay specific attention to the geographic area to which the numbers apply.

The landscape was originally a sagebrush desert, but the Northern Pacific Railroad and irrigation canals turned the valley into a major agricultural center. As the Employment Security Department notes on their website, last updated in September 2016:

> Forestry and livestock, dairies and the growing, storage and shipping/processing of deciduous tree fruits (cherry, pears, apples, etc.), are bedrocks of Yakima County's economy.
>
> In terms of jobs provided, agriculture is certainly the "big kid on the block" in Yakima County. The two other local industries in second and third place in terms of employment are health services and local government. Specifically, on an average annual basis in 2015, agricultural employers provided 30,191 jobs, or 27.7 percent of total covered employment countywide.

Yakima is best known for its apples, with the first orchard believed to have been planted between 1860 and 1864 near the recently-built Fort Simcoe.

FIGURE 5 - YAKIMA COUNTY ZONING WITHIN GWMA

Since the 1860s, the Lower Valley's soil and climate has made it an ideal location for cultivating grapes and hops. The first winery was established near Prosser in 1914, favoring dry dinner wines over the sweet dessert wines in fashion at the time.

By the 1940s, new developments in technology enabled the faster picking of hop buds, and the industry grew rapidly. Yakima went from producing 50 percent of the nation's hops in 1963 to 70 percent in 1970, and 75 percent by 2012, the last time their website was updated. The first industrial-scale wine grape plantings began in the 1960s, assisted by research from WSU scientist Walter Clore. As wine became more popular in the 1970s, the acreage devoted to growing grapes expanded. Wineries and craft breweries now dot the landscape, and the region has taken to selling itself as a major wine and beer tasting destination.

The agriculture and service sectors are the leading sources of employment in the Lower Valley, with health care and local government providing many of the higher-paid jobs. Manufacturing is in the top five sources of jobs, although this is primarily tied to agriculture as well. Local organizations have been stepping up efforts in recent years to make tourism a larger part of the economy, advertising the area's numerous craft alcoholic beverages and outdoor recreational opportunities.

Yakima is drought-sensitive. In 2015, the lack of winter precipitation and extreme summer heat led to an estimated $700 million in losses. Many farms received less than half of their allotted water supply from Irrigation Districts.

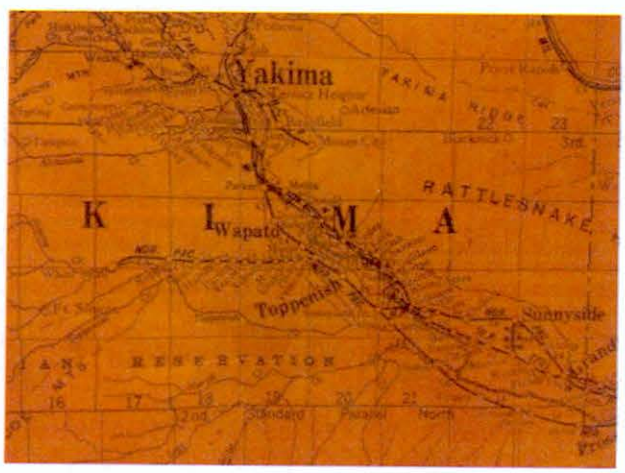
Catholic missionaries arrived in the Yakima River Basin in 1848. They established a mission in 1852 on Atanum (now Ahtanum) Creek, using irrigation on a small scale. Miners and cattlemen immigrated to the basin in the 1850s and 1860s. With increasing settlement in the mid-1860s, irrigation of the valley bottoms began. Outlying areas were used extensively for raising stock. Private companies delivered water through canal systems built between 1880 and 1904 for the irrigation of large areas. The first claims for irrigation water rights were recorded in the 1880s. The Northern Pacific Railway was constructed through the Yakima Valley, reaching Yakima in December 1884 and Seattle in 1896, facilitating the development of irrigated agriculture through transport of agricultural goods to markets. Statehood in 1889 assisted Lower Yakima Valley agricultural growth, with Yakima contending for state capital. By 1902, about 120,000 acres were under irrigation, mostly by surface-water.

The Yakima Valley Museum maintains a collection of photographs which indicate significant production of hops in the early period, primarily in the Moxee and North Yakima area.[3]

In the Lower Valley, and particularly near Mabton, early agriculture primarily involved the production of hay. New orchards were planted in the Sunnyside area by 1908. Grapes had been planted by this time as well. Field crops, such as potatoes, onions, and corn watered by flood or rill irrigation, were successful crops by the early 1920s. Tree fruits had become successful export products by the 1930s.

The Federal Reclamation Act of 1902 and Washington's Yakima Federal Reclamation Project of 1905 authorized construction of water delivery facilities to irrigate about 500,000 acres of Lower Yakima Valley agriculture. Six dams and five reservoirs were constructed as part of the Yakima Project.

These Federal reservoirs provide storage to help meet water requirements of the major irrigation districts and companies during the period of the year, called "storage control," when the natural streamflow from unregulated streams can no longer meet demands. The National Map Company's 1930 map entitled *Latest Official Survey of Washington*, now located within the Presby Museum in Goldendale, Washington, shows the route of two railroads running through the GWMA area, with which to ship agricultural goods to market. The



[3] http://yakimamemory.org/

density of the railroads' depots indicates the abundance of agricultural commodity available to be sent to market. The Union Pacific route stopped at Grandview, Forsell, Waneta, Midvale, Morris, Emerald, Bain, Noride, Granger, Blaine Acres, Dalton, Boone, Pam, Zillah, Buena, Flint, Sawyer, Dunbro, and Parker en route to Union Gap and Yakima. The Northern Pacific route stopped at Grandview, Lichty, Sunnyside, Outlook, Nass, Sinto, Granger, Boone, Gilliland, Chenauer, Zillah, Keck, Cutler, Buena, Sawyer, Donald, Mellis, and Parker en route to Union Gap and Yakima.

Crops

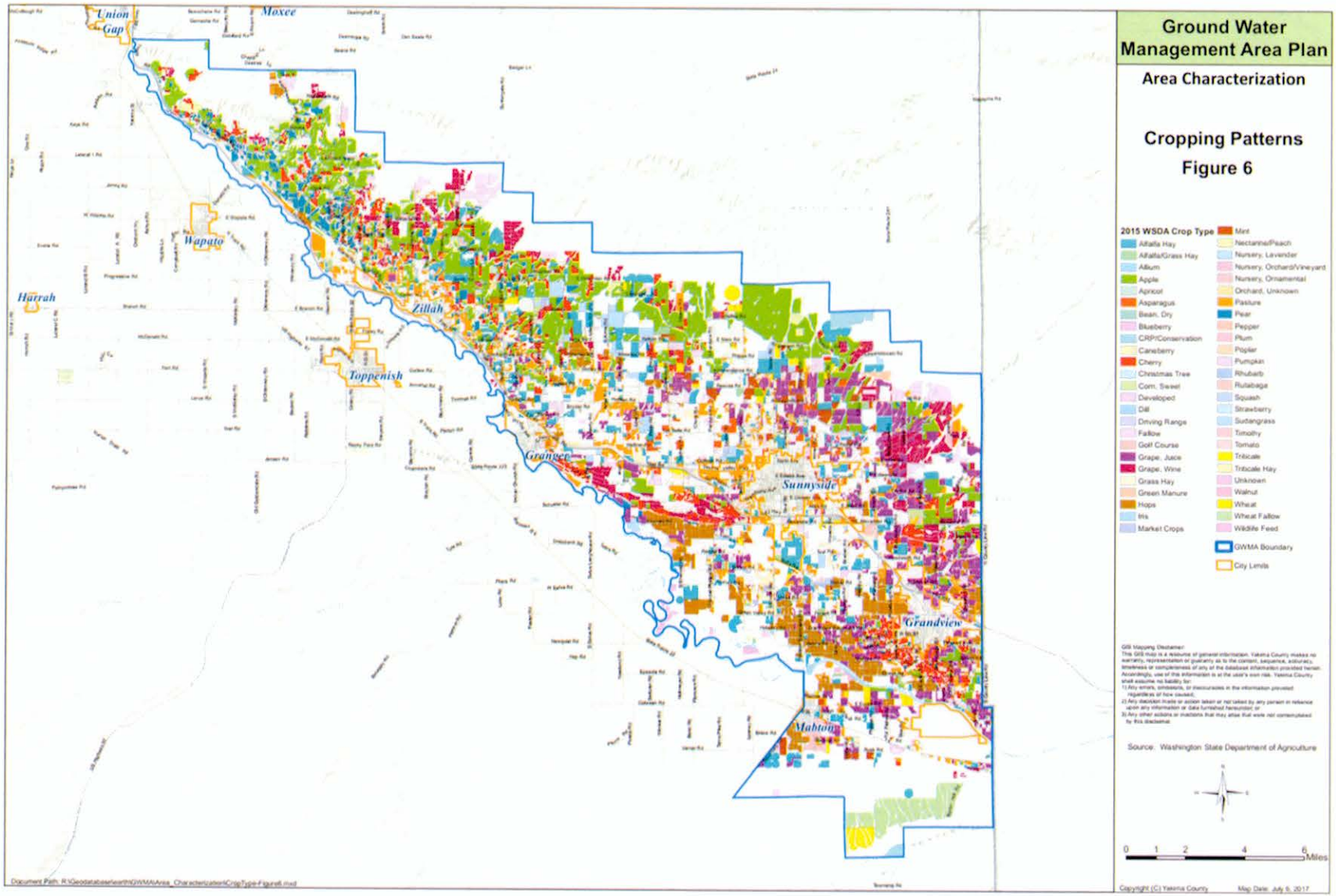
The major commodities produced in the GWMA are apples, milk, and hay. The lower valley agricultural landscape includes more than 50 active dairy farms and approximately 100,000 acres of irrigated farmland (WSDA 2016). See Figure 19, next page.

In 2015, the crops constituting one percent or more of the acreage within the GWMA were:

Top 20 Crop Types	Acres	% of Total Acres
Apple	17,351	18%
Corn, Silage	16,826	17%
Grape, Juice	10,269	11%
Alfalfa Hay	7,977	8%
Pasture	6,702	7%
Cherry	6,361	7%
Hops	5,992	6%
Grape, Wine	5,129	5%
Fallow	4,791	5%
Pear	3,335	3%
Wheat Fallow	1,761	2%
Sudangrass	1,623	2%
Mint	1,414	1%
Wheat	1,283	1%
Corn, Grain	1,148	1%
Grass Hay	1,133	1%
Developed	1,019	1%
Asparagus	853	1%
Nectarine/Peach	843	1%
Alfalfa/Grass Hay	648	1%
Total Acreage	96,459	

The acreage totals do not account for multiple cropping of any particular acreage in a single year. In 2015, triticale, which is most often double-cropped with corn, took up 10,780 acres, according to WSDA figures.

FIGURE 12– LOCATION OF CROPS GROWN WITHIN THE GWMA (2015)



Irrigation Water Supply

The Lower Yakima Valley, south of Union Gap, is semi-arid with a mean annual precipitation of 6.8 inches. Precipitation and snowpack in the Cascade Mountains provide the source water and natural storage capacity for the Yakima River and the primary irrigation supply. Diversions from the river are equivalent to about 60 percent of its mean annual flow.[4] Five major reservoirs in the Cascade Mountains, with the total capacity of 1,065,400 acre-feet (ac-ft), store 40 percent of the April to October water users' entitlements (2,490,755 ac-ft).[5]

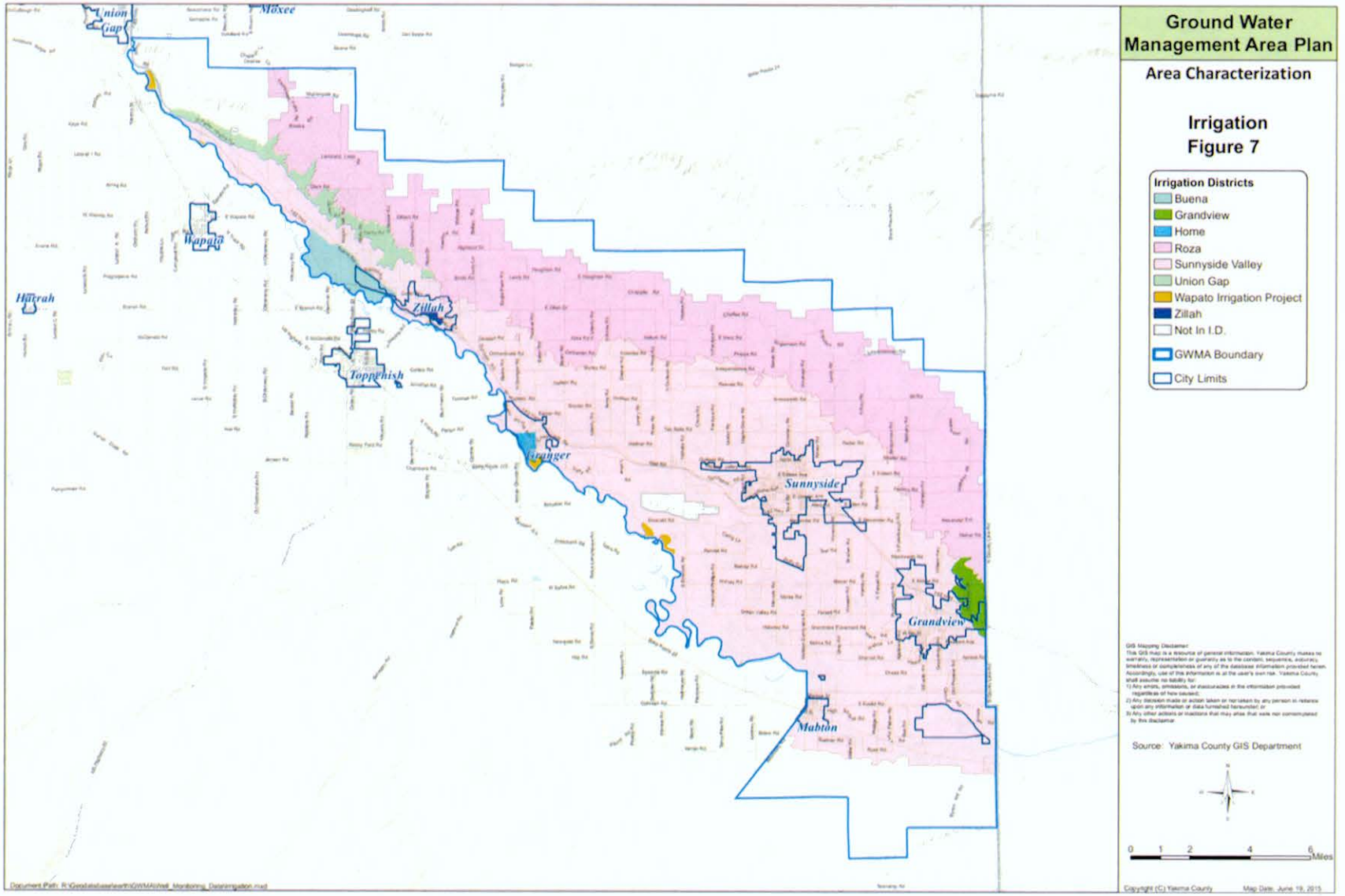
Irrigation water can also be drawn from wells. Under the Washington State Ground Water Code (RCW 90.44.050), prospective water users must obtain authorization in the form of a water right permit or certificate from DOE before withdrawing groundwater, although an exemption is allowed for industrial purposes, including irrigation, limited to 5,000 gallons per-day, but no acre limit. (Exemptions exist for other purposes as well.) Very little groundwater is used for irrigation with the exception of a drought year when use of emergency drought wells is permitted. The exact percentage of irrigation water that comes from underground wells is not known. According to communications between DOE and USGS in 2001, there were water rights for irrigation of about 129,570 acres in existence at that time (USGS 2011).

The three largest irrigation providers in the Lower Yakima Valley are the Wapato Irrigation Project, Sunnyside Division operated by the Sunnyside Valley Irrigation District (SVID), and the Roza Irrigation District (RID). [See Figure 7, next page.] Wapato Irrigation Project serves irrigators within the Yakama Indian Reservation and is managed by the U.S. Bureau of Indian Affairs on behalf of the U.S. Bureau of Reclamation. SVID serves 99,244 acres on the valley floor and lower slopes. The RID serves 72,500 acres at higher elevations on the north slopes of the valley. Diverse crops are grown in both of the latter districts but, generally, forage crops dominate the SVID and tree fruits dominate

[4] The mean annual run-off of the Yakima River varies greatly; for example, 1.3 million ac-ft in 1977, the lowest water-year on record, and 4.4 million ac-ft in the abundant water year of 1999. The mean annual irrigation diversion from 1961 to 1990 was 2.2 million ac-ft. Mean annual streamflow from 1961 to 1985 was 2.6 million ac-ft at Kiona.

[5] Bumping Dam (1910, Kachess Dam (1912), Clear Creek Dam (1914), Keechelus Dam (1917), Tieton Dam (Rimrock Lake) (1925), Cle Elum Dam (1933). About 78 percent of storage capacity is in the upper arm of the Yakima River and 22 percent is in the Naches River arm.

FIGURE 7 – YAKIMA COUNTY IRRIGATION DISTRICTS WITHIN GWMA



the RID. SVID diverts its water near Parker into a 60-mile canal. RID diverts its water from the Yakima River upstream of the City of Selah into a 94.8-mile canal. Both canals end, returning tail water to the Yakima River, near Benton City. From the canals, water is delivered through 709 miles of laterals to over 5,300 individual deliveries. Diversions usually begin in March to prime the canal system and cease in mid-October. On-farm deliveries typically begin in early April (Joint Board 2009).

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General Land Description

The Yakima River Basin

The Yakima River Basin is located in south-central Washington and includes three Washington State Water Resource Inventory Areas (WRIA—numbers 37, 38, and 39), part of the Yakama Nation lands, and three eco-regions (Cascades, Eastern Cascades, and Columbia Basin), and touches parts of four counties: Klickitat, Kittitas, Yakima, and Benton (USGS 2006). Almost all of Yakima County and more than 80 percent of Kittitas County lie within the basin. About 50 percent of Benton County is in the basin. Less than one percent of the basin lies in Klickitat County, principally in an unpopulated upland area. Within Yakima Basin are six structural sedimentary basins. The delineated basins are from north to south, the Roslyn, Kittitas, Selah-Wenas, Yakima (Ahtanum-Moxee), Toppenish, and Benton Basins. All are clearly defined by the geologic structure in the Yakima River Basin.

The Toppenish Basin is fully contained within Yakima County and encompasses an area of about 440 square miles. It is bordered on the north by the Ahtanum Ridge, on the south by the Toppenish Ridge, and bisected by the Wapato Syncline. The eastern boundary of this basin abuts the Benton Basin. Only the southeastern corner of the basin is included in the GWMA boundaries.

The Benton Basin is the largest encompassing an area of 1,020 square miles. The western boundary abuts the eastern boundary of the Toppenish Basin and a small section of the Yakima Basin. The southern boundary is bordered by the Horse Heaven Hills structure and the northeastern boundary generally follows the northern flank of the Cold Creek Syncline. The basin is dissected with numerous faults and folds surrounding the Rattlesnake Hills structure in the eastern part of the basin. The western part of the basin is dissected by the Wapato Syncline and several unnamed folds that lie within the broad flat plain that encompasses the Yakima River floodplain. Only the Western portion of the basin, approximately a third, is in the GWMA boundaries.

Topography

The topographical surface of the groundwater management area is undulating hillside running down (from an elevation of approximately 400 feet above sea level) to the valley floor and river floodplain (at an elevation of approximately 230 feet above sea level). The topographical map on the next page illustrates essentially parallel elevation contours—evidence of a gradual descent from north-northeast along the Rattlesnake Ridge to south-southwest along the Yakima River.

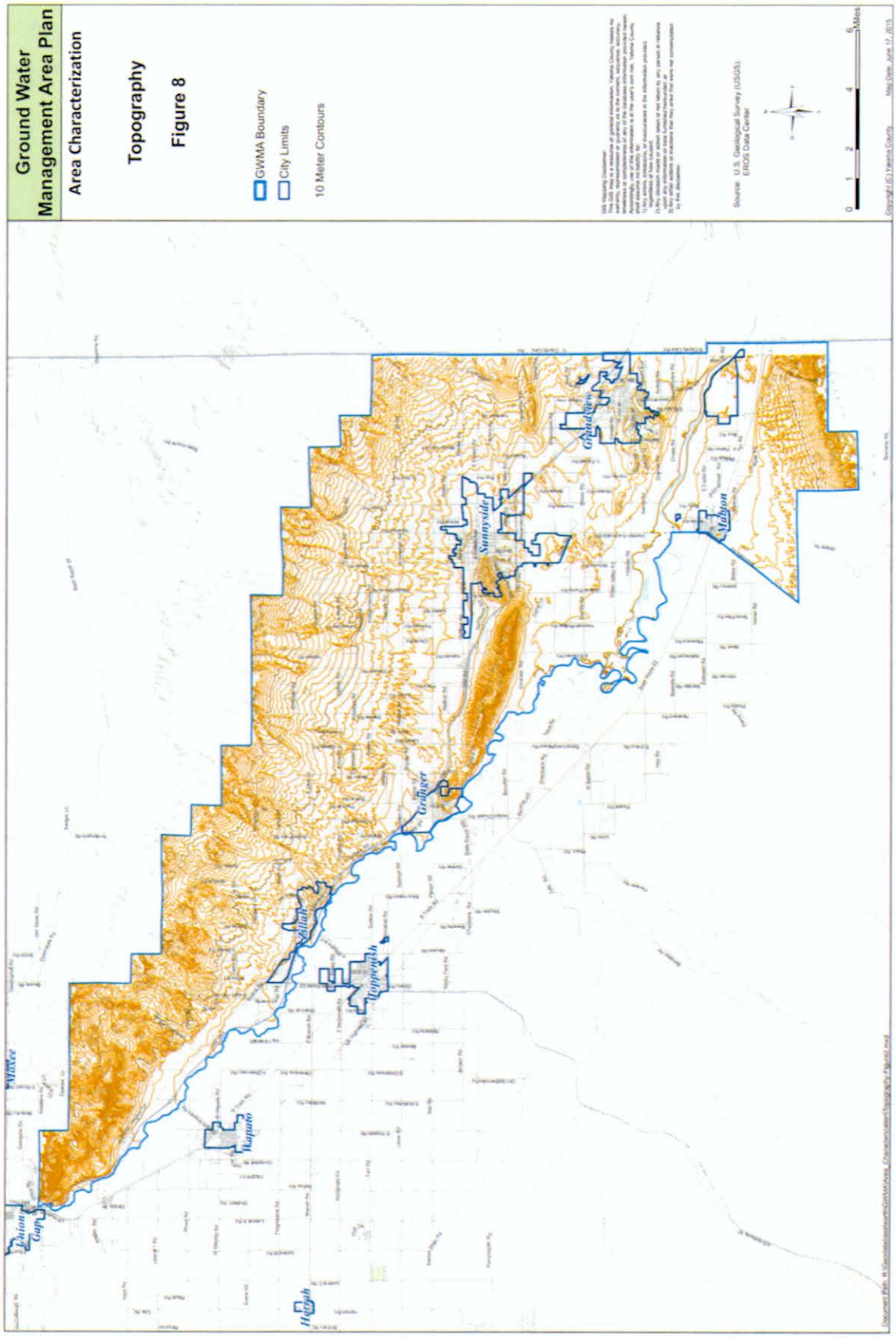
Soil Types

There are 89 soil types within the GWMA. They differ based on values of porosity, specific yield and hydraulic conductivity. For ease of consideration, they may be classified into several simple classes. For example, two relevant soil units within the GWMA (Burke and Scoon) have a saturated hydraulic conductivity less than 0.12 feet per day which is characterized as "very low to moderately low." Another soil unit (Finlay) has a saturated hydraulic conductivity of 4 to 11.9 feet per day, which is characterized as "high." (Erickson 2013)

The 89 soil types can be simplified by sorting them into groups with similar infiltration rates.

Simplified Soil Infiltration Rate Categories	
Soil Textural Classification Description	gallons/ft2/day
Coarse sands (includes the ASTM C-33 sand)	1.2
Medium Sands	1
Fine sands, Loamy coarse sands, Loamy medium sands	0.8
Very fine sands, Loamy fine sand, Loamy very fine sands, Sandy loams, Loams	0.6
Silt loams that are porous and have well developed structure	0.45
Other silt loams, Sandy clay loams, Clay loams, Silty clay loams	0.2

FIGURE 13 - TOPOGRAPHY



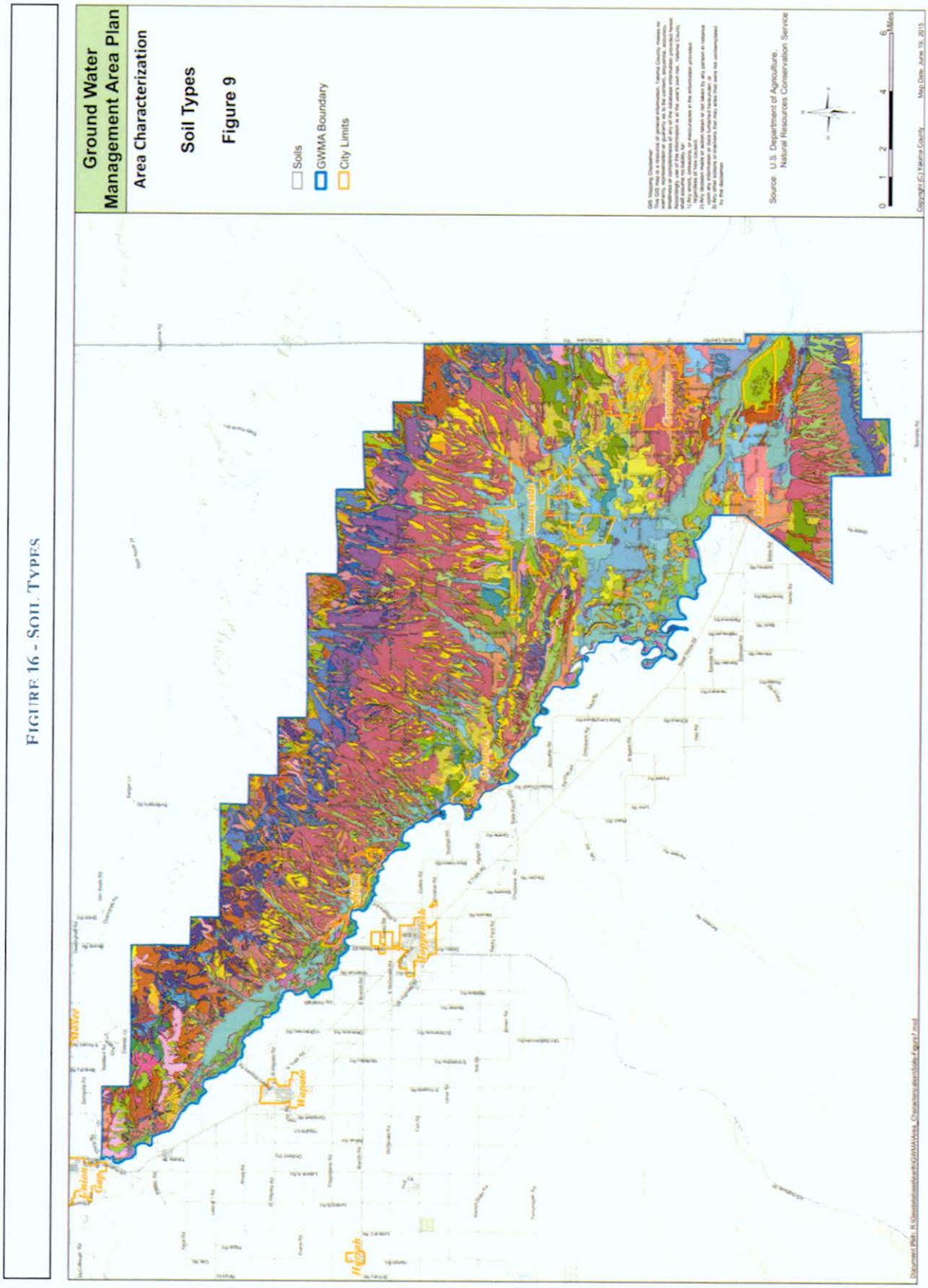


FIGURE 16 - SOIL TYPES

Soils

- Bakeoven very cobbly silt loam, 0 to 30 percent slopes
- Burke silt loam, 2 to 5 percent slopes
- Burke silt loam, 5 to 8 percent slopes
- Burke silt loam, 8 to 15 percent slopes
- Cleman very fine sandy loam, 0 to 2 percent slopes
- Cleman very fine sandy loam, 2 to 5 percent slopes
- Dam
- Esquatzel silt loam, 0 to 2 percent slopes
- Esquatzel silt loam, 2 to 5 percent slopes
- Fiander silt loam
- Finley cobbly fine sandy loam, 0 to 5 percent slopes
- Finley silt loam, 0 to 2 percent slopes
- Finley silt loam, 2 to 5 percent slopes
- Finley silt loam, 5 to 8 percent slopes
- Finley silt loam, 8 to 15 percent slopes
- Gorst loam, 2 to 15 percent slopes
- Harwood-Burke-Wiehl silt loams, 15 to 30 percent slopes
- Harwood-Burke-Wiehl silt loams, 2 to 5 percent slopes
- Harwood-Burke-Wiehl silt loams, 30 to 60 percent slopes
- Harwood-Burke-Wiehl silt loams, 5 to 8 percent slopes
- Harwood-Burke-Wiehl silt loams, 8 to 15 percent slopes
- Harwood-Burke-Wiehl very stony silt loams, 15 to 30 percent slopes
- Hezel loamy fine sand, 0 to 2 percent slopes
- Hezel loamy fine sand, 2 to 15 percent slopes
- Kiona stony silt loam, 15 to 45 percent slopes
- Kittitas silt loam
- Lickskillet very stony silt loam, 5 to 45 percent slopes
- Logy silt loam, 0 to 2 percent slopes
- McDaniel-Rock Creek complex, 5 to 30 percent slopes
- Mikkalo silt loam, 0 to 5 percent slopes
- Mikkalo silt loam, 15 to 30 percent slopes
- Mikkalo silt loam, 5 to 15 percent slopes
- Moxee cobbly silt loam, 0 to 30 percent slopes
- Moxee silt loam, 15 to 30 percent slopes
- Moxee silt loam, 2 to 15 percent slopes
- Outlook fine sandy loam
- Outlook silt loam
- Pits
- Prosser silt loam, 0 to 15 percent slopes
- Quincy loamy fine sand, 0 to 10 percent slopes
- Ritzville silt loam, 15 to 30 percent slopes
- Ritzville silt loam, 2 to 5 percent slopes
- Ritzville silt loam, 30 to 60 percent slopes
- Ritzville silt loam, 5 to 8 percent slopes
- Ritzville silt loam, 8 to 15 percent slopes
- Ritzville silt loam, basalt substratum, 15 to 30 percent slopes
- Ritzville silt loam, basalt substratum, 5 to 15 percent slopes
- Scoon silt loam, 15 to 30 percent slopes
- Scoon silt loam, 2 to 5 percent slopes
- Scoon silt loam, 5 to 8 percent slopes
- Scoon silt loam, 8 to 15 percent slopes
- Scooteney cobbly silt loam, 0 to 5 percent slopes
- Scooteney silt loam, 0 to 2 percent slopes
- Scooteney silt loam, 2 to 5 percent slopes
- Scooteney silt loam, 5 to 15 percent slopes
- Shano silt loam, 15 to 30 percent slopes
- Shano silt loam, 2 to 5 percent slopes
- Shano silt loam, 5 to 8 percent slopes
- Shano silt loam, 8 to 15 percent slopes
- Sinloc fine sandy loam, 0 to 2 percent slopes
- Sinloc silt loam, 0 to 2 percent slopes
- Sinloc silt loam, 2 to 5 percent slopes
- Sinloc silt loam, 5 to 8 percent slopes
- Starbuck silt loam, 2 to 15 percent slopes
- Starbuck-Rock outcrop complex, 0 to 45 percent slopes
- Starbuck-Rock outcrop complex, 45 to 60 percent slopes
- Umapine silt loam, drained, 0 to 2 percent slopes
- Umapine silt loam, drained, 2 to 5 percent slopes
- Wanser loamy fine sand
- Warden fine sandy loam, 0 to 2 percent slopes
- Warden fine sandy loam, 2 to 5 percent slopes
- Warden fine sandy loam, 5 to 8 percent slopes
- Warden fine sandy loam, 8 to 15 percent slopes
- Warden silt loam, 0 to 2 percent slopes
- Warden silt loam, 15 to 30 percent slopes
- Warden silt loam, 2 to 5 percent slopes
- Warden silt loam, 5 to 8 percent slopes
- Warden silt loam, 8 to 15 percent slopes
- Water
- Weirman fine sandy loam
- Weirman gravelly fine sandy loam
- Weirman sandy loam, channeled
- Willis fine sandy loam, 2 to 5 percent slopes
- Willis silt loam, 2 to 5 percent slopes
- Willis silt loam, 8 to 15 percent slopes
- Yakima silt loam
- Zillah sandy loam
- Zillah silt loam
- Zillah silt loam, channeled

Geology

Relying on the USGS publication "Hydrogeologic Framework of the Yakima River Basin Aquifer System, Washington," (USGS 2009) the Environmental Protection Agency described the geology of the relevant area in its 2012 study (EPA 2012):

> 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.

Aquifers and aquitards

In 2009, the United States Geological Survey published its study of the geology, hydrology and hydrogeology of aquifers in the Yakima River Basin. The study found that there are two main aquifer types in the GWMA. The first is a surficial unconfined to semi-confined alluvial aquifer. This aquifer is composed of highly layered alluvial material with predominantly silt, sand and cobbles and, according to USGS, has a total thickness of up to 500 feet.

The second aquifer is an extensive basalt aquifer of great thickness underlying the surficial aquifer described above. The basalt aquifer is believed by the USGS to be semi-isolated from the surficial aquifer and stream systems. Natural groundwater flow within the shallower, surficial aquifer generally follows topography, but may be locally influenced by irrigation practices, ponds, lagoons, drains, ditches, and canals. Groundwater in this shallower aquifer generally flows to the south, down the valley, and is used locally for residential water supply and eventually feeds the Yakima River.

FIGURE 10 – GEOLOGY

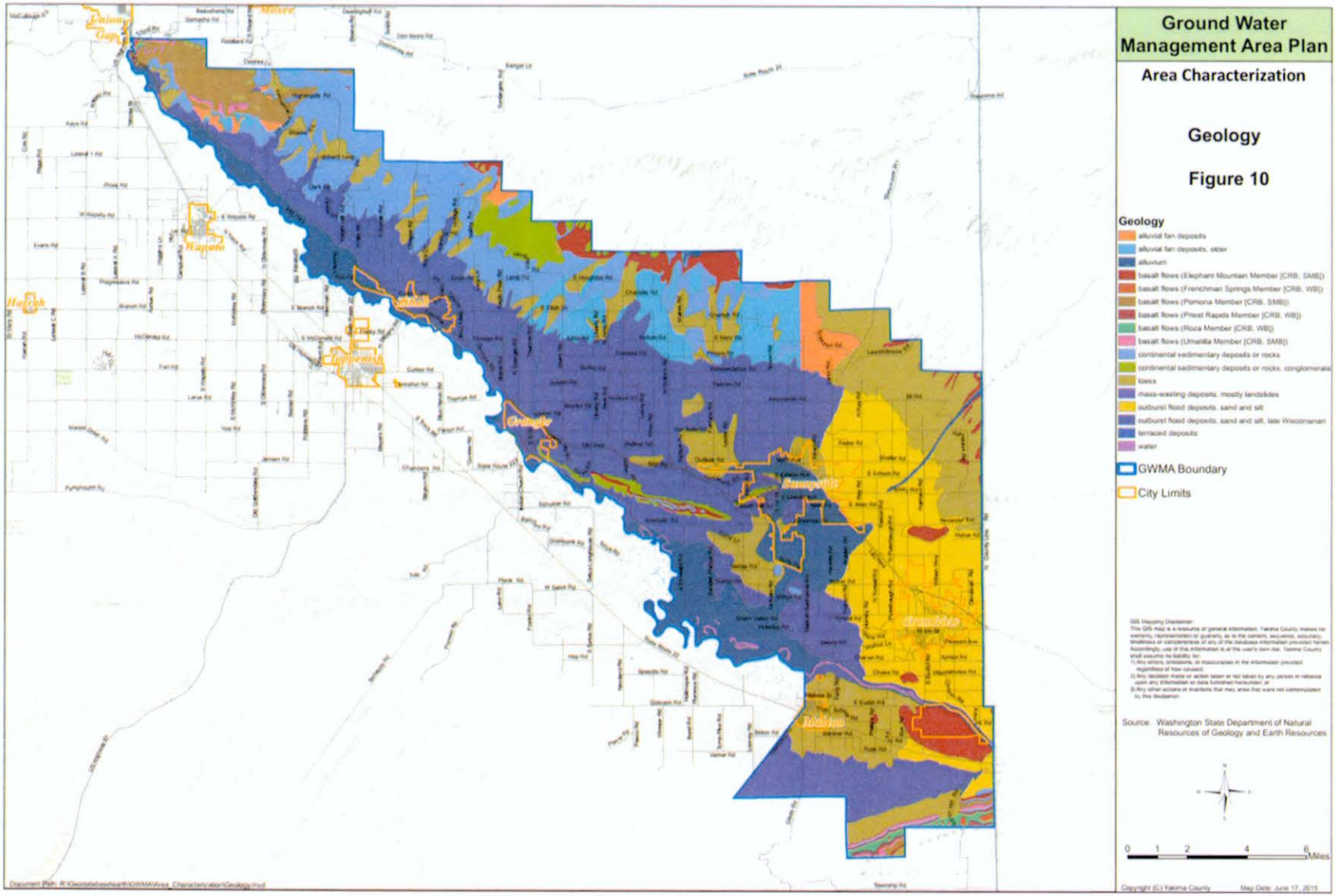
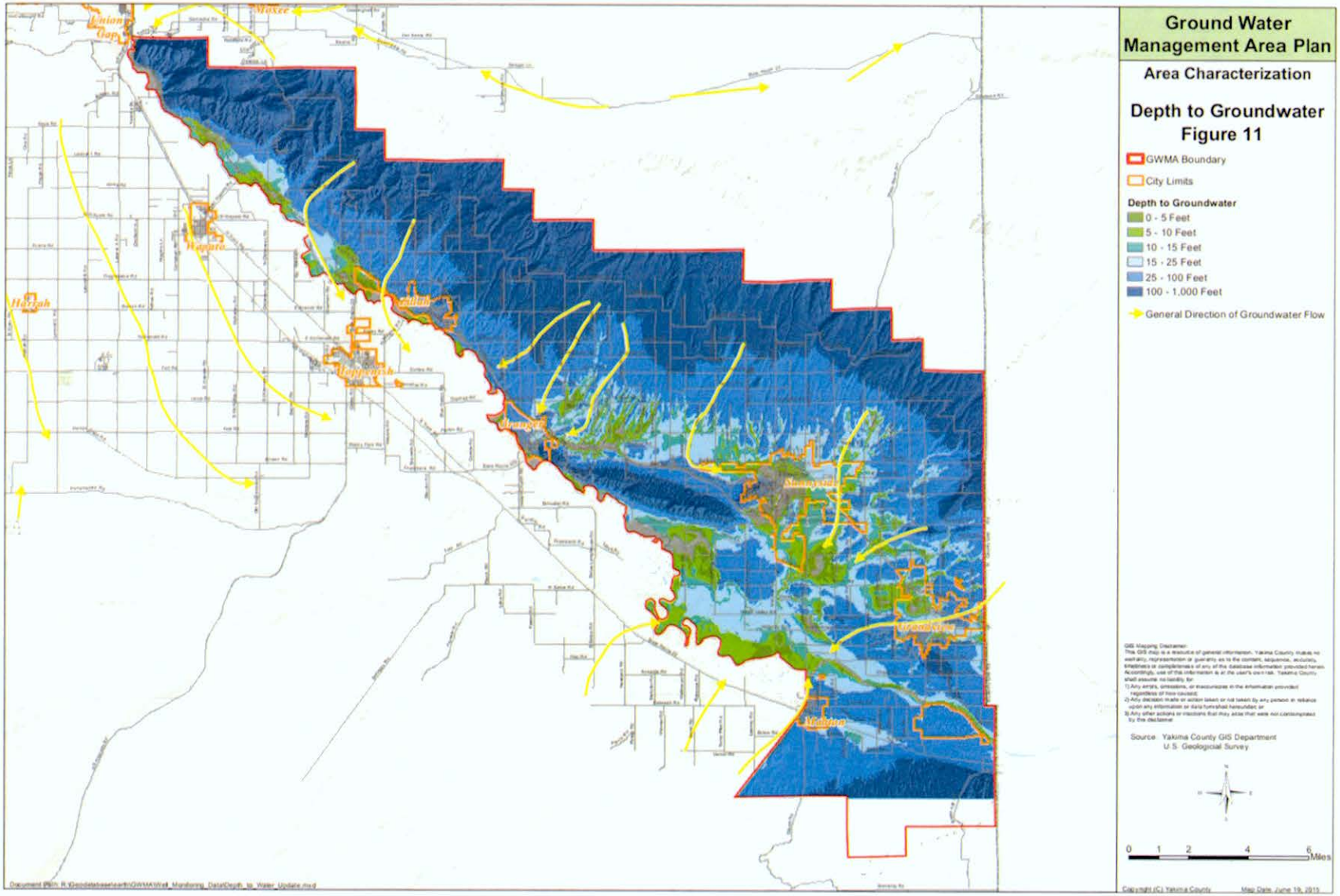


FIGURE 11 - DEPTH TO GROUNDWATER



The USGS study presented its collected data graphically, mapping the hydrogeologic setting for the entire Yakima River Basin, presenting first the Bedrock and Top Basalt Group Units:

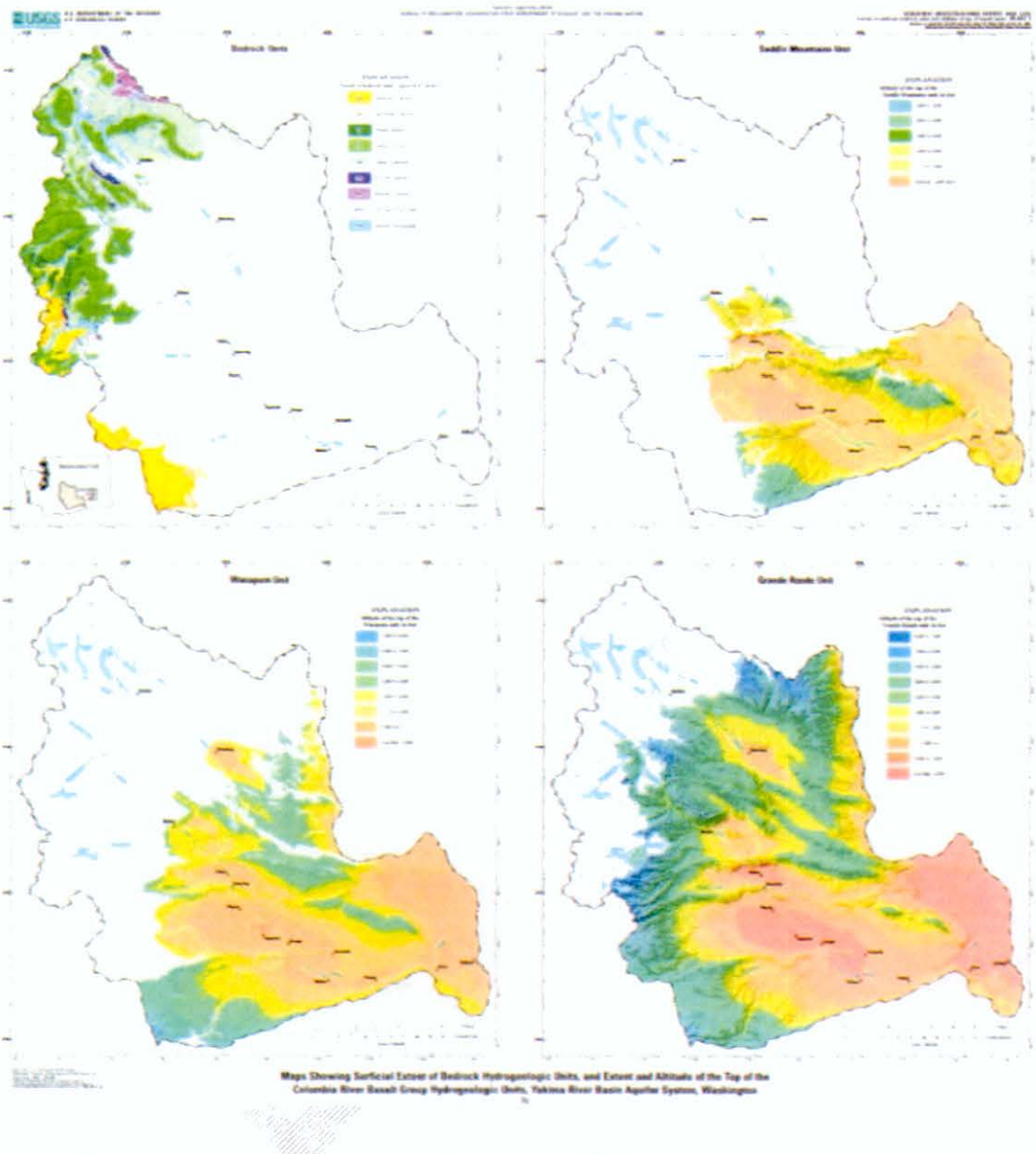


FIGURE 12 – USGS MAPS SHOWING SURFICIAL EXTENT OF BEDROCK HYDROGEOLOGIC UNITS OF YAKIMA BASIN AND EXTENT AND ALTITUDE OF THE TOP OF THE COLUMBIA RIVER BASALT GROUP HYDROGEOLOGIC UNITS (FOR EASY VIEWING, GO TO HTTPS://PUBS.USGS.GOV/SIR/2009/5152/PDF/SIR20095152_PLATE02.PDF)

The USGS Study then demonstrated Deep Geologic Water Elevations:

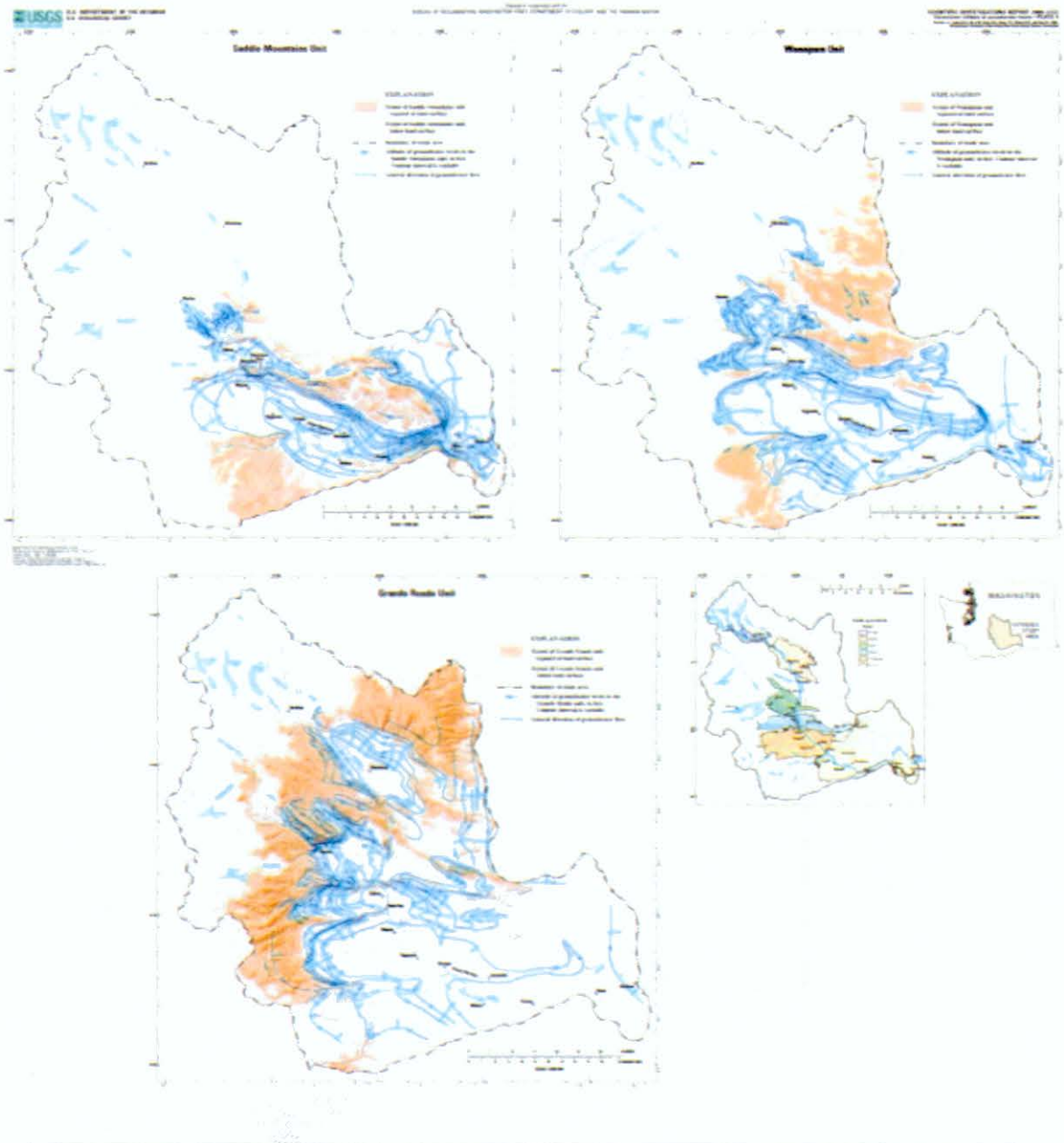


FIGURE 13 – USGS MAPS CHARACTERIZING SADDLE MOUNTAIN, WANAPUM AND GRAND RONDE UNITS OF YAKIMA BASIN (FOR EASY VIEWING, GO TO HTTPS://PUBS.USGS.GOV/SIR/2009/5152/PDF/SIR20095152_PLATE04.PDF)

The USGS study mapped the Surficial Hydrogeologic Units within the Yakima Basin:

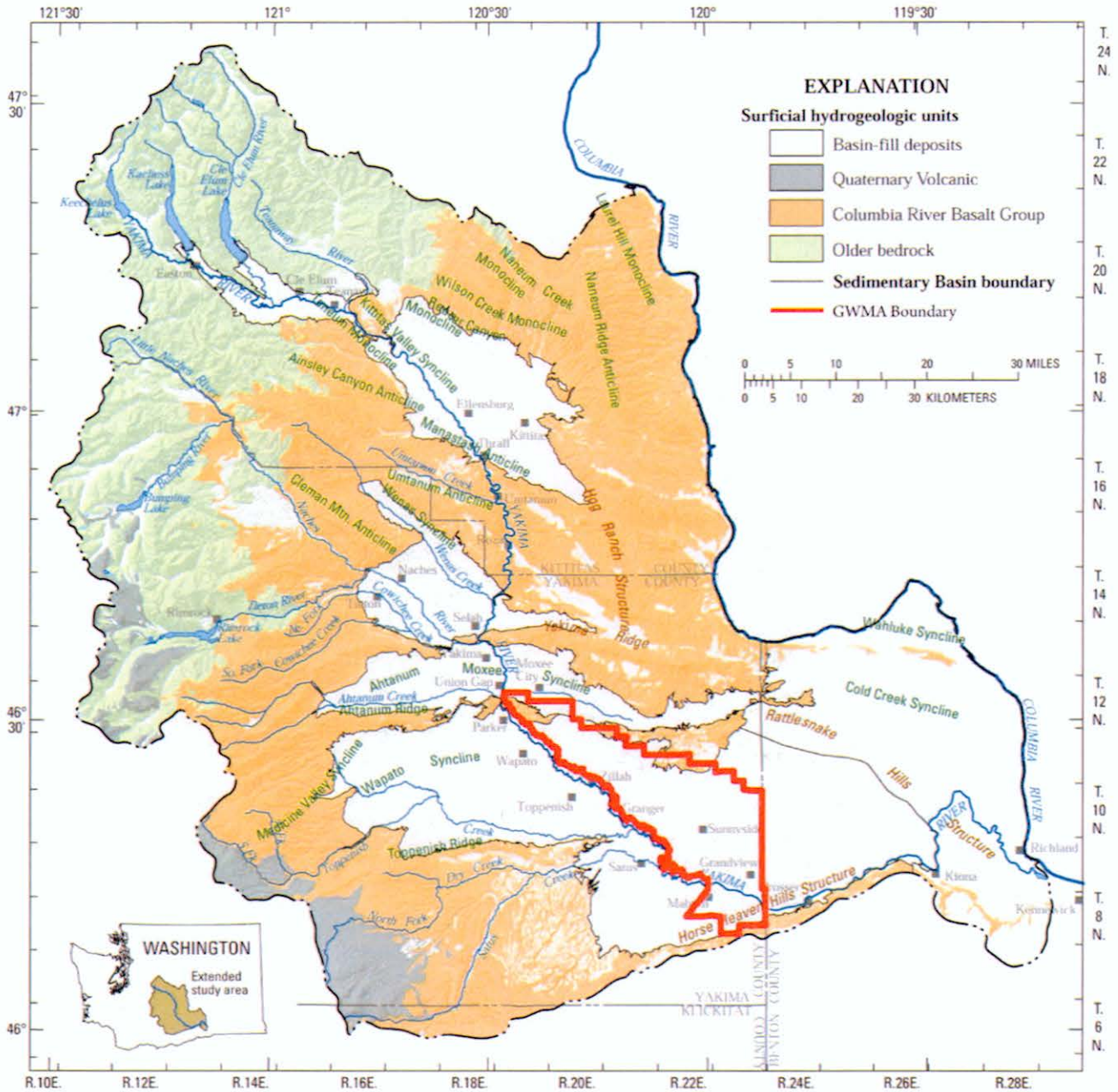


FIGURE 14 – USGS MAP SHOWING YAKIMA BASIN SURFICIAL HYDROGEOLOGIC UNITS

And the location of springs:

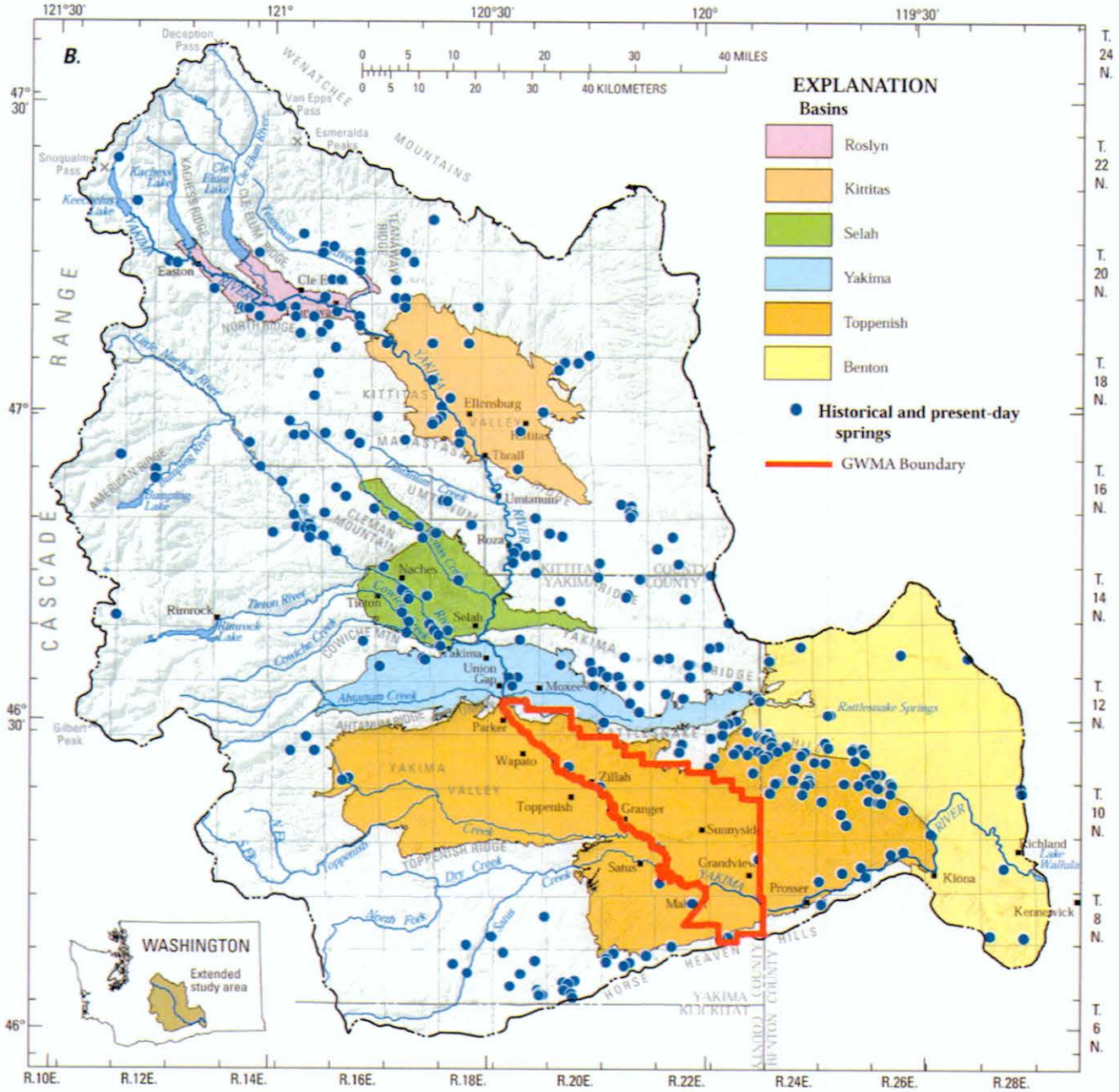


FIGURE 15 – USGS MAP SHOWING LOCATION OF SPRINGS IN YAKIMA BASIN

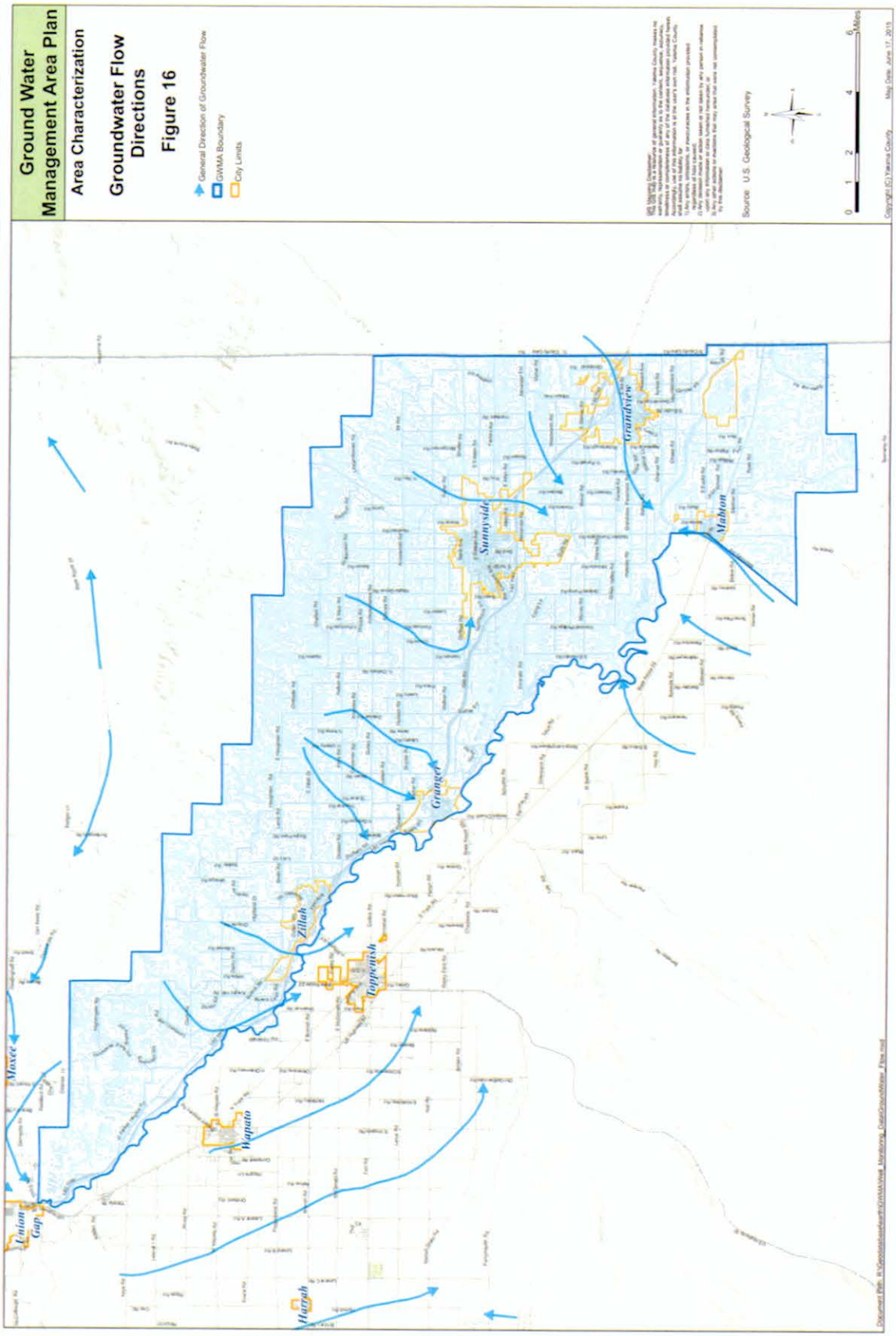
Relying on the USGS study, the Environmental Protection Agency described the hydrology of the GWMA area in its 2012 study (EPA 2012):

> 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...
>
> However, since the basalts extend to great depths, those deeper basaltic layers may convey waters across local flow divides to more regionally significant discharge locations such as the Columbia River. This pattern produces a major flow direction from northwest to southeast as water moves down the valley parallel to the course of the Yakima River. Other, more localized directions of flow, typically at shallower depths in the uppermost sediments, tend to flow toward the Yakima River. Locally, the flow direction may be modified by geologic structures and by irrigation practices, drains, ditches, canals, and other hydrologic features.
>
> 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.

The hydrology of the Lower Yakima Valley was also described in testimony presented to the U.S. District Court for Eastern Washington in 2013:

> The Lower Yakima Valley is filled with sediments eroded from nearby highlands, such as the Rattlesnake Hills, and those deposited in the valley bottom by the Yakima River. The alluvial sediments were deposited by area rivers and streams and provide a preferential flowpath horizontally along the depositional direction (*i.e.*, the permeability down the valley (Kx) is greater than the longitudinal permeability across the valley (Ky) and up to 100 times greater than the vertical permeability (Kz), which is typical of most alluvial systems). This typically results in flow in perched aquifers, especially near lagoons and irrigation ditches, where water is introduced at the surface, infiltrates until reaching a less permeable layer, and flows horizontally until a conduit is found to allow the fluid to migrate vertically. Water wells drilled in this depositional environment can penetrate the perched layer and provide a conduit for contaminant migration into the water table aquifer. As a result, a well that is located along a preferential flow path may capture a substantial portion of its water from a particular surface source, whereas a neighboring well located along a different flow path may exhibit entirely different contaminant characteristics (Erickson 2013).

FIGURE 16 – GROUNDWATER FLOW DIRECTIONS



The USGS study mapped the depth of all known water wells within the Yakima Basin, as well as the depth of flowing water wells in the Basin:

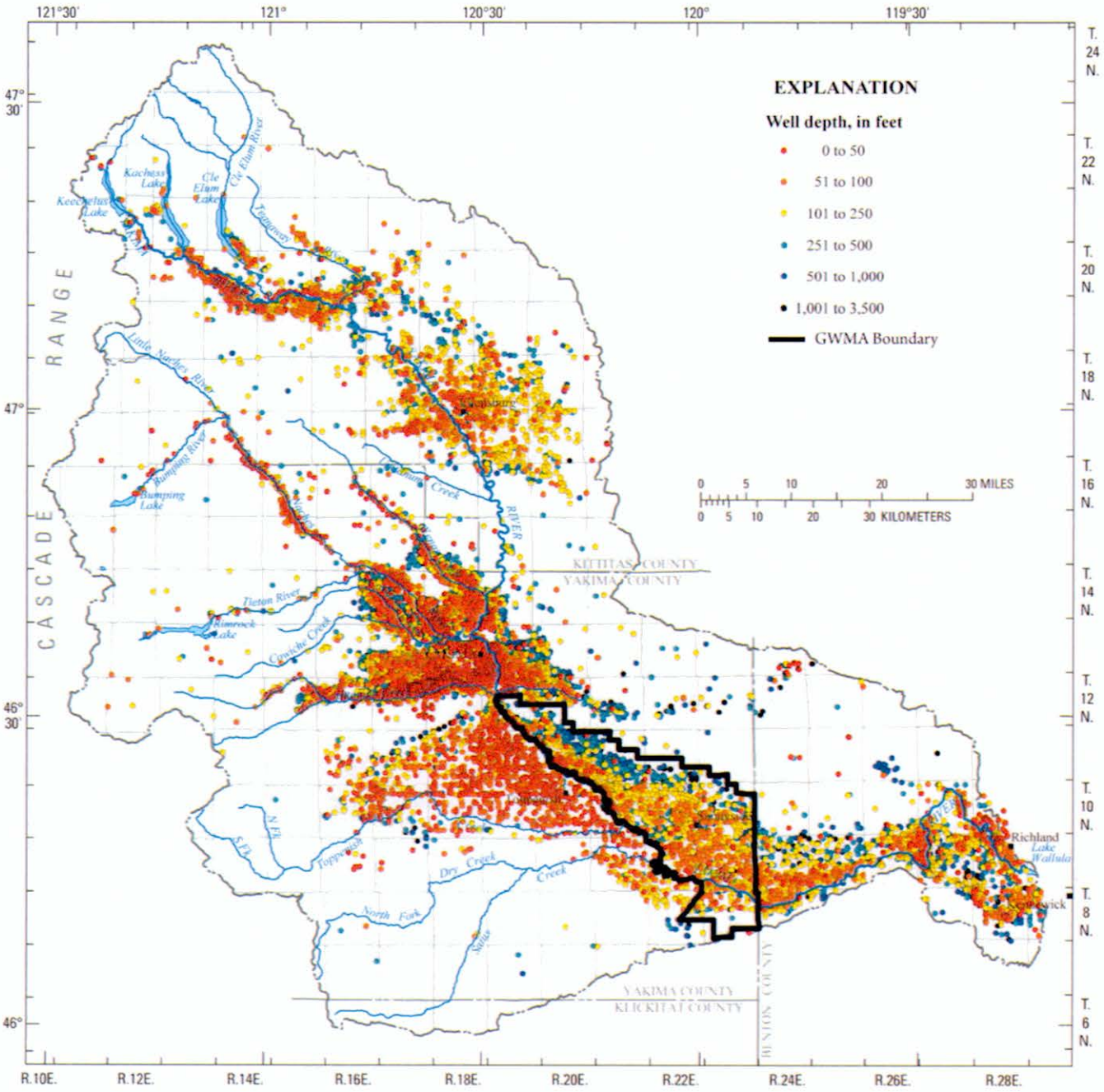


FIGURE 17 – USGS MAP SHOWING DEPTH OF ALL WELLS IN YAKIMA BASIN

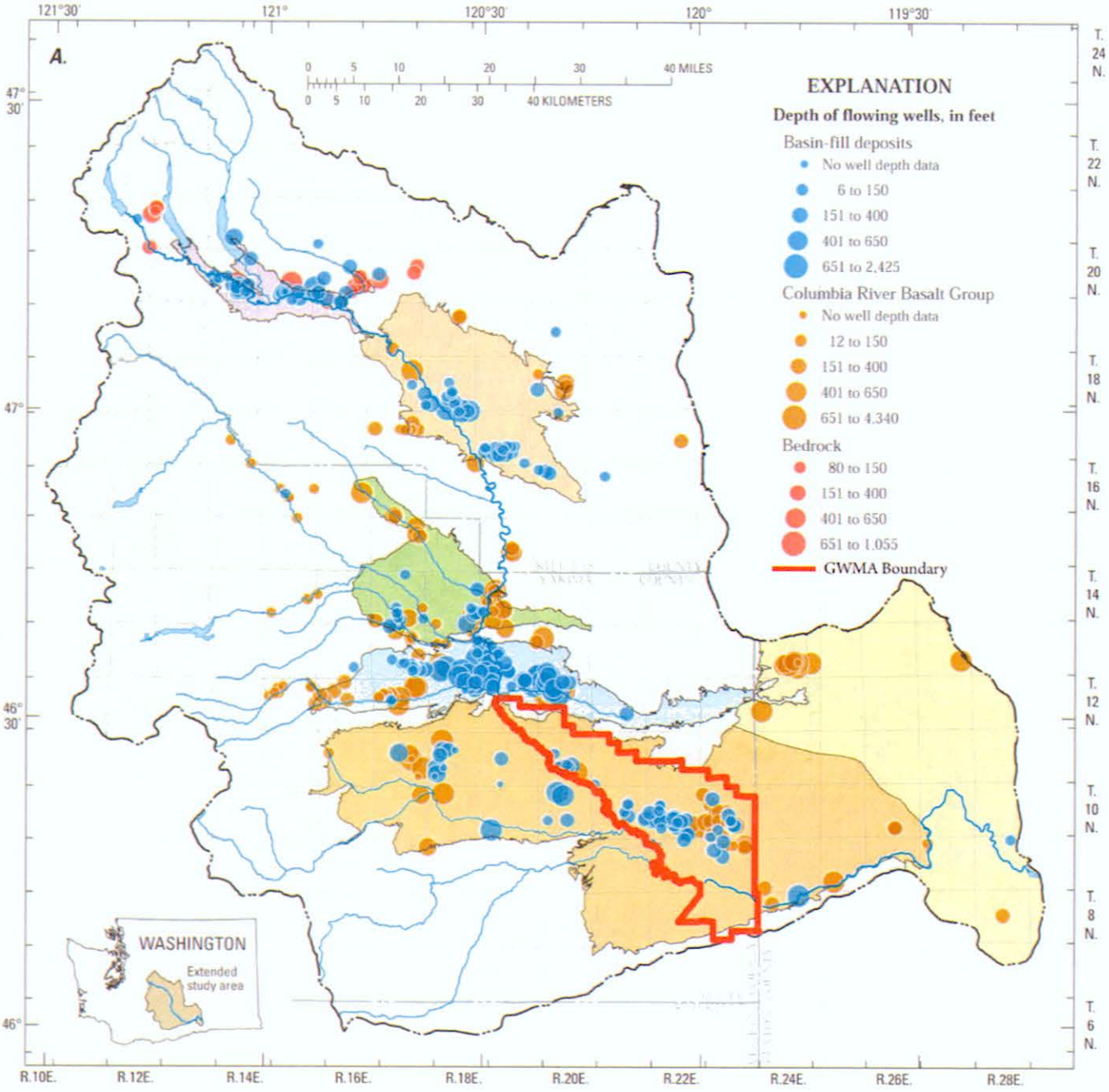


FIGURE 18 – USGS MAP SHOWING DEPTH OF FLOWING WELLS IN YAKIMA BASIN

The USGS study mapped Depth to Water Table and Mean Annual Recharge:

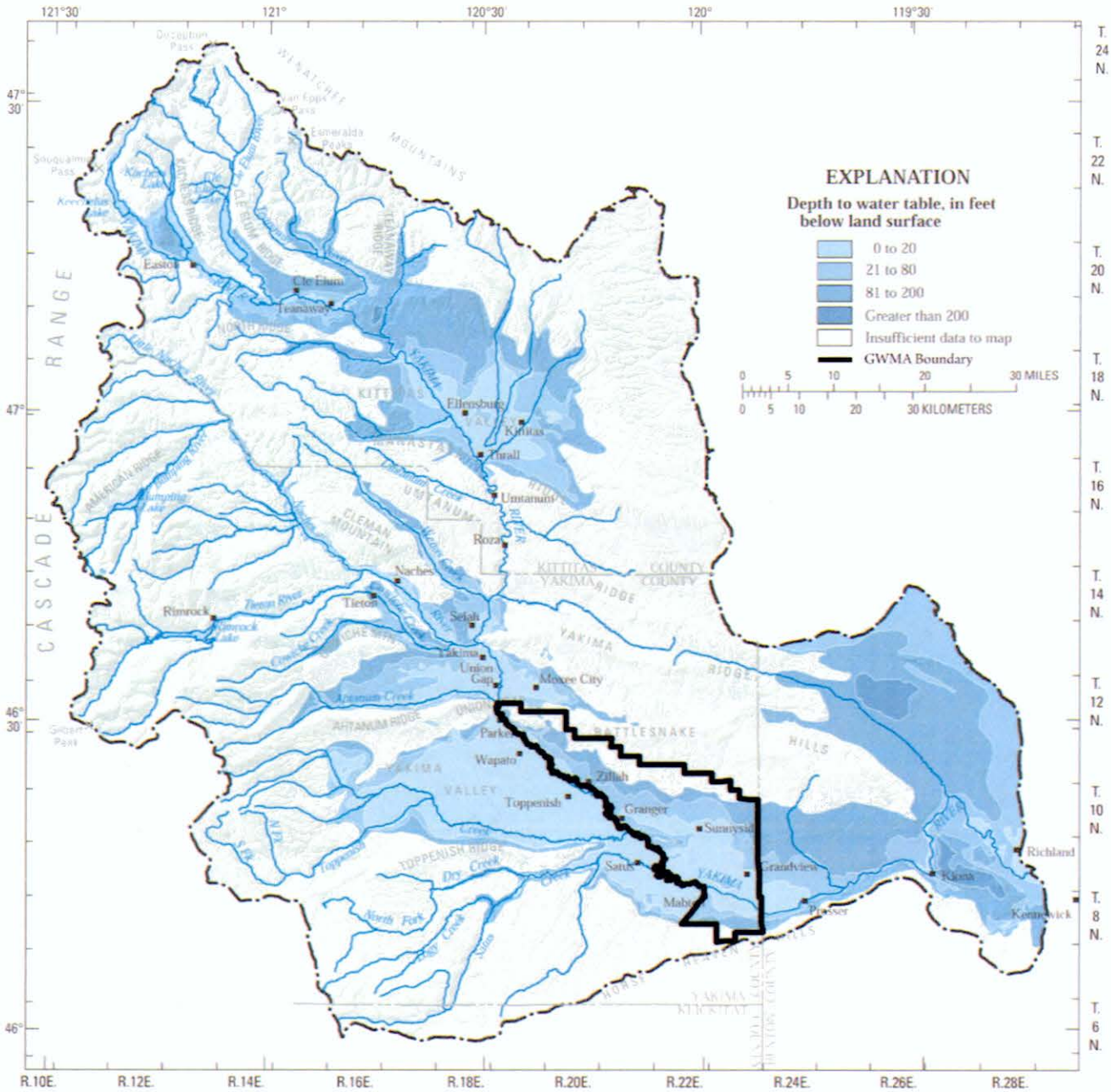


FIGURE 19 – USGS MAP SHOWING DEPTH TO WATER TABLE IN YAKIMA BASIN

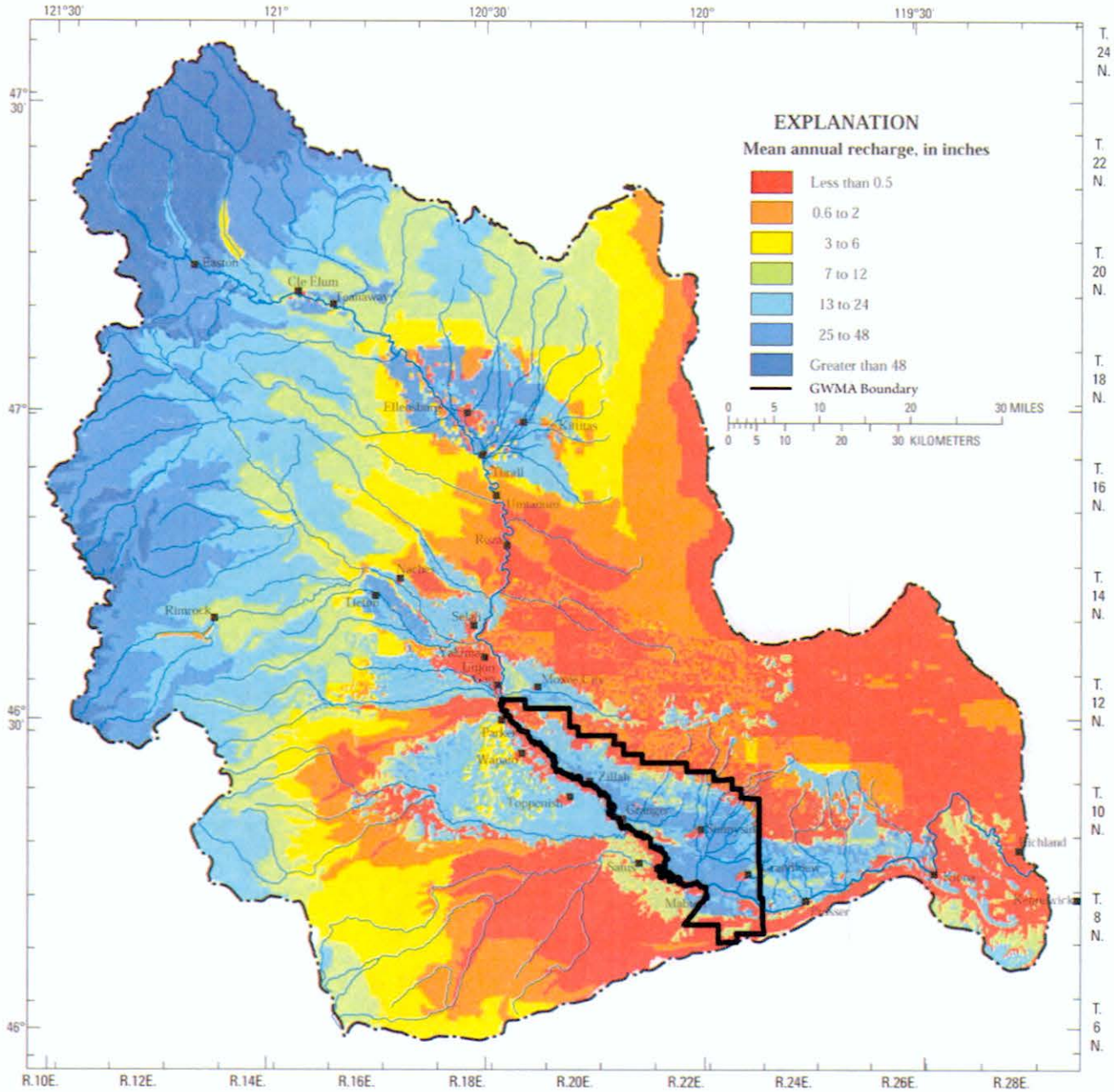


FIGURE 20 – USGS MAP SHOWING MEAN ANNUAL RECHARGE IN YAKIMA BASIN

Climate

The Western Regional Climate Center maintains climate data at three stations within the Lower Yakima Valley at Wapato, Sunnyside, and Prosser. Temperatures have historically ranged from 90 to 24 degrees Fahrenheit over the course of a year.

WAPATO, WASHINGTON (458959)

Period of Record Monthly Climate Summary, Western Regional Climate Center, wrcc@dri.edu

Period of Record : 10/01/1915 to 09/05/2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	39	47	58	66	75	81	89	88	80	67	50	40	64.8
Average Min. Temperature (F)	23	27	33	39	47	54	59	57	49	38	30	25	40.1
Average Total Precipitation (in.)	1	0.7	0.6	0.5	0.5	0.6	0.2	0.3	0.3	0.5	1	1.2	7.35
Average Total SnowFall (in.)	5.8	2.2	0.7	0	0	0	0	0	0	0	1.9	5.4	15.9
Average Snow Depth (in.)	2	1	0	0	0	0	0	0	0	0	0	1	0

SUNNYSIDE, WASHINGTON (458207)

Period of Record Monthly Climate Summary, Western Regional Climate Center, wrcc@dri.edu

Period of Record : 09/14/1894 to 01/05/2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	39	47	58	67	75	82	90	89	80	67	51	40	65.3
Average Min. Temperature (F)	23	27	32	38	45	51	54.7	53	46	37	30	25	38.4
Average Total Precipitation (in.)	0.9	0.6	0.5	0.5	0.5	0.5	0.18	0.3	0.4	0.6	0.9	0.9	6.8
Average Total SnowFall (in.)	4.5	1.8	0.2	0	0	0	0	0	0	0	1.8	4	12.4
Average Snow Depth (in.)						No	Data						

PROSSER, WASHINGTON (456768) Period of Record Monthly Climate Summary, Western Regional Climate Center, wrcc@dri.edu Period of Record : 07/01/1925 to 01/04/2015													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	38	46	56	65	73	80	89	87	78	65	49	40	63.9
Average Min. Temperature (F)	24	28	33	38	45	50	55	53	47	39	31	26	38.9
Average Total Precipitation (in.)	1.1	0.7	0.6	0.6	0.6	0.7	0.2	0.3	0.4	0.7	1	1.2	7.95
Average Total SnowFall (in.)	2.6	1.2	0.1	0	0	0	0	0	0	0	0.9	2.3	7.2
Average Snow Depth (in.)	1	0	0	0	0	0	0	0	0	0	0	0	0

Area Characterization

Population

Where People Live

Yakima County Quick Facts

- Eighth largest county in state by population: 244,654
- 2nd largest county in State by land mass: 4,311 square miles
- 14 Cities and Towns
- GWMA population: 56,210
- GWMA population living in a rural area: 19,952
- Source: figure derived using ARCGIS, a geographic information system, in combination with the 2010 Decennial Census. (See original text)

There are 14 cities in Yakima County. Five of those cities are in the LYV GWMA —Sunnyside, Grandview, Granger, Zillah and Mabton. Over half of the GWMA's residents live in those cities—10,158 of its 16,260 households:

- City of Sunnyside-4,556 households
- City of Grandview-3,136 Households
- City of Granger-813 Households
- City of Zillah-1,105 Households
- City of Mabton-2,548 Households

The remaining 6,511 households reside in an unincorporated area. Most of those remaining households– approximately 6,185 (19,952 individuals) – reside in a rural area not served by public water or sewer. These residents typically rely on a private or shared well for their drinking water. A nearly equal number rely on an on-site sewage system (OSS, or septic system) to dispose of their waste.

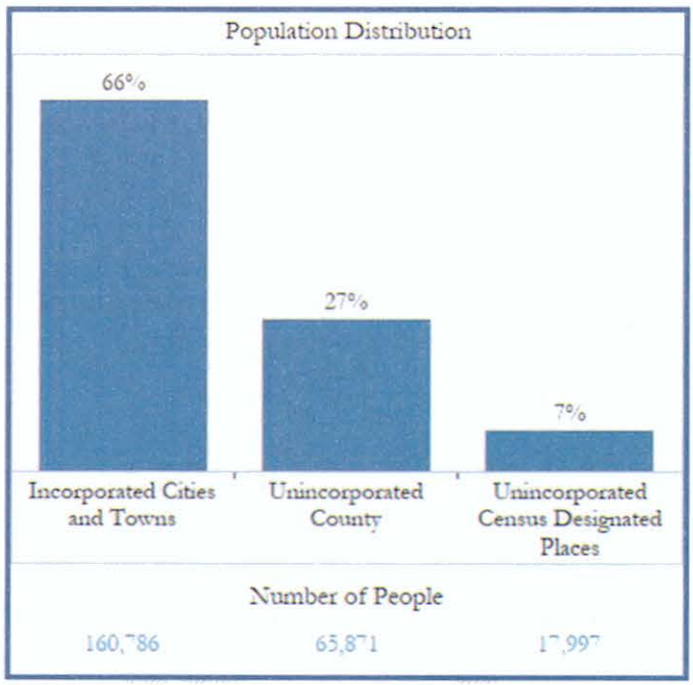


FIGURE 21 – POPULATION DISTRIBUTION

In the GWMA, economics and livelihood play a critical role in the decision to live in a rural area instead of an urban one. Affordable housing is a draw to rural areas, and so is the proximity to agricultural-related employment. Farmers, for example, usually live on or near the acreage they farm.

However, other factors are at play in addition to affordable housing and agricultural. In recent decades in Yakima County, large-tract farmsteads have been parceled off and sold in smaller pieces over time. The smaller parcels were not large enough to make a living at farming, but they did offer part-time farming opportunities for people already employed in seeking a country lifestyle. This is perhaps the chief characteristic of "rural" living in Yakima County and the GWMA [Horizon 2040 5.9.4 Rural Lands-Existing Conditions]. The desire for a "country" environment in part accounts for the growing number of rural GWMA households— ranging in property size from .5 to 10 acres— whose distance from urban areas preclude them from receiving municipal water or sewer services.

Income and Poverty

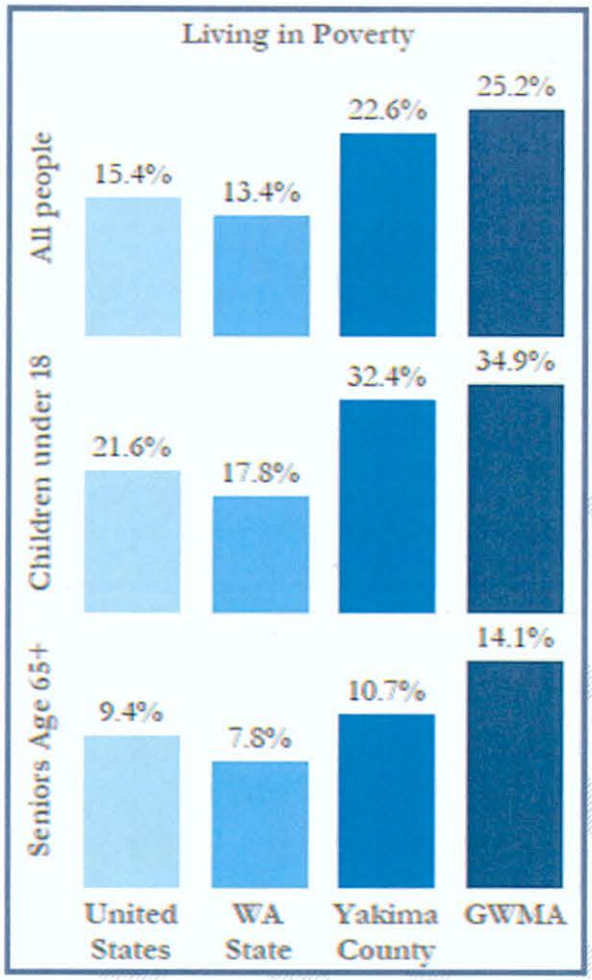


FIGURE 22 - POVERTY

The U.S. Census (5-Year American Community Survey for the years 2009-2013), has Yakima County's median household income at $43,506, well below the $59,478 median for Washington State. The County's per capita income was $19,433, compared to $30,742 for the State.

According to the U.S. Census (5-Year American Community Survey for the years 2009-2013), 22.6 percent of the population of Yakima County was living below the poverty level, an increase of 2.4 percent since 1990. In comparison, only 13.4 percent of all persons in Washington State live below the poverty level [Yakima County's Comprehensive Plan, Horizon 2040-GMA Update June 2017]

The population of the GWMA is generally poorer than the rest of Yakima County, with over a quarter of the GWMA's population living in poverty. There is also a higher percentage of children in the GWMA living in poverty which is in line with the larger percentages of children living there.

Education

The educational disparity between the State, Yakima County, and the GWMA is even greater than the income disparity. In Washington State, for example, 10 percent of the population did not graduate from high school or receive a high school diploma. In Yakima County that rate is almost 3 times higher at 29 percent. Yet in the GWMA it is almost 4 times higher than the state at 39.6 percent. In some GWMA pockets the span is even greater: in the city of Mabton, which lies in the southeast section of the GWMA, 28.1 percent of the population over the age of 25 has less than a ninth-grade education.

Households and Families

The average household size in the GWMA ranges from 3.36 to 3.98 people per household, larger than the County (3.02 people) and State (2.54 people). Average family size in the GWMA ranges from 3.72 to 4.38 people—again, larger than the average County family size (3.53) or the State (3.11). In the GWMA, 80.2 percent of all households are comprised of families compared to 73.0 percent for the County and 64.5 percent for the State.

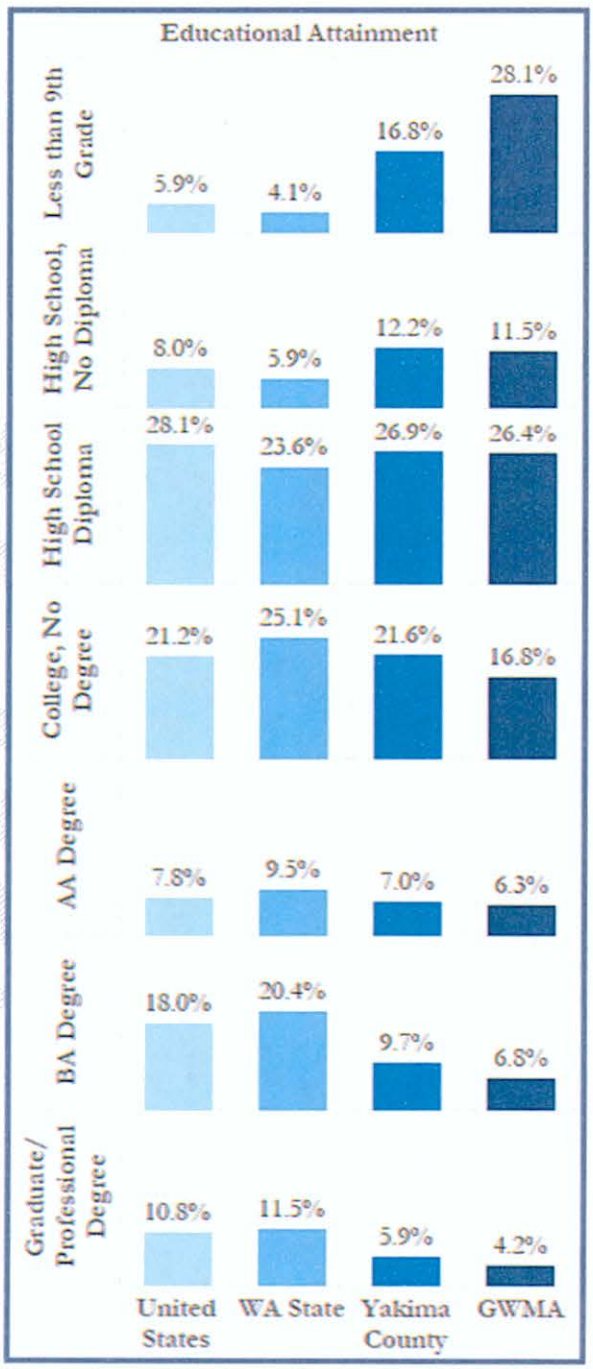


FIGURE 23 – EDUCATIONAL ATTAINMENT

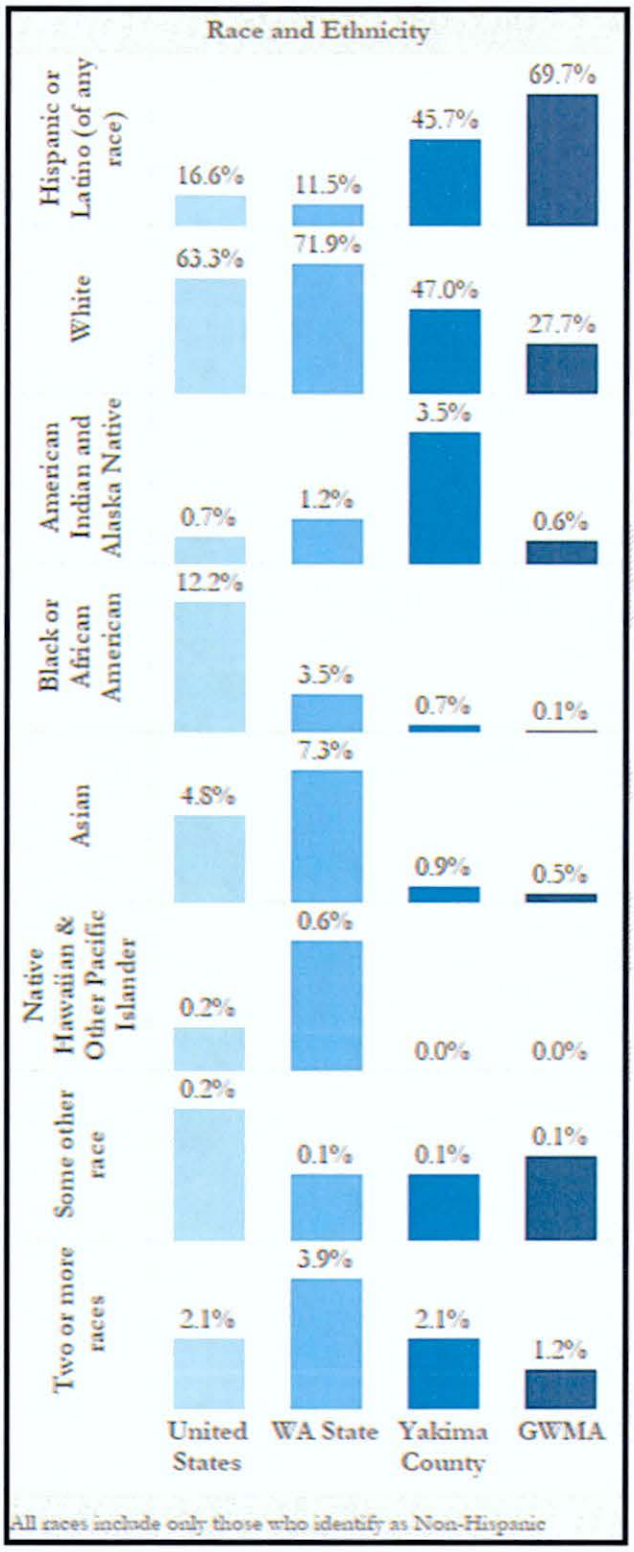


FIGURE 24 – RACE AND ETHNICITY

Race and Ethnicity

The GWMA has a higher concentration of individuals whose ethnicity is Hispanic/Latino compared to Yakima County, Washington State, or the Nation, and a lower concentration of American Indian/Alaska natives and Blacks/African-Americans.

Within Yakima County there is a wide gap between communities for both race and ethnicity. For example, the range for individuals who are Hispanic/Latino ranges from 0.4 percent in the city of Naches to 96.1 percent in the City of Mabton. Additionally, the range of individuals who are American Indian/Alaskan Native ranges from 0.0 percent in the city of Selah to 21.7 percent of the town of Harrah, which is located outside of the GWMA on the Yakama Indian Reservation.

The racial groups of Asian, Black or African-American, and native Hawaiian or other Pacific Islander represent a very small part of the population in the GWMA as well as Yakima County when compared to the State and the Nation.

Language

60 percent of people in the GWMA do not speak English at home.

In Yakima County, 39.6 percent of the population over age 5 speaks a language other than English at home (predominantly Spanish). 18.6 percent speak English less than "very well" indicating that the other 21.0 percent a bilingual. In the GWMA, 60.6 percent of the population over five speaks a language other than English at home – 24 percent speak English less than "very well" indicating that the other 36.4 percent are bilingual.

Sources of Nitrate and the Regulatory Environment

Groundwater quality in Washington is regulated by the federal Safe Drinking Water Act and Clean Water Act, the state Water Pollution Control Act and Water Resources Act and the State Department of Health's authorizing statute.

While we have attempted to make this document as readable as possible, this section contains in-depth discussion of scientific and regulatory topics. As a result, clarity of language may suffer.

Safe Drinking Water Act

The EPA has broad authority, under Section 1421 of the Safe Drinking Water Act, 42 U.S.C. 300g-1(b)(1)(A), (B), to establish national primary drinking water standards, "if the Administrator determines that . . . the contaminant may have an adverse effect on the health of persons;" "is known to occur . . . in public water systems with a frequency and at levels of public health concern;" or there is "a meaningful opportunity for health risk reduction for persons served by public water systems."

> For each contaminant that the Administrator determines to regulate under subparagraph (B), the Administrator shall publish maximum contaminant level goals and promulgate, by rule, national primary drinking water regulations under this subsection. 42 U.S.C. 300g-1(b)(1)(E)

The EPA set the maximum contaminant level for nitrate, nitrite and total nitrate and nitrite in 40 CFR § 141.62:

Contaminant	MCL (mg/l)
(7) Nitrate	10 (as Nitrogen)
(8) Nitrite	1 (as Nitrogen)
(9) Total Nitrate and Nitrite	10 (as Nitrogen)

EPA may delegate its enforcement authority under the Safe Drinking Water Act to states if they adopt drinking water regulations that are no less stringent than the federal standards. 42 U.S.C. 300g-2(a), 300h-1. "States are responsible for reviewing, establishing, and revising water quality

standards." "States may develop water quality standards more stringent than required" by federal regulations 40 CFR § 131.4 (a). DOE has adopted Chapter 173-200 WAC, *Water quality standards for groundwaters of the State of Washington.* Washington's drinking water quality standard for nitrate is 10 milligrams per liter (mg/L), or 10 parts per million (ppm). State law requires public water systems to sample for many contaminants, including nitrate, on a regular basis. Public water systems with nitrate levels over 10 ppm must notify the people who receive water from them.

DOE's groundwater regulations, WAC 173-200, implement Washington's Water Pollution Control Act, Ch. 90.48 RCW, and Water Resources Act of 1971, Ch. 90.54 RCW. The goal of the regulations is to maintain the highest quality of the state's groundwaters and protect existing and future beneficial uses of the groundwater through the reduction or elimination of the discharge of contaminants to the state's groundwaters. The regulations set groundwater quality standards that, together with the state's technology-based treatment requirements, seek to protect the environment, human health and existing and future beneficial uses of groundwaters. The regulations apply to all groundwaters of the state that occur in a saturated zone or stratum beneath the surface of land or below a surface water body. They do not apply to:

(a) contaminant concentrations found in saturated soils where those contaminants are chemicals or nutrients that have been applied at agronomic rates for agricultural purposes if those contaminants will not cause pollution of any groundwaters below the root zone;

(b) contaminant concentrations found in saturated soils where those contaminants are constituents that have been applied at approved rates and under approved methods of land treatment if those contaminants will not cause pollution of any groundwaters below the root zone; or

(c) clean up actions approved by the Department under the Model Toxics Control Act, ch. 70.105D RCW, or approved by the United States Environmental Protection Agency under the Comprehensive Environmental Response Compensation and Liability Act, 42 U.S.C. 9601 et seq., WAC 173-200-010.

WAC 173-200-040 (2) establishes "groundwater concentrations" that groundwaters of the state may not exceed. Nitrate concentrations in groundwater may not exceed 10 mg/L. WAC 173-200-040 (2) (Table 1).

> No person shall engage in any activity that violates or causes the violation of [ch. 173-200 WAC]." WAC 173-200-100 (2). Violations of maximum concentrations may be addressed by enforcement "through all legal, equitable, and other methods available to the department including, but not limited to: issuance of state waste discharge permits, other departmental permits, regulatory orders, court actions, review and approval of plans and specifications, evaluation of compliance with all known, available, and reasonable methods of prevention, control, and treatment of a waste prior to discharge, and pursuit of memoranda of understanding between the department and other regulatory agencies. WAC 173-200-100 (3).

If DOE determines that a potential to pollute the groundwater exists, it may request a permit holder or responsible person to prepare and submit a groundwater quality evaluation program for its approval. Each evaluation program must be based on soil and hydrogeologic characteristics and be capable of assessing impacts on groundwater at the "point of compliance." The evaluation program approved by DOE may include (a) groundwater monitoring for a specific activity; (b) groundwater monitoring at selected sites for a group of activities; (c) monitoring of the vadose zone; (d) evaluation and monitoring of effluent quality; (e) evaluation within a treatment process; or (f) evaluation of management practices. WAC 173-200-080 (2). The "point of compliance" is the location where the "enforcement limit," is "measured and shall not be exceeded." WAC 173-200-060 (1). The "enforcement limit" is established in accordance with WAC 173-200-050.

When drinking water in private wells contains nitrate above the MCL, EPA may determine that an imminent and substantial danger exists. EPA may then take action, including collecting samples to investigate the sources of the contamination. In addition, where appropriate, EPA may issue orders to require provision of alternative water supplies by persons who caused or contributed to such conditions. EPA may also judicially enforce its orders, through action seeking civil penalties of not more than $25,000 for each day of such violation. If violation of EPA's orders is "wilfull," EPA may seek criminal penalties of fines or imprisonment for not more than three years. 42 U.S.C. § 300g-2(b). Citizens may also seek protection of underground sources of drinking water, under 42 USC 300j-8, so as to mandate EPA regulatory or litigative action.

The EPA may also designate sole source drinking water aquifers under Section 1427 of the Safe Drinking Water Act, 42 U.S.C. 300h.

Clean Water Act

The Clean Water Act, 33 U.S.C. §1251 et seq., establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under the Clean Water Act, EPA has implemented pollution control programs such as setting wastewater standards for industry and water quality standards for all contaminants in surface waters. The Clean Water Act makes it unlawful to discharge any pollutant from a point source into navigable waters, unless a National Pollutant Discharge Elimination System (NPDES) permit is obtained (33 U.S.C. 1342) NPDES permitting authority has been delegated to the DOE. (33 U.S.C. 1342 (b)).

The DOE is the primary agency in Washington State responsible for the protection of both ground and surface water quality. DOE's Water Quality Program operates primarily pursuant to the Water Pollution Control Act, Chapter 90.48 RCW. The Act makes it "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." (RCW 90.48.080)

DOE may implement measures to protect both ground and surface waters from pollutants, and has established regulations for the protection of ground and surface water quality, permitting of discharging activities, and financing of water quality protection activities. This regulation lists numerical limits for specific contaminants ("water quality criteria") that apply to all groundwaters in the state. These criteria are used when evaluating the performance of permitted discharge activities (such as sprayfields and holding ponds), implementation of best management practices implementation, or when conducting clean-up activities at historical or current waste sites.

DOE's water quality standards incorporate an "antidegradation policy," an otherwise existing part of state water quality law (WAC 173-200-030). This policy forbids degradation which would harm existing or future beneficial uses of groundwater (drinking water, irrigation and support of wildlife habitat). The standards provide numeric values which must not be exceeded to protect the beneficial use of drinking water. Washington's water quality standards are enforceable through DOE's actions. Washington's Water Pollution Control Act authorizes DOE to "bring any appropriate action, in law or equity, including action for injunctive relief . . . as may be necessary to carry out the provisions" of

that Act (RCW 90.48.037), including its prohibition of the discharge of organic or inorganic matter that may cause pollution of ground or surface water. (RCW 90.48.080).

DOE's water quality standards apply to both point source activities and nonpoint source activities. Point source activities are activities where a source of pollution can be readily distinguished, such as the industrial discharge of waste onto or into the ground. State law requires point sources to operate under permits that set conditions for discharges. These permits may be issued to a specific entity with conditions designed to protect water quality.

A "point source" is "any discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture." (WAC 273-226-030 (21))

"Nonpoint sources" are more diffuse in nature. They often consist of many small pollutant sources that have a cumulative effect, like highway runoff, on-site septic systems in developed areas, and application of pesticides or nutrients in both agricultural and urban areas. Some nonpoint sources are managed through the development of siting and design standards.

DOE's permits describe penalty provisions which may be put into effect if discharge limitations (or other conditions specified in the permit) are not met. Repeated violations of the permit can result in closure of the discharging activity and fines for potential clean-up activities.

"General permits" may be issued to a group of entities with common discharge characteristics and conditions. (WAC 273-226-020) Permits issued under Chapter 273-226 WAC are designed to satisfy the requirements for discharge permits under Sections 307 and 402(b) of the federal Water Pollution Control Act (33 U.S.C. §1251) and the state law governing water pollution control (Ch. 90.48 RCW). (WAC 273-226-020). All point sources must apply for and obtain a general permit as a condition of operation. General permits have been issued to industries and municipalities for treated discharges into surface waters such as Sulphur Creek Wasteway or the Yakima River.

General permits are issued for fixed terms not exceeding five years from the effective date. Point source facility operators must apply to the DOE for coverage under a general permit. (WAC

227-226) All permittees covered under a general permit must submit a new application for coverage under a general permit or an application for an individual permit at least 90 days prior to the expiration date of the general permit under which the permittee is covered. When a permittee has made timely and sufficient application for the renewal of coverage under a general permit, an expiring general permit remains in effect and enforceable until the application has been denied, a replacement permit has been issued by the DOE, or the expired general permit has been cancelled by the DOE. Coverage under an expired general permit for permittees who fail to submit a timely and sufficient application shall expire on the expiration date of the general permit. (WAC 173-226-200)

A general permit may be modified, revoked and reissued, or terminated, during its term if information is obtained by DOE which indicates that cumulative effects on the environment from dischargers covered under the general permit are unacceptable. (WAC 173-226-230 (1)(d)) DOE may require any discharger to apply for and obtain an individual permit, or to apply for and obtain coverage under another more specific general permit. Also, any interested person may petition the DOE to require a discharger authorized by a general permit to apply for and obtain an individual permit. (WAC 173-226-240 (2), (3))

DOE may revoke, or "terminate coverage under" a general permit where terms or conditions of the general permit are violated, conditions change such that either temporary or permanent reduction or elimination of permitted discharges is required, or DOE determines that the permitted activity endangers human health, safety, or the environment, or contributes to water or sediment quality standards violations. (WAC 173-226-240 (1) (a), (c), and (d))

Currently, the permit framework is reactive, a permit is not required unless there is or was a documented discharge to surface waters. The permitting process now requires a facility to submit a complete Nutrient Management Plan with the permit application. The Nutrient Management Plan is approved by DOE and becomes the facility's effluent limitation. After a facility is permitted, it must submit an updated Nutrient Management Plan if it wants to make changes to its operation.

Under §303(d) of the Clean Water Act, states are required to develop lists of impaired waters. These are waters for which technology-based regulations and other required controls are not stringent enough to meet the water quality standards set by the state. The law requires that states establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDL) for

these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards. A TMDL is generally administered by establishing limits on the discharge of pollutant materials otherwise permitted under the NPDES program—a program that relates to discharges to surface water only.

DOE issues permits for large on-site systems and these systems are required to monitor. In other cases, general permits establish standards for management. The standards apply to all underground waters in the saturated zone (generally at or below the water table), but do not apply in the root zone of saturated soils where agricultural pesticides and nutrients have been applied at agronomic rates for agricultural purposes and pollution does not occur below the root zone. (WAC 173.200.010(3)(a))

State Department of Health

DOH is authorized to adopt regulations "to protect public health." (RCW 43.20.050(2)) These may include rules for Group A public water systems, as necessary, to assure safe and reliable public drinking water and to protect the public health. Those rules set requirements regarding: (i) The design and construction of public water system facilities, including proper sizing of pipes and storage for the number and type of customers; (ii) Drinking water quality standards, monitoring requirements, and laboratory certification requirements; (iii) Public water system management and reporting requirements; (iv) Public water system planning and emergency response requirements; (v) Public water system operation and maintenance requirements; (vi) Water quality, reliability, and management of existing but inadequate public water systems; and (vii) Quality standards for the source or supply, or both source and supply, of water for bottled water plants.

DOH requires that nitrate levels (concentrations) (as N) in Group A public water systems not exceed the maximum contaminant level ("MCL") of 10 mg/L, and that nitrite levels (concentrations) not exceed the MCL of 1 mg/L. WAC 246-290-310(3) (Table 4). The requirements for Group B public water systems are the same. WAC 246-291-170 (2)(b) Nitrate and nitrite are "primary inorganic contaminants" and the MCL for nitrate and nitrite are "primary MCLs." When primary MCLs are exceeded by a public water system the water purveyor must "determine the cause of the contamination" and "take action as directed by the Department of Health." WAC 246-290-320(1)(b)(iii).

DOH is also sets rules for Group B public water systems, as defined in RCW 70.119A.020. These rules establish minimum requirements for the initial design and construction of a public water system and "rules and standards for prevention, control, and abatement of health hazards and nuisances related to the disposal of human and animal excreta and animal remains." RCW 42.30.050 (2) (b), (c)

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) (Pub. L. No. 94-590, 90 Stat 2795, 42 U.S.C. §§6901-6987, 9001-9010) contains both regulatory standards and remedial provisions to achieve goals of conservation, reducing waste disposal, and minimizing the present and future threat to human health and the environment. RCRA provides a comprehensive national regulatory structure for the management of nonhazardous solid wastes (subtitle D, 42 U.S.C. §§ 6941/y-6949a) and hazardous solid wastes (subtitle C, 42 U.S.C. §§ 6921/y-6939b). "Solid waste" is defined as "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities . . . ." 42 U.S.C. §6903(27)

Materials are discarded if they are either abandoned or recycled or are inherently waste-like. 40 C.F.R. § 261.2. Materials are "disposed" if they are discharged, deposited, injected, dumped, spilled, leaked or otherwise placed into or on land or water such that it may enter into the environment or be emitted into the air or discharged into any waters, including groundwaters 42 U.S.C. §6903(3). Agricultural wastes, including manures, crop residues, or commercial chemical fertilizers applied to the soil in amounts greater that can be used as fertilizers or soil conditioners may be the disposal of solid waste.

Irrigated Agriculture

There are 360,906 acres of crops in Yakima County. 96,459 (28 percent) of those acres are located within the GWMA. Irrigated agriculture made up 55 percent (more than 175,161 acres) of the total land area within the GWMA boundaries in 2015.

Most crops grown in the GWMA have the potential for positive nitrogen loading under some management practices. WSDA 2014 crop data shows that there is a large and diverse number of crops

grown in the GWMA. The top 15 crops by acreage represent 96 percent of the irrigated agricultural land within the GWMA. Each crop has a unique cultivation practice.

Anecdotal information provided by members of the GWMA's Irrigated Agriculture Working Group indicates that growers do not want to over-irrigate and have disincentives to over-applying commercial fertilizers.

The native organic matter content of lower Yakima soils is around one percent but when these soils have a history of organic inputs such as manure, there can be an increase in organic matter levels of two to three percent. In general, organic matter in soils can mineralize to provide between 20 and 65 lbs N per one percent organic matter for crop utilization.

Nitrogen from organic matter becomes available for crop uptake as well as losses including leaching below the crop root zone with water.

The Lower Yakima Valley Conservation District completed a Deep Soil Sampling project for the Irrigated Agriculture Work Group. The sampling data from the project, including 163 samples taken in spring and fall have been assembled by Yakima County Public Services. The data collected showed that irrigated agriculture is at least partially responsible for high nitrates in the groundwater within the GWMA.

a. Crops Supporting Livestock Operations

A significant portion of irrigated agricultural acreage within the GWMA (31,790 acres or 32 percent) is dedicated to crops and land uses (corn, triticale, pasture, and alfalfa) that support dairy or other livestock operations. The majority of manure and compost applications observed by representatives of the WSDA during interviews with farmers and crop consultants were taking place on crops intended for animal feed.

Triticale is "double-cropped" (two crops in one growing year). Triticale is planted in the fall (September-October) and harvested in the spring (April-May). Silage corn is seeded immediately afterward and harvested in late summer or fall (August-September).

Alfalfa is also planted. Alfalfa is a complex perennial crop. It removes large quantities of nutrients from the soil (Pacific Northwest Extension Publication PNW0611). 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.

Based on a DOE survey during 1998-2003, 29 percent of the irrigated acres in the Granger drainage and 12 percent in the Sulphur drainage were owned by dairies (Laurie Crowe, South Yakima Conservation District, personal communication, February 2004) and there were 20, 24, 2, and 0 dairies in Granger, Sulphur, Spring and Snipes drainages, respectively. (Joint Board, 2009)

WSDA's regulations implementing the Dairy Nutrient Management Act, Ch. 16-611 WAC, require dairy producers to maintain records to demonstrate that applications of nutrients to crop land are within acceptable agronomic rates. Soil analysis should include annual postharvest soil nitrate nitrogen analysis; triennial soil analysis that includes organic matter; pH, ammonium nitrogen; phosphorus, potassium; and electrical conductivity. Nutrient analysis is required for all sources of organic and inorganic nutrients including, but not limited to, manure and commercial fertilizer supplied for crop uptake. Manure and other organic sources of nutrients must be analyzed annually for organic nitrogen, ammonia nitrogen, and phosphorus. There is no equivalent requirement for non-dairy agricultural producers.

Nutrient application records should include field identification and year of application, crop grown in each field where the application occurred, crop nutrient needs based on expected crop yield, nutrient sources available from residual soil nitrogen including contributions from soil organic matter, previous legume crop, and previous organic nutrients applied, date of applications, method of application, nutrient sources, nutrient analysis, amount of nitrogen and phosphorus applied and available for each source, total amount of nitrogen and phosphorus applied to each field each year; and the weather conditions twenty-four hours prior to and at time of application.

b. Tree Fruit and Vegetable Crops

The other main crops in the region are tree fruit, grapes (both juice and wine), hops, wheat, mint, and asparagus. The orchard and vineyard crops, e.g., apples, grapes, cherries, pears, peaches/nectarines are permanent crops.

Fertilizers

Fertilizers available within the GWMA include commercial fertilizer, manure, or compost. There is no current measured data regarding the distribution of the amounts of these three nitrogen sources within the GWMA. WSDA interviews with farmers and crop consultants indicate that the most commonly used product is commercial fertilizer. The only exceptions were silage corn and triticale, where more acres were fertilized with manure than with commercial fertilizer. The only crops where growers or crop consultants reported use of all three fertilizer products were hops and triticale.

Bulk commercial fertilizer distributors are required by RCW 15.54.275 to be licensed. They are also required by RCW 15.54.362 to report the number of net tons of fertilizer distributed within the state during six-month periods (January to June, July to December) (annual report permitted if less than 100 tons). 220,909 tons (200,406,000 kg) of commercial fertilizer was purchased in Washington State in 2011. As the statute does not require that the report be subdivided by county, region or groundwater management area, there is no specific information with which to evaluate the amount of commercial fertilizer sold within the GWMA. "Bulk fertilizer" is commercial fertilizer distributed in a nonpackage form such as tote bags, tanks, trailers, spreader trucks, and railcars. Fertilizers are required to meet the nutrient value guaranteed by the fertilizer manufacturer. There is no requirement that agricultural producers be licensed to apply commercial or any other fertilizer. Unmanipulated animal and vegetable manures, organic waste-derived materials and biosolids are not commercial fertilizer. WAC 16-200-701.

Chemigation procedures are described by regulations of the Department of Agriculture. Ch. 16-202 WAC. Chemigation" is the application of any substance a pesticide, plant or crop protectant, or system maintenance compound applied with irrigation water. WAC 16-202-1002 (17). All pesticide laws apply to chemigation. Pesticides cannot be applied with an open surface, gravity irrigation system unless allowed by the product label.

The Director of the Department of Agriculture may adopt regulations for the appropriate use and disposal of commercial fertilizers for the protection of groundwater. RCW 15.54.800. Although "deep percolation" ("the movement of water downward through the soil profile below a plant's effective rooting zone") is defined by WSDA regulations, WAC 16-202-1002 (23), the regulations do not specifically prohibit deep percolation.

Fertilizer application timing can affect nitrogen availability for plant uptake and resultant leaching of excess nitrogen. For instance, synthetic fertilizers are formulated to release a specific amount of nutrients at a specific rate over a select period of time. Nitrogen from compost or manure would be released over a much longer period of time at a much lower rate. Crop fertilizers (manure, compost, and synthetic fertilizer) also react differently at the point of application. Compost or manure also contain components with soil health improvement properties.

Generally, crop fertilizer application choices are affected by several parameters including fertilizer type, crop nitrogen needs, application recommendations, expected crop pricing, and anticipated yields. They also may be influenced by 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, soil type and organic matter content, soil nutrient content, manure nutrient content, handling, and storage before application, organic carbon cycling and mineralization, and fertilizer fixing in alfalfa will all affect whether or not any fertilizer application represents a nitrogen loading risk. (Alfalfa will resort to fixing nitrogen (i.e., create its own nitrogen by pulling it out of the air) only if there is insufficient nitrogen already in the soil. If there is sufficient nitrogen in the soil, it will utilize the soil nitrogen first.)

Generally speaking, fertilizers of any type should be applied only at an "agronomic rate," that is, the rate of application of nutrients to supply crop or plant nutrient needs to achieve realistic yields, while at the same time minimizing the movements of nutrients to surface and ground waters. Cf. WAC 16-611-010.

Further information should be developed about the use of each of the three fertilization materials, as well as information about application timing and specific application site characterization prior to application.

a. Crops Supporting Livestock Operations

Annual crops such as silage corn, triticale (for silage) and wheat use both commercial nitrogen and manure throughout the GWMA. Generally, the nitrogen application for this corn/triticale cropping system is split - one in the fall and one in the spring. Corn (silage and grain) use fairly even amounts of commercial nitrogen and manure on most of the acreage.

b. Tree Fruit and Vegetable Crops

High nutrient applications or application of multiple nutrient sources may be used on permanent tree fruit and vegetable crops to improve soil health and maximize fruit production. Producers of crops intended for human consumption may be reluctant to make manure and compost application because of concerns about pathogen transfer, reducing fertilization options.

c. Organic Fertilizers: Cover Crops, Manure and Compost

Cover crops can fix nitrogen within the soil, if plowed into the soil onsite. The variety of cover crop and number of years of integration of cover-crops into the soil can affect overall nitrogen concentrations in the soil.

Manure from dairy and livestock operations within the GWMA is a widely-used source of organic fertilizer for irrigated crops within the GWMA. While total volume of manure production can be calculated, as a function of total animals, no public records are currently maintained from which to analyze whether, in gross (minus exportation of such materials), the application of such volume on available irrigated acreage within the GWMA equates to an agronomic rate in-gross. Some pre-application site-specific soil characterization is practiced, so as to accomplish specific site application at an agronomic rate.

> Manure contains two primary forms of nitrogen: ammonium and organic nitrogen. The organic form of nitrogen is nearly immobile; however, it becomes mobile, and available to crops as fertilizer, through mineralization. Mineralization is the process by which soil microbes decompose organic nitrogen into ammonium, which is then available as fertilizer for crops. By tilling manure into the subsurface to depths of 4-5 feet, plant uptake is eliminated and mineralization results in elevated ammonium in the subsurface. The rate of mineralization varies with soil temperature, soil moisture, and the amount of oxygen in the soil. After mineralization, microorganisms within the soil convert ammonium into nitrate. This process, called nitrification, occurs most rapidly when the soil is warm, moist, and well-aerated. Nitrates are the most plant-available form of nitrogen for fertilization purposes, but as described above, are highly mobile and susceptible to leaching loss to groundwater, especially when tilled below the root zone or over applied to the fields. (Erickson 2013)

Although livestock wastes contain low concentrations of nitrogen relative to inorganic fertilizer, it is difficult to estimate nitrogen loading to soil, air and water from manure application without sufficient analysis of nitrogen content in these waste streams. These are subject to some nitrogen loss to air and soil under natural conditions.

The Dairy Nutrient Management Act requires that manure transfer records, including imports or exports, be maintained by dairies that transfer ownership of manure to others. These records should include date of manure transfer; amount of nutrients transferred, the name of the persons supplying and receiving the nutrients, and a nutrient analysis of manure transferred. Irrigation water management records should include field identification and the total amount of irrigation water applied to each field each year.

d. Synthetic Fertilizers

There is no public record of the total amount of synthetic fertilizers sold or used within the GWMA. Anecdotal evidence suggests that the form of synthetic fertilizers has shifted, generally, from dry, granulated fertilizers to liquid fertilizers capable of simultaneous application with irrigation water ("fertigation").

Crop consultants or agronomists, either academic or mercantile (G.S. Long, Co., D & M Chemical, Bleyhl's, Wilbur-Ellis, Simplot, Crop Production Services, Husch and Husch) are used by the majority of commercial farms operating within the GWMA. There are only a few companies that do this type of work. These consultants are not usually farmers. They create prescriptions for pesticide and fertilizer applications across multiple crops on many different farms. Mercantile crop consultants have economic incentives to recommend larger applications of fertilizers. Agronomists without such incentives could review and evaluate such recommendations for farmers.

There are no federal, state or local regulations specifically pertaining to the application of nitrogen-based fertilizer to agricultural crops, so long as they are applied at an agronomic rate.

Water Applications

Irrigation practices can affect both amounts and rates of nitrogen leaching and the potential for increased nitrogen concentrations in irrigation return flows (which relocate nitrogen applied through fertilizer).

The irrigation water nitrogen input is unique to each commodity. The average N concentration of high flow (late spring) and low flow (late summer) conditions of the Yakima River at Kiona during the 2012 irrigation season was 0.809 mg N/L. (USGS 2012)

Irrigated agriculture is mapped statewide by WSDA, including the area within the GWMA. There is no current measured data regarding the distribution of the three general irrigation methods (sprinkler, drip, macro/rill) within the GWMA. Interviews with farmers and crop consultants indicate that sprinkler irrigation was used on 61 percent of the total irrigated acreage in the GWMA, drip irrigation (including drip, micro sprinkler, drip/sprinkler, and combinations) was used on 23 percent of the acreage. Macro, or rill, irrigation was used on 15 percent of the acreage.

Silage corn and triticale cultivation is almost all irrigated with sprinkler or center pivot irrigation systems. Triticale cultivation rarely occurs on rill irrigated fields.

Any improperly decommissioned wells beneath livestock operations, including crop fields onto which waste is applied, could provide a direct conduit for contaminants to reach the groundwater.

There are no federal, state or local regulations specifically pertaining to the application of irrigation water to agricultural crops. State water law generally precludes wasting water.

Livestock Operations/CAFOs and Groundwater Quality Regulation

a. Dairy Operations

The WSDA's Nitrogen Availability Assessment (WSDA 2017) reported that USDA's 2012 estimate of dairy operations was 99,532 milk cows on 97 farms (USDA NASS 2014) in Yakima County. The majority, or near total of these, are thought to be located within the GWMA. According to WSDA, dairy farms are increasing in size while the number of farms is decreasing.

Manure and other animal wastes supply nutrients to crops because they contain nitrogen and other elements essential to plant growth, and that the recycling of animal nutrients to increase soil fertility and crop yield is a historic practice. Manures are recommended over commercial fertilizers where there is a desire to build the soil profile by increasing and diversifying soil organisms, increasing moisture holding capacity, and reducing the need for inputs. Manure is a "dairy nutrient" under Washington State's Dairy Nutrient Management Act. Ch. 90.64 RCW "'Dairy nutrient' means any organic waste produced by dairy cows or a dairy farm operation." RCW 90.64.010 (11)

Livestock operations have the potential to release nitrate, chloride, sulfate, and bacteria to surface or groundwater. (Harter, et al., 2002; Harter et al., 2008; Harter, et al., 2014; Park et al., 2012; Unc et al., 2012) Whether groundwater contamination occurs depends on contaminant characteristics,

management practices, meteorological conditions, soil types, geological conditions, and groundwater characteristics. (Viers et al., 2012) Contaminant sources can be animal holding areas, manure storage impoundments (either lagoons or settling ponds/basins), and manure applications to cropland. (Harter, Davis, Mathews, and Meyer 2002)

The national statistical average of manure production of milk cows (in 2000) was 15.24 tons per animal unit of manure excreted per year. The national statistical average of nitrogen per ton of manure excreted is 10.69 pounds of nitrogen per ton. (Kellog, et al., 2000). The formulas used by the EPA to calculate animal manure production, nitrogen production and losses due to volatilization or denitrification (EPA, 2012c, attributable to WSDA) in the Yakima Valley are as follows:

> Annual manure production is calculated using the following formula: [((# of milking cows)*1.4*108) + ((# of dry cows)*1.4*51) + ((# of heifers)*0.97*56) + ((# of calves *0.33*83)]*365/2000 (WSDA 2010)
>
> Nitrogen production is calculated using the following formula: [((# of milking cows)*1.4*.71) + ((# of dry cows)*1.4*.3) + ((# of heifers)*0.97*.27) + ((# of calves *0.33*.42)]*365/2000 (WSDA 2010)
>
> Losses due to volatilization or denitrification during storage are estimated at 35 percent. This does not include application losses.

The effects of livestock operations on groundwater quality are addressed through the Clean Water Act's regulations and Washington's Dairy Nutrient Management Act. DOE has authority under Washington's Water Pollution Control Act to enforce the Clean Water Act. Voluntary financial and technical assistance programs are available from the National Resource Conservation Service to eligible landowners and agricultural producers to help them manage natural resources in a sustainable manner.

Washington's Dairy Nutrient Management Act (DNMA) (Ch. 90.48 RCW) authorizes WSDA to "protect water quality from livestock nutrient discharges," and to "help maintain a healthy agricultural business climate." Dairies that are licensed to sell Grade A milk and who generate large quantities of animal waste that can pollute surface water and ground water must have an "approved" Nutrient Management Plan (NMP) on site within six months after licensing. The plan must be "certified" within two years after licensing. (RCW 90.64.026) The purpose of such plan is to prevent the discharge of livestock nutrients to surface and ground waters of the state. An employee of the South Yakima Conservation District often writes the NMP. "Approved" means the local conservation district has determined that the facility's plan to manage nutrients meets all the elements identified on

a checklist established by the Washington Conservation Commission. Certified means the local conservation district has determined all plan elements are in place and implemented as described in the plan. To be certified, both the dairy operator and an authorized representative of the local conservation district must sign the plan. Dairies whose NPDES permits require dairy nutrient management plans need not be otherwise "certified." "Farm Plans," developed and approved by local conservation districts for farmers, must include "livestock nutrient management measures." RCW 89.08.560. Local conservation districts also provide dairies with technical assistance and planning services with which to implement nutrient management plans.

Local Conservation Districts are authorized to provide dairies and other farms with technical assistance and planning services (RCW 89.08.560) and are required to approve and certify all NMPs. "Farm Plans" developed by conservation districts for farmers must include "livestock nutrient management measures" RCW 89.08.560. The South Yakima Conservation District (SYCD) often writes the NMPs for dairy farms and later certifies them.

The primary goal of an NMP is to protect water quality from dairy nutrient discharges. The required elements of an NMP specified by the State Conservation Commission include the collection, storage, transfer and application of manure, waste feed and litter, and any potentially contaminated runoff at the site. Plans should focus on management of nitrogen, and phosphorus as well as preventing bacteria and other pollutants, such as sediment, from reaching surface or ground water. Excess nutrients must be exported off site.

The elements of a dairy nutrient management plan must include methods and technologies of the nature prescribed by the Natural Resources Conservation Service, a department of the U.S. Department of Agriculture RCW 90.64.026(3).

Nutrient management plans are required to be maintained on the farm for review by WSDA inspectors. The DNMA requires that all dairies be inspected for implementation of their nutrient management plans and to ensure protection of waters of the state. Most dairies keep their NMP and associated sampling data on location.

WSDA's regulations implementing the DNMA are published at chapter 16-611 WAC. WAC 16-611-010 defines "agronomic rate" as "the application of nutrients to supply crop or plant nutrient needs to achieve realistic yields and minimize the movements of nutrients to surface and ground waters." The same section defines "Nutrient" as "any product or combination of products used to

supply crops with plant nutrients including, but not limited to, manure or commercial fertilizer." The phrase "transfer of manure" is defined as "the transfer of manure, litter or process waste water to other persons when the receiving facility is in direct control of application acreage, rate or time, and transfer rate and time.

Dairy producers must maintain records to demonstrate that applications of nutrients to crop land are within acceptable agronomic rates. Those records should demonstrate that applications of nutrients to the land were within acceptable agronomic rates. Soil analysis should include annual postharvest soil nitrate nitrogen analysis; triennial soil analysis that includes organic matter; pH, ammonium nitrogen; phosphorus, potassium; and electrical conductivity. Nutrient analysis is required for all sources of organic and inorganic nutrients including, but not limited to, manure and commercial fertilizer supplied for crop uptake. Manure and other organic sources of nutrients must be analyzed annually for organic nitrogen, ammonia nitrogen, and phosphorus.

Nutrient application records should include field identification and year of application, crop grown in each field where the application occurred, crop nutrient needs based on expected crop yield, nutrient sources available from residual soil nitrogen including contributions from soil organic matter, previous legume crop, and previous organic nutrients applied, date of applications, method of application, nutrient sources, nutrient analysis, amount of nitrogen and phosphorus applied and available for each source, total amount of nitrogen and phosphorus applied to each field each year; and the weather conditions twenty-four hours prior to and at time of application. Manure transfer records, including imports or exports should include date of manure transfer, amount of nutrients transferred, the name of the person supplying and receiving the nutrients, and a nutrient analysis of manure transferred. Irrigation water management records should include field identification and the total amount of irrigation water applied to each field each year.

The GWMA's Livestock/CAFO Working Group found consensus that DNMPs are important tools for managing nitrate concentrations in groundwater within the GWMA but was unable to reach consensus whether alternative or additional regulatory approaches should be implemented.

b. Concentrated Animal Feeding Operations

The Clean Water Act's regulations (40 CFR, Part 122) define dairies with 750 or more animals and feedlots with 1,000 or more animals as Large Concentrated Animal Feeding Operations

(CAFO). Large CAFOs are defined as point sources of water pollution if they can or do discharge to surface waters, becoming subject to the National Pollutant Discharge Elimination System (NPDES) requirement for permit. However, unlike other point sources that have continuous or regular discharges to surface waters, CAFOs are not considered to automatically have a surface water discharge. Consequently, they may be required to obtain an NPDES CAFO permit only if they have a discharge or potential to discharge. The DOE administers the CAFO permit, decides when a facility is required to apply for a permit, approves the nutrient management plan that is required under the permit and is responsible for enforcing the permit.

In Washington, the NPDES permit program, including the CAFO permit, is the responsibility of the DOE. On February 3, 2017, the DOE announced its reissuance of a new CAFO NPDES and a new State Waste Discharge (SWD) General Permit. These permits became effective on March 3, 2017, and expire March 2, 2022. They were reissued as two separate permits, the CAFO SWD General Permit (state permit) and the CAFO NPDES and SWD General Permit (combined permit). The state and combined permits regulate the discharge of pollutants such as manure, litter, or process wastewater from CAFOs into waters of the state. The state permit conditionally authorizes discharges to groundwater only. The combined permit conditionally authorizes discharges to surface and groundwater, including agricultural stormwater. Coverage under a general permit will be available to facilities that meet the definition of a CAFO and that have a discharge or that voluntarily apply for permit coverage.

The CAFO permit requires large-scale livestock operations in Washington to implement specific practices to better protect groundwater, rivers, lakes and marine waters from manure pollution. Discharges conditionally authorized by the CAFO permit must not cause or contribute to a violation of water quality standards.

The DOE has the authority to decide when a facility is required to apply for a permit, approves the nutrient management plan that is required under the permit and is responsible for enforcing the permit. DOE issued a CAFO General permit in 2006 that covered five of the 69 dairies in Yakima County. None of the 11 small or medium sized dairies in the county were considered CAFOs and were not covered by the prior CAFO permit.

The permittee is prohibited from discharging manure, litter, feed, process wastewater, other organic by-products, or water that has come into contact with manure, litter, feed, process wastewater, or other organic by-products, to surface waters of the state from the production area except when:

> 1. Precipitation events cause an overflow of manure, litter, feed, process wastewater, or other organic by-product management and storage facilities which are designed, constructed, operated, and maintained to contain all manure, litter, feed, process wastewater, and other organic by-products including the contaminated runoff and direct precipitation from a 25-year, 24-hour rainfall event for the location of the facility and still have lagoon design freeboard;
>
> And,
>
> 2. The production area is operated in accordance with the applicable inspection, maintenance, recordkeeping, and reporting requirements of this permit.

Also, a permittee is prohibited by the permit from discharging manure, litter, feed, process wastewater, or other organic by-products from their land application fields, unless the discharge is generated only by precipitation, not caused by human activities during the precipitation, and the permittee is otherwise in compliance with the permit. The permit establishes production area runoff controls, including the requirement that the permittee must keep manure, litter, and process wastewater from being tracked out onto public roadways. If manure, litter, process wastewater, or other sources of pollutants are tracked out onto public roadways, the permittee must clean-up the material tracked onto the roadway.

The permit establishes conditions related to solid manure, litter, and feed storage, composting facilities, above and below-ground infrastructure, diversion of clean water, prevention of direct contact between animals and water, handling of chemicals, management of dead animals, sampling and analysis of manure, litter, process wastewater, and other organic by-products, and soil sampling.

The permittee must land-apply manure, litter, process wastewater, or other organic by-products in accordance with their yearly field nutrient budgets and at the appropriate rates and times. If the permittee generates more manure, litter, process wastewater, or other organic by-products than the land application fields available to the permittee can appropriately utilize according to their yearly field nutrient budgets, the permittee must find other avenues of appropriately utilizing the excess manure, litter, process wastewater, or other organic by-products e.g., export, composting. The permittee's staff must have sufficient training to be able to land apply in accordance with the yearly field nutrient budgets and at appropriate rates and times to comply with permit conditions.

The permittee must manage the application irrigation water so that the amount of water applied from precipitation and irrigation does not exceed the water holding capacity in the top two feet of soil, thereby preventing the downward movement of nitrate.

The permittee must use field discharge management practices on their land-application fields to limit discharge of manure, litter, process wastewater, and other organic by-products to down-gradient surface waters or to conduits to surface or ground water.

The permittee is permitted to "export" manure, i.e., to relinquish control of how the manure is used. When exporting manure, the permittee must provide the most recent manure, litter, process wastewater, or other organic by-product nutrient analysis to the recipient as part of export. The permittee must keep records of its manure exports.

The GWMA's Livestock/CAFO Working Group found consensus that the DOE's reissued CAFO permits are an affirmative action in addressing groundwater nitrate concentrations within the GWMA, but did not find consensus whether the conditions contained in the reissued CAFO permits are overly, satisfactorily, or insufficiently restrictive.

The elements of a NMP must include methods and technologies of the nature prescribed by the Natural Resources Conservation Service (NRCS), a department of the U.S. Department of Agriculture. RCW 90.64.026(3).

NRCS provides technical assistance to farmers and other private landowners and managers. NRCS has six mission goals: high quality, productive soils, clean and abundant water, healthy plant and animal communities, clean air, an adequate energy supply, and working farms and ranchlands.

NRCS helps landowners develop conservation plans and provides advice on the design, layout, construction, management, operation, maintenance, and evaluation of recommended, voluntary conservation practices. NRCS activities include farmland protection, upstream flood prevention, emergency watershed protection, urban conservation, and local community projects designed to improve social, economic, and environmental conditions. NRCS conducts soil surveys, conservation needs assessments, and the National Resources Inventory to provide a basis for resource conservation planning activities.

NRCS conservation practice standards contain information on why and where the practice is applied, and sets forth the minimum quality criteria that must be met during the use of that practice.

State conservation practice standards are available through the Field Office Technical Guide (FOTG). NRCS believes that nutrient management for the protection of groundwater, although different on each farm, is best accomplished through best management practices beginning with those stated in Standards 590, 449 and 313.

Ch. 90.64 RCW does not require that the best management practices recommended by the NRCS be followed. Nutrient Management Plans are required to be maintained on the farm for review by inspectors. The DNMA requires that all dairies be inspected for implementation of their Nutrient Management Plans and to ensure protection of waters of the state. Most dairies keep their NMP and associated sampling data on location.

The DNMA does not authorize the WSDA to compel nutrient management consistent with NMPs. Representatives of the WSDA state that most "enforcement" is accomplished through the "soft enforcement" efforts that the Department accomplishes through its administrative activities under its Dairy Nutrient Management Program.

Although "farm plans" are not subject to disclosure under Washington's public records law, (RCW 42.56.270 (17)), 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 NPDES permit are disclosable under Washington's public records law (Ch. 42.56 RCW), but 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; and (5) crop yields. The ranges of the information required to be disclosed by the public disclosure law (Ch. 42.56 RCW) are set forth in the WSDA's rules implementing that law and Ch. 90.64 RCW, WAC 16-06-210 (29).

c. Waste Storage Facilities (Lagoons)

Liquid manure stored in lagoons can be a source of nitrate and other contaminants. Contents of lagoons often consist of liquid manure (including urine), rainfall and snowmelt, any other liquid corral runoff, and process water from feeding pens and milking areas. Design, construction and management of lagoons are all very important for the protection of groundwater. In studying dairy, beef, and swine lagoons, researchers found substantial variation in the composition of solids, liquids

and dissolved constituents and leakage rates causing a wide variation in the potential to impact groundwater quality. (Ham 2002, Harter et al., 2014, Vander Schans et al., 2009)

The distinction between a lagoon, a settling basin, a settling pond, or a pond can be hard to clarify. Different professionals use different terms for different manure storage impoundments, and different impoundments may be used for different purposes at different times of year. Producers may mix manure and water in additional ponds before land application.

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 impoundments that are drained and cleaned as needed. Some ponds are concrete lined, engineered basins, which would make using permeabilities for a clay lined impoundment inappropriate.

Lagoon nitrogen concentration depends on farm practices and unit operations on site. Operational differences are often related to whether a dairy uses a flush or scrape system to clean barns, the type of solids separation systems utilized and whether irrigation water is mixed with liquid manure for land application, and potential seasonal effects.

Under the 2017 CAFO permit, the permittee must have adequate storage space for the manure, litter, process wastewater, feed, and any other sources of pollutants on-site during the storage period for the area where the CAFO is located. Lagoons and other liquid storage structures built, expanded, or having major refurbishment e.g., complete emptying and re-compaction to restore the earthen liner done after the issuance of this permit must achieve a permeability of $1x10^{-6}$ cm/s without consideration for manure sealing and there must be a minimum of two feet of vertical separation between the bottom of the lagoon (measured from the outside of the earthen liner) and the water table, including seasonal high water table. Lagoons must be inspected, maintained as to structure and volume, and permanently decommissioned when closed.

d. Animal Holding Areas or Corrals

Animal holding areas or corrals at animal feeding operations are typically unvegetated areas that include pens, freestalls, corrals, and resting and feeding areas. Some areas have extensive concrete and other areas are dominated primarily with a flooring or surface of unlined and compacted soil that can be susceptible to leaching or runoff to contaminant areas. If properly constructed and maintained,

concrete floor surfaces can contain wastes and minimize leaching. Corral surfaces become compacted with use and become dense enough to slow down the downward movement of water and pollutants. Manure accumulating on the surface mixes with the soil layer and forms a low-permeability interface layer that further reduces the permeability of corral and pen surfaces. (Harter et al., 2014, Mielke et al., 1974, Miller et al., 2008) Nitrogen loading from corrals and pens at dairy and feedlot facilities is governed by engineered sloping, soil type, dairy or feedlot age, unsaturated zone thickness, stocking rate, rainfall, and evapotranspiration rates. In some situations, increased short-term leaching in corrals may occur due to cracking during seasonal weather events.

e. Pens and Composting Areas

There are 2,632 acres within the GWMA identified by WSDA as pens or composting areas. (1,597 acres Dairy CAFO, 499 acres Nondairy CAFO, 536 acres compost). The nitrogen loading rates of pens vary depending upon number and size of stock contained within them and the management of those pens. Nitrogen leaching potential in pens and compost areas is mitigated by low annual precipitation and management of the amount of manures in those pens. Beef cattle feedlots and dairies have different number of animals per-lot. The majority of pens that have been identified as non-dairy CAFOs are most 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 and adult cows may be moved into that same corral or pen.

Management practices are required on the site of dairy CAFO pens, such as maintaining an intact layer between the cattle and the underlying ground to inhibit leaching through the surface of the pen, changes in precipitation and evapotranspiration from season to season, and animal density rates

"Composting," which as a term may refer to a category of activities rather than a specific practice or technology, may occur in windrows, composting in bags, spreading material out over a concrete pad or large surface area to dry, turning frequency, potential moisture additions to material that has dried out. Composting reduces the weight of the basic material. Composted waste can be desired by organic growers as a source of additive to soil structure, soil density, nutrient and weed defoliant.

WSDA, although it does not regulate dairy waste composting, reports that a number of dairies compost their manure on site. 30% to 40% of that composted material is exported out of Yakima

Valley. Limiting factors are the costs of processing and loading. Generally, liquids are applied close to dairies, solids can be transported mid-range and compost may be moved further, due to weight reduction.

f. Buildings Housing Animals

Animals may spend time in freestall barns, milking parlors or loafing sheds. These facilities are built with concrete floors and are cleaned multiple times a day. Potential leaching from these types of buildings, even anticipating cracks in concrete floors that could provide a pathway to leaching, is much smaller than potential from pens and lagoons.

g. Administration and Enforcement

The WSDA's regulations implementing the DNMA are published at chapter 16-611 WAC. WAC 16-611-010 defines "agronomic rate" as "the application of nutrients to supply crop or plant nutrient needs to achieve realistic yields and minimize the movements of nutrients to surface and ground waters."

The WSDA's mission under the DNMA is to "protect water quality from livestock nutrient discharges" and to "help maintain a healthy agricultural business climate." The DNMA does not authorize the WSDA to compel nutrient management consistent with dairy nutrient management plans, Washington's Water Pollution Control Act authorizes the DOE to "bring any appropriate action, in law or equity, including action for injunctive relief . . . as may be necessary to carry out the provisions of that Act (RCW 90.48.037), including its prohibition of the discharge of organic or inorganic matter that may cause pollution of ground or surface water. (RCW 90.48.080)

The WSDA encourages compliance by providing technical assistance as a first step as required by RCW 43.05, but when that is not successful the WSDA has authority under both RCW 90.64 and RCW 90.48 and has informal (warning letters and notices of correction) and formal (civil penalties and orders) enforcement tools available.

In 2013-2014, WSDA issued 17 notices of correction, one order, and 11 notices of penalty for discharges of pollutants to surface waters, statewide, as well as 122 warning letters and 27 notices of correction for potential to pollute. WSDA usually begins with informal enforcement, using warning letters and notices of correction, then proceeding to formal enforcement through civil penalty or administrative order. Most penalties include a settlement process including reduction in

penalty, requirements to adopt specific management practices, to abstain from discharge and collection of entire penalty in the event of non-performance.

Washington's Water Pollution Control Act authorizes the DOE to "bring any appropriate action, in law or equity, including action for injunctive relief . . . as may be necessary to carry out the provisions of that Act (RCW 90.48.037), including its prohibition of the discharge of organic or inorganic matter that may cause pollution of ground or surface water. (RCW 90.48.080)

DOE and WSDA signed a Memorandum of Understanding (MOU) in 2003 to guide coordination and cooperation between the two agencies for dairies, CAFOs and other animal feeding operations. A key element of the MOU is that WSDA inspectors must provide field inspections and technical assistance to DOE for CAFO and other AFO related water quality activities. The two agencies continue to coordinate on livestock and manure related complaints and in implementing the CAFO permit. An updated MOU was signed in 2009. The MOU can be found at

http://agr.wa.gov/FP/Pubs/docs/MOUAgricultureEcology2011Final.pdf

Under the MOU, DOE is responsible to EPA for Clean Water Act compliance for AFOs and CAFOs. DOE maintains authority under Ch. 90.48 RCW to take compliance actions on any livestock operations where human health or environmental damage has or may occur due to potential or actual discharges, for pasture or rangeland based operations, for manure spreading operations when it is determined the manure was not applied by a dairy, for non-dairy AFOs, CAFOs and permitted CAFOs, and ultimately for permitted dairies. Where compliance actions are against non-permitted dairies, DOE recognizes WSDA as lead. Where DOE is involved in investigations and compliance actions against non-permitted dairies, DOE will discuss the compliance actions with WSDA to ensure that timely compliance actions are sufficient to protect human health and the environment. DOE is responsible for the approval of best management practices used to show compliance with water quality standards. DOE must provide available monitoring data and trend analysis for livestock related pollutants to WSDA upon request. DOE's TMDL process must involve WSDA as a stakeholder if livestock issues are anticipated.

The DOE/WSDA MOU requires that both agencies provide the other all livestock related records that either may possess as necessary to fulfill state and federal requirements for livestock under the Clean Water Act (MOU ¶ C.2), and that the two agencies will coordinate in response to public disclosure requests for AFOs, CAFOs and dairies. (MOU ¶ C.4)

WSDA is responsible for implementing Ch. 90.64 RCW and is required to follow Ch. 43.05 RCW. WSDA is responsible for inspections and may initiate compliance actions on permitted dairies, but must notify DOE if there is a discharge to waters of the state and provide a Recommendation for Enforcement. WSDA is responsible for inspections, complaint response and warning letters for all non-dairy permitted CAFOs. DOE is responsible for complaint response for non-dairy AFOs and CAFOs but WSDA may respond for initial complaint response if resources are available and may write warning letters. WSDA must coordinate, but seldom becomes involved with DOE when compliance actions beyond warning letters are necessary for non-dairy AFOs and CAFOs or permitted CAFOs. WSDA must enter complaint inspections and warning letters on non-permitted AFOs and CAFOs into DOE's PARIS database.

NRCS offers voluntary financial and technical assistance programs to eligible landowners and agricultural producers to help them manage natural resources in a sustainable manner. Those under contract with NRCS to participate in voluntary programs must adhere to relevant standards for funded projects. Current financial assistance programs in Washington State include:

- Agricultural Management Assistance (AMA): helps agricultural producers use conservation to manage risk and solve natural resource issues through natural resources conservation.
- Conservation Stewardship Program (CSP): helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resources concerns.
- Environmental Quality Incentives Program (EQIP): provides financial and technical assistance to agricultural producers in order to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation or improved or created wildlife habitat.

Washington's Right to Farm Law

Washington State's right to farm law, RCW 7.48.300-320, was first enacted in 1979, with the purpose of protecting agricultural activities conducted on farm and forest lands from lawsuits sounding in nuisance. As a consequence, "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." RCW 7.48.305 (1) The defense does not apply however if "the activity or practice has a substantial adverse effect on public health and safety." "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." RCW 7.48.305 (2) In 2005, Washington's right to farm law was amended to provide for full recovery of costs of litigation in the defense of nuisance suits where the right to farm law was a successful defense. RCW 7.48.315

Residential, Commercial, Industrial and Municipal Groundwater Quality Regulation

Residential and non-residential Onsite Sewage Systems (OSS) are present throughout the Lower Yakima Valley Ground Water Management Area (LYV GWMA) outside of those areas served by municipal sewage collection and treatment systems. Outside of the municipal sewage systems, OSS provide some level of sewage treatment and disposal for both residential and non-residential activities. Residential OSS are especially common in and near the urban growth boundaries of many of the valley's municipalities. Non-residential OSS are scattered throughout the project area serving a variety of public and private entities. OSS comprise one of the several potential sources contributing nitrate-N to the underlying shallow alluvial groundwater system.

Non-agricultural sources of potential contamination of groundwater within the GWMA boundaries include the following:

a. Residential Onsite Sewage Systems (ROSS)

Residential Onsite Sewage Systems (OSS) are present throughout the Lower Yakima Valley Ground Water Management Area (LYV GWMA) outside of those areas served by municipal sewage collection and treatment systems. Residential OSS are especially common in and near the urban growth boundaries of many of the valley's municipalities. Non-residential OSS are also scattered throughout the project area serving a variety and public and private entities. OSS comprise one of the several potential sources contributing nitrate-N to the underlying shallow alluvial groundwater system.

"Septage" is "the mixture of solid wastes, scum, sludge and liquids pumped from within septic tanks, pump chambers, holding tanks and other OSS components." WAC 246-271A-0010 The total nitrogen content of septage generated in the GWMA varies under individual circumstances. An area-wide average is not available.

WAC 246-272A-0270 provides that the owner of an OSS is responsible for its operation, monitoring, maintaining, repairing, altering or expanding an OSS. The owner must also assure that an evaluation of a simple gravity septic system's components happens at least once every three years and that an evaluation of all other systems occurs every year. The solids and scum must be pumped from the septic system by an approved pumper generally every three to five years or whenever necessary. (EPA 2002) The septic system must not be covered by structures or impervious material. Surface drainage must be trained away from the septic system. The soil above the drain field should not be compacted by vehicles or livestock. Information about the septic system should be disclosed to any future buyer of the property.

There are 6,044 residential households within the GWMA that discharge wastewater to an onsite sewage system. 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.

The highest density of OSS is within and near urban growth areas associated with municipalities. Specifically:

- The highest density of OSS are found on the east and north side of Sunnyside where OSS density ranges from 80 to 100 OSS per section.
- West of Sunnyside near Outlook where OSS density approaches 80 OSS per section.
- In the Zillah to Buena area where density approaches 80 OSS per section.
- Slightly lower OSS density is found south of Grandview, Sunnyside, and Mabton where the OSS range from 50 to 70 per section.

Density of 1-10 ROSS per section are considered to be low density, 11-40 ROSS per section is considered medium density, and over 40 ROSS per section are considered to be high density by the EPA.

The frequency of septic tank pumping in each ROSS in the GWMA is unknown. In a survey conducted by Yakima County, without statistical sampling methodology, 82 percent of 458 surveys collected indicated that they had had their "septic tank pumped recently."

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 soil and the environmental conditions of the soil through which the wastewater percolates. Wastewater parameters, such as levels of nitrogen, are removed to varying degrees. Under good conditions (and proper operation and management), 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 groundwater. 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 2002) Within the GWMA, moderate denitrification occurs about three months a year and poor denitrification occurs about three months (soil saturated and no warmth). These factors determine that the total denitrification average in the GWMA is in the range of 10 to 13 percent.

Conventional ROSS technology relies on primary treatment (settling) for solids and organic reduction prior to dispersion to the ground. Innovative ROSS technologies combine the primary treatment with biological treatment to achieve a higher level of treatment. The biological processes promote the removal of nitrogen from wastewater through the multi-step bacterial conversion of ammonia and organic nitrogen to nitrates (nitrification) and the reduction of nitrates to gaseous nitrogen (denitrification). The optimum nitrogen removal of properly operating conventional ROSS technology is up to 20 percent. The projected nitrogen removal of properly operating innovative ROSS technology could be up to 50 percent.

The predominant soil types underlying the ROSS drain fields located within the GWMA are characterized as silt loams that are porous and have a well-developed structure. The estimated depth to groundwater is equal to or greater than 10 feet at approximately 90 percent of the ROSS locations.

It is reasonable to assume that the environmental conditions underlying the drain fields are conducive to some level of denitrification.

The location, design, installation, operation, maintenance, and monitoring of OSS is regulated by Chapter 246-272A WAC. The chapter is intended to coordinate with other statutes and rules for the design of OSS under Chapter 18.210 RCW and Chapter 196-33 WAC.

A local board of health must apply to the state DOH to approve local regulations. They must be at least as stringent as the regulations of the state department WAC 246-272A-0015 (9), (10).

The minimum liquid volume for a septic tank serving a single-family residence containing three or fewer bedrooms is 900 gallons. A septic tank serving a single-family residence containing four bedrooms may be 1,000 gallons. Each bedroom after that requires an additional 250 gallons of septic capacity. The actual size of each ROSS within the GWMA is unknown. Permitting for septic systems is done by the Yakima Health District. That agency is also authorized by WAC 246-272A-0015 (5) to "develop a written plan that will provide guidance to the local jurisdiction regarding development and management activities for all OSS within the jurisdiction." The elements of the plan are listed in the WAC.

The local health officer may require the owner of a failing OSS located within 200 feet of a public sewer service to hook up to that system WAC 246-272A-0025. Design specifications for OSS tanks are located at WAC 246-272C.

The amount of land necessary for the installation of an onsite sewage (septic) tank varies depending upon soil type. Table X in WAC 246-272A-0320 establishes the minimums. Table V in WAC 246- 272A-0220 describes the soil types.

TABLE X (WAC 246-272A-0320)

Minimum Land Area Requirement
Single-Family Residence or Unit Volume of Sewage

	Soil Type (defined by WAC 246-272A-0220)

Type of	1	2	3	4	5	6
Public	0.5 acre	12,500 sq. ft.	15,000 sq. ft.	18,000 sq. ft.	20,000 sq. ft.	22,000 sq. ft.
	2.5 acres					
Individual, on each lot	1.0 acre	1 acre	1 acre	1 acre	2 acres	2 acres
	2.5 acres					

TABLE V (WAC 246-272A-220)

Soil Type	Soil Textural Classifications
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding soil types 5 and 6, all soil types with greater than or equal to 90% rock fragments.
2	Coarse sands.
3	Medium sands, loamy coarse sands, loamy medium sands.
4	Fine sands, loamy fine sands, sandy loams, loams.
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate or strong structure (excluding platy structure).
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.

7 Unsuitable for treatment or dispersal	Sandy clay, clay, silty clay, strongly cemented or firm soils, soil with a moderate or strong platy structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays.

b. Large Onsite Sewer Systems (LOSS)

A LOSS is a septic system having a design volume over 3,500 gallons. Washington State Department of Health records show that there are two LOSS located within the GWMA. One is located outside of Zillah with a design capacity of 5,000 gallons. The second LOSS site is located outside of Granger with a design capacity of 4,850 gallons. Annual reports for LOSS are submitted to the DOH.

Regulations for large on-site sewage (septic) systems (LOSS) are found at WAC 264-272B.

c. Commercial Onsite Sewer Systems (COSS)

A COSS is a septic system used for employees working at agricultural or other businesses that operate year-round and are not classified as a LOSS by the DOH. The most likely locations of these facilities within the GWMA are wineries, schools, agriculture packing lines, small businesses (stores, fire stations), agricultural business offices and maintenance buildings, churches, and confined animal feeding operations (CAFOs).

d. Biosolids

Biosolids are a nutrient rich soil amendment derived from public waste treatment plant septage. Septage is a class of biosolids that comes from septic tanks, treatment works and similar systems receiving domestic wastes. WAC 173-308-050. Biosolids are produced by treating sewage sludge to meet certain quality standards that allow it to be applied to the land for beneficial use.

The DOE's biosolid program is administered independently of other agencies, but coordinated with health districts. Land application of biosolids requires pre-approval of application rates that are based upon agronomic crop requirements. Permittees receive coverage under a statewide general permit. Permit coverage is mandated for those who produce and/or land apply biosolids. The DOE's regulatory program incorporates site specific approvals with specific testing and analysis procedures, development of land application plans that prescribe specific practices and prohibitions, and a review and approval process for land application of the wastewater solids. Land application may only occur on permitted sites with pre-established buffers and setbacks. Application rates require advance approval based on pre-plant soil tests, evaluation of

crop type and yield estimates, soil types, use of irrigation. Intermittent post-harvest tests are also conducted. Permittees receive coverage under a statewide general permit. Permit coverage is mandated for those who produce and/or land apply biosolids. The DOE's regulatory program incorporates site specific approvals with specific testing and analysis procedures, development of land application plans that prescribe specific practices and prohibitions, and a review and approval process for land application of the wastewater solids. Land application may only occur on permitted sites with pre-established buffers and setbacks. Application rates require advance approval. Intermittent post-harvest tests are also conducted. The single site approved for land application of biosolids within the GWMA is Natural Selection Farms, 6800 Emerald Road, Sunnyside. Yakima County also receives some biosolids and County landfills.

e. Residential Lawn Fertilizers

Residential lawns exist primarily within towns or urban growth areas within the GWMA. Anecdotal evidence indicates that not all residents fertilize their lawn regularly, and some do not fertilize their lawns at all. Rough estimates are necessary to evaluate how much nitrogen is applied within the GWMA to residential lawns. Nitrate accumulation in the groundwater is not just a matter of nitrogen application rates but also water application rates. While not everyone fertilizes regularly, overwatering occurs at municipal properties, including residences, schools and businesses, particularly if they water daily. Both can have an effect on the loading of even a small amount of nitrogen. Higher population density areas can have a higher percentage of lawn area and the associated potential for more fertilization and overwatering that could be a factor in N loading.

There are no known laws or regulations regarding homeowner maintenance of residential lawns. There are also no known laws or regulations regarding municipal maintenance of parks or grounds.

f. "Hobby Farms"

The term "hobby farm" is intended to mean a land, which may or may not contain a residence, other than lawns, upon which minimialist agriculture is maintained without the intention of profit. It may contribute nitrogen within the GWMA area. These land uses are on parcels of land less than 10 acres that are not included in the WSDA's crop inventory. Nitrogen contributions on these parcels may come from individual gardens, pastures, pets, and other animals. Co-location of septic drain fields and hobby farming operations, particularly animal farming operations, may cause drain field failure and reduction of denitrification potential.

There are no known laws or regulations regarding maintenance of animals or herbaceous material on "hobby farms."

Underground Injection Wells

Part C of the Federal Safe Drinking Water Act (SDWA), 42 U.S.C. §300h-3, regulates underground injection wells (UIC). Washington's regulations about UIC are found at WAC 173-218. Most UIC's in Yakima County are road based and county-owned, put in place to receive surface water runoff from county roads.

Yakima County's Role in Groundwater Quality Protection

Yakima County's role in groundwater quality protection is enabled by Washington's Growth Management Act (GMA) and the State Environmental Policy Act (SEPA).

Growth Management Act

The GMA, primarily codified in Ch. 36.70A RCW, requires counties and cities planning under the act to adopt comprehensive plans and development regulations consistent with the GMA. The GMA establishes goals to guide the development and adoption of comprehensive plans and development regulations of those counties, like Yakima, that are required or choose to plan under RCW 36.70A.040. Relevant goals include:

> (5) Encourage economic development . . . that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, promote the retention and expansion of existing businesses and recruitment of new businesses, recognize regional differences impacting economic development opportunities, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
>
> (8) Maintain and enhance natural resource-based industries, including . . . agricultural . . . industries. Encourage the conservation of . . . productive agricultural lands, and discourage incompatible uses.
>
> (10) Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water. RCW 36.70A.020
>
> The GMA requires that:
>
> Each comprehensive plan shall include a plan, scheme, or design for each of the following: A land use element designating the proposed general distribution and general location and extent of the uses of land, where appropriate, for agriculture, timber production, housing, commerce, industry, recreation, open spaces, general aviation airports, public utilities, public facilities, and other land uses. The land use element shall include population densities, building intensities, and estimates of future population growth. The land use element shall provide for protection of the quality and quantity of groundwater used for public water supplies." (RCW 36.70A.070(1) Emphasis supplied.)

The GMA identifies both agriculture and groundwater quality as protectable resources. GMA recognizes the importance of rural lands and rural character to Washington's economy, its people, and its environment. Rural lands and rural-based economies enhance the economic desirability of the state, help to preserve traditional economic activities, and contribute to the state's overall quality of life. (RCW 36.70A.011). The statute also recognizes that, in order to retain and enhance the job base in rural areas, rural counties must have flexibility to create opportunities for business development. Rural counties must have the flexibility to retain existing businesses and allow them to expand. Not all business developments in rural counties require an urban level of services. Many businesses in rural areas fit within the definition of rural character.

When defining the county's rural element, a county should foster land use patterns and develop a local vision of rural character that will: help preserve rural-based economies and traditional rural lifestyles; encourage the economic prosperity of rural residents; foster opportunities for small-scale, rural-based employment and self-employment; permit the operation of rural-based agricultural, commercial, recreational, and tourist businesses that are consistent with existing and planned land use patterns; be compatible with the use of the land by wildlife and for fish and wildlife habitat; foster the private stewardship of the land and preservation of open space; and enhance the rural sense of community and quality of life. (RCW 36.70A.070(5))

RCW 36.70A.030 (15) defines "Rural character" as the:

"Patterns of land use and development established by a county in the rural element of its comprehensive plan:

(a) In which open space, the natural landscape, and vegetation predominate over the built environment;

(b) That foster traditional rural lifestyles, rural-based economies, and opportunities to both live and work in rural areas;

(c) That provide visual landscapes that are traditionally found in rural areas and communities;

(d) That are compatible with the use of the land by wildlife and for fish and wildlife habitat;

(e) That reduce the inappropriate conversion of undeveloped land into sprawling, low-density development;

(f) That generally do not require the extension of urban governmental services; and

(g) That are consistent with the protection of natural surface water flows and groundwater and surface water recharge and discharge areas.

"Rural development" means: development outside the urban growth area and outside agricultural, forest, and mineral resource lands designated pursuant to RCW 36.70A.170. Rural development can consist of a variety of uses and residential densities, including clustered residential development, at levels that are consistent with the preservation of rural character and the requirements of the rural element. Rural development does not refer to agriculture or forestry activities that may be conducted in rural areas. (RCW 36.70A.030 (16))

"Rural governmental services" includes: those public services and public facilities historically and typically delivered at an intensity usually found in rural areas, and may include domestic water systems, fire and police protection services, transportation and public transit services, and other public utilities associated with rural development and normally not associated with urban areas." (RCW 36.70A.030 (17))

Yakima County enacted its Comprehensive Plan (*Plan 2015*) in 1997. On June 27, 2017, the Board of County Commissioners approved Ordinance 4-2017, adopting an updated Comprehensive Plan, *Horizon 2040*. In both plans, three separate chapters – 2) Natural Setting, 5) Land Use and 9) Utilities – include goals and policies related to water quality. *Horizon 2040*'s goals and policies are implemented through various titles of Yakima County Code. Yakima County's zoning code, YCC Title 19[3], applies to all of unincorporated Yakima County. Table 19.10.020-1 lists the zoning classifications applicable throughout the unincorporated areas. Table 19.14-1 lists which specific land uses are allowed within particular zoning districts. Each permitted use is subject to a particular level of review: Type 1 - permitted; Type 2 - administrative review; Type 3 - conditional; Type 4 - quasi-judicial review. YCC 19.30.030

Yakima County's Agriculture (AG) Zoning District is by far the most prevalent use district in the Lower Yakima Valley, followed by the Remote/Extremely Limited Development Potential (R/ELDP) district on the ridges and along the Yakima River, Valley Rural (VR) on the Valley floor, and some Rural Transitional (RT) Zoning Districts near the cities and towns. The AG zone allows a broad array of agricultural uses under Type 1 review, including: Animal Feeding Operations, land application of soil amendments or agricultural waste at agronomic rates. CAFOs are allowed in the AG and R/ELDP zones under Type 2 review and by Type 3 hearing review in the VR. New or expanding CAFOs, feedlots and other agricultural uses may be subject to environmental review

under the State Environmental Policy Act (SEPA) depending upon the size of the proposal and whether the project falls below SEPA's flexible exemption thresholds.

The Growth Management Act requires counties to designate critical areas. (RCW 36.70A.060(2), 170(d)) "Critical areas" include the following areas and ecosystems: (a) wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas; (d) frequently flooded areas; and (e) geologically hazardous areas. "Fish and wildlife habitat conservation areas" do not include such artificial features or constructs as irrigation delivery systems, irrigation infrastructure, irrigation canals, or drainage ditches that lie within the boundaries of and are maintained by a port district or an irrigation district or company. RCW 36.70A.030(5) "Development regulations" may be established for critical areas so as to prohibit or refine permitted uses under existing zoning requirements. RCW 36.70A.172(1))

As amended by Yakima County Ordinance 13-2007, the Yakima County Code now addresses regulation of land use within critical areas in Ch. 16C. Application of that chapter to agricultural activities defined in YCC 16C.01.050(3)(a) is limited due to the provisions of RCW 36.70A 700-760. (YCC Title 19 became effective October 1, 2015, replacing YCC Titles 15 and 15A, pursuant to Yakima County Ordinance 7-2013.) Regulation of agricultural activities on designated agricultural and rural lands is retained in Ch. 16A. Critical areas subject to the Shoreline Management Program are addressed in YCC Ch. 16D.

RCW 36.70A.700 through .760 establish a "Voluntary Stewardship Program" (VSP) under which counties may choose to adopt a voluntary practices approach in lieu of protecting critical areas in areas used for agricultural activities through development regulations adopted under RCW 36.70A.060. Yakima County adopted the voluntary practices approach by ordinance. This approach involves the establishment of a "watershed group" to develop a "work plan to protect critical areas while maintaining the viability of agriculture in the watershed." RCW 36.70A.720 (1)

The Growth Management Act requires local jurisdictions to designate and protect areas with a critical recharging effect on aquifers used for potable water, or areas where a drinking aquifer is vulnerable to contamination that would affect the potability of the water. RCW 36.70A and YCC 16C.09.01 (1)

A "critical aquifer recharge area" is an area "with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is

vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge." WAC 365-190-030 (3)

Regulations of the Washington Department of Commerce provide that:

> (2) The quality and quantity of groundwater in an aquifer is inextricably linked to its recharge area. Where aquifers and their recharge areas have been studied, affected counties and cities should use this information as the basis for classifying and designating these areas. Where no specific studies have been done, counties and cities may use existing soil and surficial geologic information to determine where recharge areas exist. To determine the threat to groundwater quality, existing land use activities and their potential to lead to contamination should be evaluated.
>
> (3) Counties and cities must classify recharge areas for aquifers according to the aquifer vulnerability. Vulnerability is the combined effect of hydrogeological susceptibility to contamination and the contamination loading potential. High vulnerability is indicated by land uses that contribute directly or indirectly to contamination that may degrade groundwater, and hydrogeologic conditions that facilitate degradation. Low vulnerability is indicated by land uses that do not contribute contaminants that will degrade groundwater, and by hydrogeologic conditions that do not facilitate degradation. Hydrological conditions may include those induced by limited recharge of an aquifer. Reduced aquifer recharge from effective impervious surfaces may result in higher concentrations of contaminants than would otherwise occur. WAC 365-190-100

Yakima County has prohibited certain uses in critical aquifer recharge areas. YCC. 16C.09.07 Currently, those limitations include:

> (1) Landfills. Landfills, including hazardous or dangerous waste, municipal solid waste, special waste, wood waste and inert and demolition waste landfills;
>
> (2) Underground Injection Wells. Class I, III and IV wells and subclasses 5F01, 5D03, 5F04, 5W09, 5W10, 5W11, 5W31, 5X13, 5X14, 5X15, 5W20, 5X28, and 5N24 of Class V wells;
>
> (3) Wood Treatment Facilities. Wood treatment facilities that allow any portion of the treatment process to occur over permeable surfaces (both natural and manmade);
>
> (4) Storage, Processing, or Disposal of Radioactive Substances. Facilities that store, process, or dispose of radioactive substances;
>
> (5) Mining. Hard rock; and sand and gravel mining, unless located within the mineral resource designation; and
>
> (6) Other Prohibited Uses or Activities:
>
> > (a)Activities that would significantly reduce the recharge to aquifers currently or potentially used as a potable water source;

(b)Activities that would significantly reduce the recharge to aquifers that are a source of significant base flow to a regulated stream.

"Susceptible Groundwater Management Areas," defined as "areas that have been designated as moderately or highly vulnerable or susceptible in an adopted groundwater management program developed pursuant to Chapter 173-100," are among those designated Critical Aquifer Recharge Areas (CARAs). YCC 16C.09.02(3) The Lower Yakima Groundwater Management Area is currently developing such a program, but it has not yet been "adopted."

Unless the VSP work plan to protect critical areas contemplated by RCW 36.70A.720 (1) is first put in place, and adopted within the groundwater management program, those provisions of the Growth Management Act requiring establishment of development regulations within CARAs would not apply to agricultural activities within the CARA. Again, application of the critical areas aspects of the Growth Management Act to agricultural activities defined in YCC 16C.01.050(3)(a) is limited due to the provisions of RCW 36.70A 700-760.

The county commission may also "create one or more aquifer protection areas for the purpose of funding the protection, preservation, and rehabilitation of subterranean water." (RCW 36.36.020) The creation of an aquifer protection area is subject to the vote of residents within a proposed area. Fees imposed within a designated CARA may be used to address:

(1) The preparation of a comprehensive plan to protect, preserve, and rehabilitate subterranean water, including groundwater management programs adopted under Chapter 90.44 RCW. This plan may be prepared as a portion of a county sewerage and/or water general plan pursuant to RCW 36.94.030;

(2) The construction of facilities for: (a) The removal of waterborne pollution; (b) water quality improvement; (c) sanitary sewage collection, disposal, and treatment; (d) storm water or surface water drainage collection, disposal, and treatment; and, (e) the construction of public water systems;

(3) The proportionate reduction of special assessments imposed by a county, city, town, or special district in the aquifer protection area for any of the facilities described in subsection (2) of this section;

(4) The costs of monitoring and inspecting on-site sewage disposal systems or community sewage disposal systems for compliance with applicable standards and rules, and for enforcing compliance with these applicable standards and rules in aquifer protection areas created after June 9, 1988; and,

> (5) The costs of: (a) Monitoring the quality and quantity of subterranean water and analyzing data that is collected; (b) ongoing implementation of the comprehensive plan developed under subsection (1) of this section; (c) enforcing compliance with standards and rules relating to the quality and quantity of subterranean waters; and (d) public education relating to protecting, preserving, and enhancing subterranean waters. RCW 36.36.040

Yakima County's Zoning Ordinance also implements a number of *Horizon 2040*'s policies intended to reduce the number of individual wells approved in the higher density zones.

Washington State Environmental Policy Act

Washington State's Environmental Policy Act (SEPA), Ch 43. 21C RCW, requires state agencies and local governments to consider the environmental implications of potential actions. It is like the National Environmental Policy Act, enacted by Congress in 1970. Using a check list of environmental factors, governmental officials must consider the threshold question whether a potential action has "a probable significant, adverse environmental impact." RCW 43.21C.031 (a) If not, an environmental assessment or determination of non-significance may be published. If so, then an environmental impact statement is required. The environmental impact disclosure process imposed by these requirements is used by local governments exercising their police power in zoning, subdivision or other permitting actions to identify factors militating toward denial of specific development proposals or conditions that may be attached to the approval of those proposals.

When the Yakima County Planning Department receives an application for approval of a particular activity, it circulates a completed checklist of environmental factors to other governmental agencies with jurisdiction of the potential activities in order to solicit their expertise with respect to the anticipated action. Whenever those agencies suggest concerns, those concerns may be incorporated as a basis to deny or impose conditions upon approval of the proposed action.

Yakima Health District

The board of the Yakima County Health District consists of seven members, including three members of the Yakima County Board of County Commissioners and two elected officials of the cities and towns within Yakima County who are appointed by their legislative bodies and two citizens

from within Yakima County with an interest in public health appointed by county commissioners. YCC 6.04.010

The Health District approves the acceptability of site conditions for installation and construction of onsite septic systems. WAC 246-272A-0015(5) requires that the Yakima Health District prepare a written plan to provide guidance to Yakima County regarding development and management activities for all onsite septic systems within the county. At a minimum, the plan should include a description of the Yakima Health District's capacity to provide education and operation and maintenance information for all types of systems in use within the county; a description of how the local health officer will remind and encourage homeowners to complete the operation and maintenance inspection required by WAC 246-272A-0270; and, a description of its capacity to adequately fund its onsite septic system plan.

The Yakima Health District inspects about 50 percent of newly constructed wells, seeking proper bentonite or other sealing, tags, etc. It determines the GPS coordinates of each inspected well and reports the same to the DOE.

WAC 246-272A-0015(9) authorizes the Health District to adopt its own rules for septic systems more stringent than rules adopted by the State DOH, provided that they are approved by DOH.

DRAFT LYV GWMA PROGRAM

GWAC Member Comments

Date:_____ Member Name:_____

Program Section	Page No.	Excerpt Comment Pertains To:	Comment:

Attachment D

2017_1102 Summary of NAA Comments

	WSDA NRAS and Yakima County Summary of Comments for the DRAFT Nitrogen Assessment Report		
Item	Commenter	Comment Summary	Explanation/discussion
1	Mendoza	Report does not assess nitrogen loading to groundwater; the term 'nitrogen loading to groundwater' used in initial scope of work in description of calculation, document no longer titled 'Nitrogen Loading Assessment'.	The term 'nitrogen loading to groundwater' was used in the initial scope of work to describe the objective of the assessment. During the peer review meeting on 4/21/16, in discussion with peer reviewers, the point of analysis of the 'end of effective treatment' was chosen. This depth varies according to nitrogen source, and as a result the assessment does not include an evaluation of nitrogen movement through the soil profile.
2	Mendoza	Geodatabase not submitted to workgroups for review before data input; workgroup review of geodatabase was planned in scope of work.	Comment noted; this step was not conducted.
3	Mendoza	Cross check CAFO and irrigated agriculture mass balance results by comparing manure available for land application to manure applications to cropland; this comparison was planned in the scope of work.	Comment noted; this step to compare CAFO and irrigated agriculture results is not possible because the manure exports to cropland were not assessed. A mass balance was not used for the CAFO calculation, published nitrogen loss rates from other research were used instead. Different methodologies were used for the CAFO and irrigated agriculture sections based on availability of local data.
4	Mendoza	Cross check irrigated agriculture mass balance results by comparing estimated commercial fertilizer applied to commercial fertilizer sales; this comparison was planned in the scope of work.	Fertilizer sales data is not comparable to actual fertilizer applications. The sales data is not publicly available, and often fertilizer is stored rather than used.
5	Mendoza	Did not include population of GWMA in Introduction.	WSDA will add population information for the lower Yakima Valley in the introduction.
6	Mendoza	Some data sources are not available for review without public records requests.	Comment noted. The data sources chosen were used because of the need for local, accurate data. WSDA has attempted to use the best available information in the calculations.
7	Mendoza	Pie chart inputs from irrigated agriculture are wrong. More specifics with irrigated agriculture comments.	Comment noted.
8	Lindsey	More discussion of why each calculation method is used in each chapter, and how different nitrogen sources are related.	WSDA will add more discussion on calculation methods and relationships between nitrogen sources.
9	Lindsey	Recommendations for operators are only included in the CAFO section, not in the irrigated agriculture or RCIM sections - this inconsistency could be corrected by removing from CAFO or adding to other sections.	WSDA will correct this inconsistency.
10	Lindsey	Correct inconsistency - stated in executive summary that report not intended for analysis of small-scale areas, but the usage example demonstrates analysis of small-scale areas.	WSDA will correct this inconsistency.
11	Lindsey	Comparison of GWMA totals and per/acre summary is confusing and includes too much qualifying language.	WSDA will simplify this discussion.
12	Lindsey	Add final summary of nitrogen loss from all sources, with range, evaluation location, constraints, and additional work recommended for each section.	WSDA will add this material to the conclusion.
13	Lindsey	Terms used (loading, transport, available etc.) are inconsistent. Should use consistent terms and/or glossary.	WSDA will edit entire report to make sure terminology is consistent.

	WSDA NRAS and Yakima County Summary of Comments for the DRAFT Nitrogen Assessment Report		
Item	Commenter	Comment Summary	Explanation/discussion
14	Lindsey	Units are used inconsistently. Should use either english or metric, with other unit in parentheses. Consider adding a glossary with conversion factors.	Comment noted. Due to wide variety of data sources with inconsistent units (both english and metric), as well as multiple authors, WSDA believes that maintaining data in reported units and presenting results in both english and metric units is the best solution.
15	Edmondson	From our review, it was not clear from the report what type of Quality Assurance Project Plan (QAPP) WSDA/the county used in the development of the report. We encourage any future iterations to include a QAPP	WSDA appreciates this comment. For the original data collected during the irrigated agriculture survey, there is a completed QAPP. The rest of the report methodology is laid out in the report itself. An overall project QAPP was not completed.
16	Edmondson	The report references work completed under the Yakima Valley Dairies administrative order on consent (AOC) with EPA. Future report updates and additional work can benefit from using existing relevant data developed under the AOC in accordance with EPA-approved QAPPs. For example, the draft report does not appear to account for excess nitrogen in forms of nitrate and ammonia which were measured at excessive levels in the Yakima AOC Dairies' fields.	WSDA appreciated this comment and agrees that any and all relevant work conducted under the AOC could be included in future updates. Lagoon nitrogen concentrations from EPA reports were utilized in this study.
17	Edmondson	Incorporating this information into future analysis can help identify areas where excess nitrogen loading is occurring and could help the state/the county identify specific areas of focus for reducing nitrogen loading.	Agreed.
18	Edmondson	The conclusion of the report indicates that soil organic matter mineralization is a critical information gap. EPA agrees that there is good opportunity to better understand this topic through additional research. The University of Idaho has completed research that shows how the mineralization of nitrogen and changes in soil organic matter over time can be a significant source of nitrogen in the soil, and that these sources of nitrogen are not typically accounted for in the nutrient management planning or budgeting process.	Agreed.
19	Edmondson	We support future efforts to further understand how these process affect the amount of nitrogen in soil in Yakima Valley and encourage the county/WSDA to look at some of research from the University of Idaho and USDA's Agriculture Research Service in Kimberly, Idaho.	Thank you for the comment directing us to further data sources.
	Irrigated Agriculture		
20	Mendoza	Voluntary questionnaire was not circulated to growers to collect application data; this was specified in scope of work.	Given the diversity of crops grown within the GWMA boundaries and the difficulty in conducting a questionnaire survey, WSDA staff used best professional judgment and collected data via anonymous survey rather than mailed questionnaire.

	WSDA NRAS and Yakima County Summary of Comments for the DRAFT Nitrogen Assessment Report		
Item	Commenter	Comment Summary	Explanation/discussion
21	Mendoza, Lyall	The survey data from crop consultants is insufficient (too few sources) and should not be anonymous. This data is overly reliant on single consultants with large acreages who have large influence over results.	See comment above. To note, the data collection methodology used in this study is similar to that used by WSDA to collect pesticide use information throughout the state. That data, even when collected from a small representative group of individuals, compares extremely well to statistically surveyed NASS data collected on the topic.
22	Lyall	Fertilizer guide application rates should be used instead of survey data.	WSDA will review fertilizer guide recommendations and compare and contrast these recommendations with the survey data.
23	Mendoza	Nitrogen fixing for alfalfa should be included as an element in mass balance.	WSDA will research the influence of nitrogen fixing in alfalfa, and update the mass balance and report if necessary and possible with the available data.
24	Mendoza	Report does not include denitrification rates in the vadose zone (related to not assessing nitrogen loading to groundwater).	The scope of this study ends at the bottom of the treatment area (in the case of irrigated agriculture, that is the root zone). This is not intended to assess nitrogen leaching to groundwater, but rather what could be available for transport. Denitrification in the vadose zone is not an appropriate measure for this type of analysis.
25	Mendoza	Report did not compare irrigated agriculture mass balance results to DSS soil testing results.	The deep soil sampling surveys do not cover the wide variety of crops evaluated in the mass balance. Only a few crops in the DSS have enough data to warrant a statistical analysis. In addition, this report only evaluates to the bottom of the root zone (12-18 inches below the surface). The DSS data goes far beyond that depth and is not an appropriate evaluative tool in this assessment.
26	Mendoza	Contributions from organic and inorganic fertilizer were not presented separately.	Comment noted. Due to the way mass balance was calculated, presenting commercial fertilizer, compost, and manure as separate 'pieces of the pie' was not possible. Irrigated ag inputs are presented separately to illustrate the contributions from different fertilizer types.
27	Mendoza	How is double cropped acreage accounted for? Counted once or twice? How does this affect triticale acreage?	WSDA will review accounting of double cropped acreage and update report if necessary.
28	Mendoza, Lyall	Cover crops should be included in the mass balance.	WSDA will review usage of cover crops in the region and evaluate if the mass balance should be updated.
29	Mendoza, Lindsey	Irrigation water nitrogen may be variable depending on source - is this accounted for? This should be accounted for. Include more discussion of the variability of irrigation water nitrogen.	Comment noted. To accurately account for the variability in groundwater nitrogen concentration a randomized sampling of irrigation water sources in the region needs to be completed. More discussion of the implications of varying nitrogen content in irrigation water will be added.
30	Mendoza	There are problems with the calculation for calculated residual nitrogen and N soil conversion for permanent crops.	Comment noted.
31	Mendoza	Crops that receive manure applications and crops that don't should be distinguished when calculating soil organic matter from DSS results.	Comment noted.
32	Mendoza	Nitrogen contribution from animals housed on pasture is not included in mass balance (related to CAFO comment about animals on pasture/range).	Stocking rates on pastures in Yakima County were not available at the time this report was written.

	WSDA NRAS and Yakima County Summary of Comments for the DRAFT Nitrogen Assessment Report		
Item	Commenter	Comment Summary	Explanation/discussion
33	Mendoza	Excluding crops with net deficits from irrigated agriculture nitrogen losses is not appropriate.	Comment noted.
34	Mendoza	Results are summarized by using crops with nitrogen surpluses only and then applying that rate to all the acreage - this does not give a reasonable estimate to include in summary material.	Comment noted.
35	Lyall	For permanent and perennial crops the low application rate should be 0 lb N/ac	Comment noted.
36	Lyall	For pasture the low application rate should be 0 lb N/ac	Comment noted.
37	Lindsey	Explain the presence and implications of negatives in mass balance more clearly - what does this mean about agricultural practices.	WSDA will add more explanation in this section.
38	Lindsey	2015 crop acreages are out of date, especially for hops. Need more discussion of rapid change in cropping systems.	Comment is noted. The report is based on an assessment for one year in time. WSDA will review crops with rapid growth and evaluate if acreages need to be adjusted. WSDA did conduct a specific survey for hops and juice grapes to determine change from 2015 to 2017. Hops (2015) 5961.3 acres increased to 6880.7 (2017); Juice grapes (2015) 10,257.2 acres decreased to 9902.8 (2017). The report could be adjusted in the future for all crops at once. Because some acreage may have shifted from one crop to another, it is not appropriate to selective update crop acreages.
39	Lindsey	Should evaluate potential losses from commercial nitrogen storage onsite at farms and at vendors facilities.	Comment noted. A detailed evaluation from nitrogen storage facilities on-farm and at vendors would require significant additional resources.
40	Lindsey	Discuss how new permit requirements from ECY will address some of these concerns.	WSDA will add information from the recently issued CAFO permit.
	CAFO		
41	Mendoza	Equation specified in scope of work was not used.	Data was not available to complete a mass balance for the CAFO portion of the report. This could be completed in coming years if additional funding and staff resources are made available.
42	Mendoza	Data specified in scope of work was not collected.	Staff leading this project worked to follow the scope of work and gain guidance from the workgroups and Yakima County on how to proceed with certain tasks. Resources and funding were not always available to acheive every task in the scope of work. The document can be updated as more data collection occurs.
43	Mendoza	Literature review was insufficient. Literature review on lagoon leakage rates specifically was insufficient. Mielke 1974 should not be used as a reference.	Mielke 1974 is referenced in this report.
44	Mendoza	Survey of regional manure nitrogen content was specified in scope of work but not conducted.	Staff leading this project worked to follow the scope of work and gain guidance from the workgroups and Yakima County on how to proceed with certain tasks. Resources and funding were not always available to acheive every task in the scope of work. The document can be updated as more data collection occurs.

	WSDA NRAS and Yakima County Summary of Comments for the DRAFT Nitrogen Assessment Report		
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45	Mendoza	Requirements for manure handling at dairies and beef feedlots not surveyed; this was specified in scope of work.	Staff leading this project worked to follow the scope of work and gain guidance from the workgroups and Yakima County on how to proceed with certain tasks. Resources and funding were not always available to acheive every task in the scope of work. The document can be updated as more data collection occurs.
46	Mendoza	Did not coordinate with EPA for dairy cluster lagoon data as specific in scope of work.	The dairy cluster lagoon data was reviewed as part of this study. EPA data for lagoon nitrogen concentrations is included in this report.
47	Mendoza	Manure generation rates based on livestock population data were not evaluated; this was specified in the scope of work.	Staff leading this project worked to follow the scope of work and gain guidance from the workgroups and Yakima County on how to proceed with certain tasks. Resources and funding were not always available to acheive every task in the scope of work. The document can be updated as more data collection occurs.
48	Mendoza	Manure export and third party applicators were not evaluated; this was specified in the scope of work.	Staff leading this project worked to follow the scope of work and gain guidance from the workgroups and Yakima County on how to proceed with certain tasks. Resources and funding were not always available to acheive every task in the scope of work. The document can be updated as more data collection occurs.
49	Mendoza	Lagoon leakage rates based on local data were not developed; this was specified in the scope of work.	The Data Wrokgroup, CAFO workgroup, and GWAC agreed on the lagoon liner permabilities used in this study.
50	Mendoza	Soil testing results not evaluated; this was specified in scope of work.	Staff leading this project worked to follow the scope of work and gain guidance from the workgroups and Yakima County on how to proceed with certain tasks. Resources and funding were not always available to acheive every task in the scope of work. The document can be updated as more data collection occurs.
51	Mendoza	Nitrogen contributions from animals on range and pasture were not evaluated.	Data is not currently available to complete this analysis.
52	Mendoza	Stocking rates WSDA calculated don't match those calculated from USDA NASS data.	Comment noted.
53	Mendoza	Animal numbers for nondairy CAFO pens are not included.	Data is not currently available to complete this analysis.
54	Mendoza	Literature review on compost areas was insufficient. WSDA soil testing data from compost areas should have been used to estimate loading from compost areas.	WSDA evaluated existing data available and determined there wasn't enough soil testing in compost areas to conduct calculations for the report. WSDA soil testing data was used for comparison purposes only.
55	Mendoza	Report should include estimate of nitrogen emissions from CAFO facilities	This study covers nitrogen available for transport on the land surface, which includes nitrogen deposition rates based on available information and modeled data. Nitrogen emissions do not equate with deposition rates and are not appropriate to include.
56	Mendoza	Proportion of cows/acre lagoon surface area should be calculated to compare to UC Davis results.	WSDA will add this calculation to the report.

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57	Mendoza	Lagoon volume and depth are not proportional because of side slope. At depth of 43% of full depth, volume is 37% of full volume.	Comment noted. See Appendix C for a detailed explalnation on lagoon surface area reduction methodology.
58	Mendoza	Were dairy cluster lagoons included?	WSDA will clarify that data from dairy cluster lagoons was included.
59	Mendoza	A higher permeability should be used for low rate nitrogen loss through lagoon liners.	Permeability rates were taken from the literature and agreed upon through the GWAC.
60	Mendoza	Selected liner thickness of 1 foot not appropriate.	This liner thickness is based on available data for the region and literature review.
61	Mendoza	Loading from settling ponds should be calculated.	WSDA did not have data available to conduct this type of calculation.
62	Lindsey	Is nitrogen removed from lagoons and pens during cleaning accounted for? This removed nitrogen is applied to crops - is this material double counted?	WSDA will clarify how cleaning and land application of this material is accounted for.
63	Lindsey	Calculating lagoon nitrogen as total mass instead of concentration would allow accounting for removal during cleaning and also be consistent with other sections.	This choice was based on the information presented in the data sources WSDA based the calculations on.
64	Lindsey	Divide CAFO material into dairy and nondairy sections, in parts it is unclear if report is referring to dairy CAFO, nondairy CAFO, or both.	WSDA will clarify these sections.
65	Lindsey	Why are soil sampling results included when calculation is conducted at interface? This appears to be outside the scope of the report.	WSDA researchers included as much local data as possible, with caveats around limitations and relevance.
66	Lindsey	Were assumptions for Darcy's law (saturated flow, continuous steady flow) met? Typical lagoon operation does not meet these assumptions. Need more discussion of this.	WSDA will clearly discuss assumptions for Darcy's law
67	Lindsey	Discuss variations in fluid viscosity due to seasonal temperature changes and how this affects parameters of Darcy's law.	This is a valid comment and could be included in further study refinement. Variabilites in fluid viscocity were not accounted for in this report.
68	Lindsey	Consider using a range for nitrogen concentration.	At this time calculations for low and high lagoon leakages estimates are based on a difference in lagoon liner permability. It would be possible to complete additional iterations of the estimates with varying lagoon nitrogen concentrations. Additional work to randomly sample lagoon nitrogen concentrations would be the preffered method for determining this range.
69	Lindsey	Does table 3, p 13 reflect varying fullness of lagoons?	These values were taken from various peer reviewed articles and an EPA report. It is assumed that these values reflect varying fullness of lagoons.
70	Lindsey	Does table 5 account for periodic pen cleaning?	WSDA will explain limitations of results and how pen cleaning relates.
71	Lindsey	Most pasture and rangeland is outside GWMA.	WSDA will include more accurate information in text.
72	Edmondson	The 2013 Fall Soil Reports show excessive nitrate levels in many of the dairies' manured application fields. Data are provided for the 1-foot, 2-foot and 3-foot soil depths.	Comment noted. With additional resources an indepth comparison can be made between the soil reports and the findings from this study.

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73	Edmondson	The lagoon assessment memoranda summarize the difficulty of finding available information regarding how the lagoons were constructed. The 90 percent Bosma and DeRuyter lagoon basis of design plans provide data regarding the permeability of soils at some of their lagoons (see Figure 3 and Appendix C in each plan). The data are posted on EPA's website	Comment noted. This suggestion will be added to the recommended next steps to improve the estimates in the conclusions section of the report.
74	Edmondson	EPA encourages the authors to further study the results of the post-harvest deep soil sampling that has been occurring in the Yakima Valley and to evaluate nitrogen inputs by producers in the mass balance in the study. A key component of the mass balance is the accurate representation of the application of nitrogen by producers.	This nitrogen assessment is intended to be a living document and as such, can be updated any time new or better information becomes available. WSDA encourages Yakima County to consider establishing a timeline for periodic updates.
		Atmospheric deposition	
75	Mendoza	Both wet and dry deposition were not evaluated.	Data for both wet and dry deposition were included in the calculations for this chapter.
76	Mendoza	Wet and dry deposition were not evaluated separately.	The data used to construct this portion of the assessment is not specific to Yakima County. The authors felt that combining the totals was appropriate and described that in the report.
77	Mendoza	Removing acreage from atmospheric deposition to avoid double counting makes it hard to evaluate atmospheric deposition as an independent source.	WSDA authors understand and appreciate the comment. Double counting was a concern to the authors and they felt it appropriate to apply the nitrogen loading estimate only to those lands not already covered in the report.
78	Mendoza	Atmospheric deposition estimates are too low.	This estimate is based on best available data and best professional judgment of the state of Washington's atmospheric scientist at Department of Ecology.
79	Lindsey	The plants in the ecosystem will take up much of deposited nitrogen - discuss how this affects loading to groundwater.	WSDA authors understand and appreciate the comment. Further study could include a literature review of data associated with nitrogen uptake of different plant communities (non-cultivated). That would require additional financial and staffing resources.
		RCIM	
80	Mendoza	The report does not include an analysis of Biosolids	Yakima County will include a discussion of Biosolids in the report.
81	Mendoza	UIC's were not addressed in the study.	Yakima County will address UIC's in the study.
82	Mendoza	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.	The report contains the following staement: "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."

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83	Lindsey	The RCIM section has no conclusions or recommendations. Each chapter should have dedicated conclusions/recommendations, or they should all be consolidated in the final chapter.	RCIM conclusions and recommentdations will be added to the report.
84	Lindsey	RCIM Chapter - In the introduction to this chapter we recommend additional discussion of OSS's pertaining to the following: They are designed to leach, whereas most other nitrogen sources are not. While leaching is not relevant to the objective (as we've commented on elsewhere on other topics) it might be worth noting that it occurs.	Comment noted.
85	Lindsey	RCIM Chapter - In the introduction to this chapter we recommend additional discussion of OSS's pertaining to the following: There are several high-density OSS areas in the LYVGWMA, as defined by EPA, EPA defines these densities as <10, 10 to 40, and >40 per square mile, pertaining to low, medium, and high density, respectively. Designating these domains on Figure 11 would illustrate these EPA criteria which EPA considers to be reflective of the risk to groundwater contamination.	Agreed. Yakima County will include this information as a new figure in the report.
86	Lindsey	RCIM Chapter - In the introduction to this chapter we recommend additional discussion of OSS's pertaining to the following: Comment on the importance of maintenance and increase effluent volumes due to seasonal increase in population.	Comment noted.
87	Lindsey	***RCIM Methods:*** In this section, the last few bullets refer to soil type, elevation, and depth to groundwater. How are these relevant to the basic objective of this section which is to estimate nitrogen at the end of the drain field? Suggest the methods focus on how the nitrogen estimate for OSS effluent is determined, and that discussion of soil type, elevation, etc. be removed.	Comment noted.
88	Lindsey	***RCIM Nitrogen Removal by Denitrification:*** This section focuses on denitrification in the soil column, following discharge from the OSS system. This discussion, while important and interesting, is not relevant to the stated objective of the report which is to estimate nitrogen at the drain field (OSS) system discharge point. In addition, the use of soil denitrification to estimate total nitrogen at the point of discharge is using a process downstream of the OSS discharge to estimate the nitrogen concentration at the point of discharge. This doesn't make sense given the stated objective.	The Nitrogen Availability report is looking at "the end of treatment zone". For on-site sewage systems a biomat develops within the drainfield which is anaerobic and fosters denitrification. The biomat is part of the drainfield, which is part of the treatment process.

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89	Lindsey	*OSS Pumping:* The nitrogen removal discussion via OSS pumping is interesting and useful. Given that, shouldn't a similar logic be applied to the lagoon discussion? Generally, lagoons are pumped dry at least once per year, and using the logic in the ROSS discussion, shouldn't this removal be applied to the lagoon nitrogen estimates as a credit.	Although nitrogen removal due to annual lagoon drawdowns was not explicitly included in the lagoon calculations, average lagoon capacity was estimated based on multiple DNMP lagoon assessment visits. These visits took place at different times of year, and would have included both lagoons that were full and lagoons that were near empty or empty, either because they were not in regular use or because they had recently been pumped dry. As a result, the average capacity that was used for the Darcy's Law calculation accounts for lagoons that might have been emptied, although empty lagoons are not explicitly included in the calculation. An explicit accounting for lagoon pumping would mean that relying on the DNMP lagoon assessment capacity estimates to determine average lagoon capacity might undercount lagoon capacity because lagoons that were empty or low (having recently been emptied) would have additional estimated nitrogen removals (based on pumping). This might result in an underestimate of available lagoon nitrogen during the course of the year. OSS were not inspected in various states of capacity like the dairy lagoons were and so estimation of the OSS pumping practices were included in the OSS calculations. Yakima County will keep the OSS pumping calculations in the assessment.
90	Lindsey	RCIM - Page 50, first bullet lists 6,044 households. When we merged two databases acquired from the County for the LYVGWMA we identified over 6,100 different sites. Can the authors explain the apparent discrepancy?	There are 6,044 households using an OSS. The spreadsheet used to calculate the Nitrogren Availability Assessment provided to Mr. Lindsey is/was correct. However, the GIS parcel file sent to Mr. Lidnsey contained several duplicate locations (parcel numbers).

Attachment E

October 19 presentation Map, identifying the GIS layers in the GWMA

Ground Water Management Area Plan

DRAFT DATA

NITRATE mg/l
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 30
- 30 - 100
- GWMA
- General Direction of Groundwater Flow
- Dairies
- Triticale
- Corn Silage
- Triticale and Corn Silage

Tons/Year

N Availability (All Sources)
- 0 - 10
- 10 - 25
- 25 -50
- 50 - 75
- 75 - 114

Assigned Soil Infiltration Rate
- 0.2
- 0.45
- 0.6

2015 WSDA Crop Type
- Alfalfa Hay
- Alfalfa/Grass Hay
- Allium
- Apple
- Apricot
- Asparagus
- Bean, Dry
- Blueberry
- CRP/Conservation
- Caneberry
- Cherry
- Christmas Tree
- Corn, Grain
- Corn, Silage
- Corn, Sweet
- Developed
- Dill
- Driving Range
- Fallow
- Golf Course
- Grape, Juice
- Grape, Table
- Grape, Wine
- Grass Hay
- Green Manure
- Hops
- Iris
- Market Crops
- Mint
- Nectarine/Peach
- Nursery, Lavender
- Nursery, Orchard/Vineyard
- Nursery, Ornamental
- Oat Hay
- Orchard, Unknown
- Pasture
- Pear
- Pepper
- Plum
- Poplar
- Pumpkin
- Rhubarb
- Rutabaga
- Sorghum
- Squash
- Strawberry
- Sudangrass
- Timothy
- Tomato
- Triticale
- Triticale Hay
- Unknown
- Walnut
- Wheat
- Wheat Fallow
- Wildlife Feed

Depth to Groundwater
- 0 - 5 Feet
- 5 - 10 Feet
- 10 - 15 Feet
- 15 - 25 Feet
- 25 - 100 Feet
- 100 - 1,000 Feet

N W E S

0 0.75 1.5 3 4.5 6 Miles

Map Date: August 9, 2017