Yakima AOC Dairies Progress Summary

Yakima Valley, Washington

Presentation Overview

- Nitrate
- The AOC Dairies
- AOC Requirements
- Conceptual site model
- Groundwater data
- Soil data
- Irrigation water management
- Lagoon evaluations
- Contaminated residential wells
- Source control actions
- Looking forward

Nitrate

- Nitrate MCL = 10mg/l
- Acute contaminant - causes methemoglobinemia ("blue baby syndrome") which can be fatal in infants
- Some studies show cancer association in adults, birth defects
- Highly mobile in groundwater
- Documented cases of methemoglobinemia
  - One in Yakima County
  - Five in Benton County

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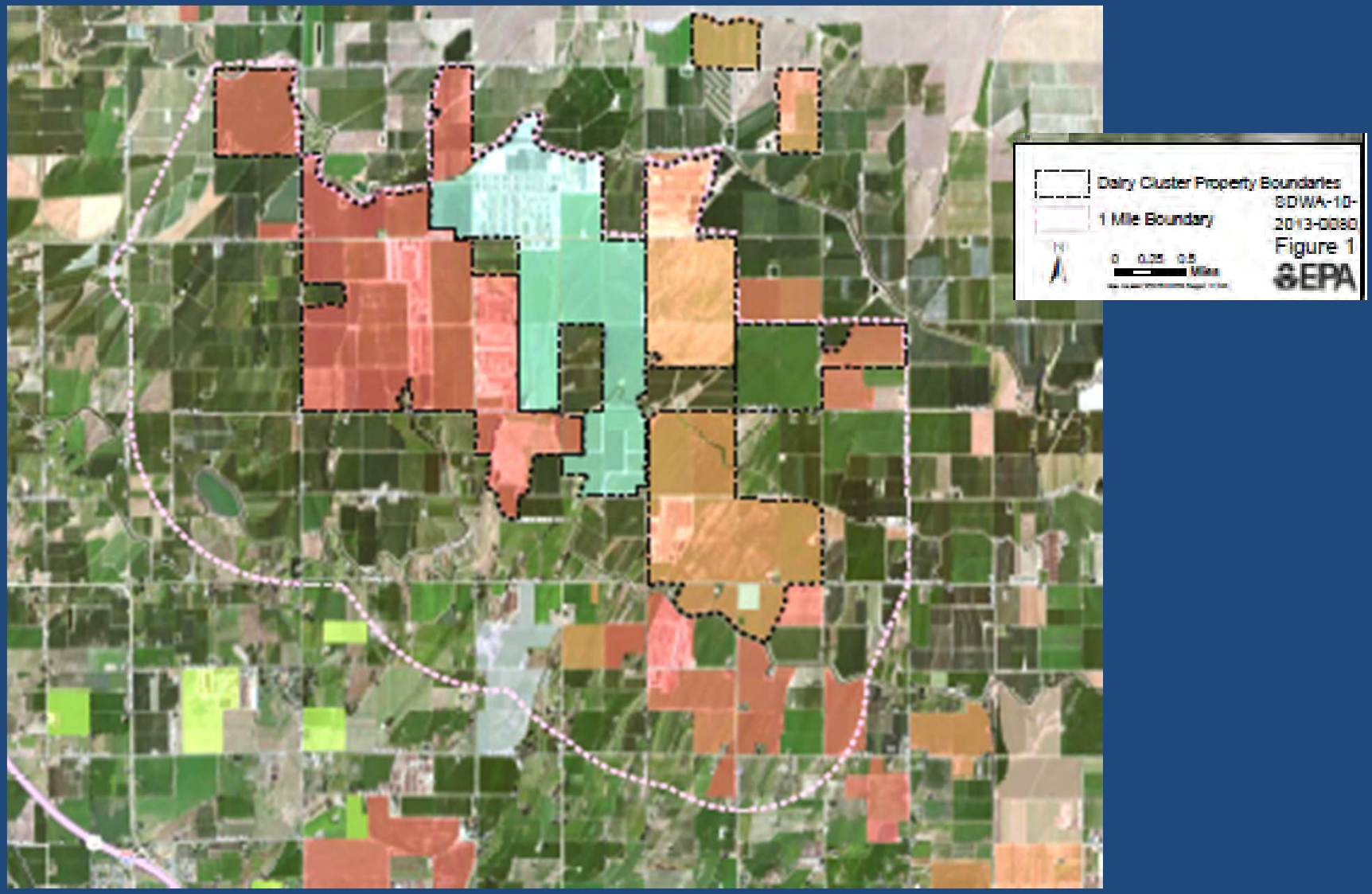
The Dairies


Dairy Cluster Property Boundaries
1 Mile Boundary
0 0.25 0.5
Miles
SDWA-10-2013-0080
Figure 1
EPA

The Dairies

- Selected several dairies with high nitrate levels in downgradient wells
- Large dairies – together:
  - More than 24,000 animals
  - Generate more than 500,000 tons of manure per year
  - Containing more than 3,000 tons of nitrogen per year
  - Their footprint (including application fields) more than 5 square miles

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AOC Requirements

In signing the Consent Order the dairies agreed to:

- Provide an alternate source of drinking water for neighbors within one mile down gradient of the dairies whose wells have levels of nitrate above EPA's drinking water standard of 10 mg/L, or "parts per million" (ppm).
- Conduct soil and groundwater testing at each dairy to evaluate if nitrogen sources are being controlled.
- Take steps to control nitrogen sources (manure and commercial fertilizer) at their facilities.

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SDWA-10-2013-0080
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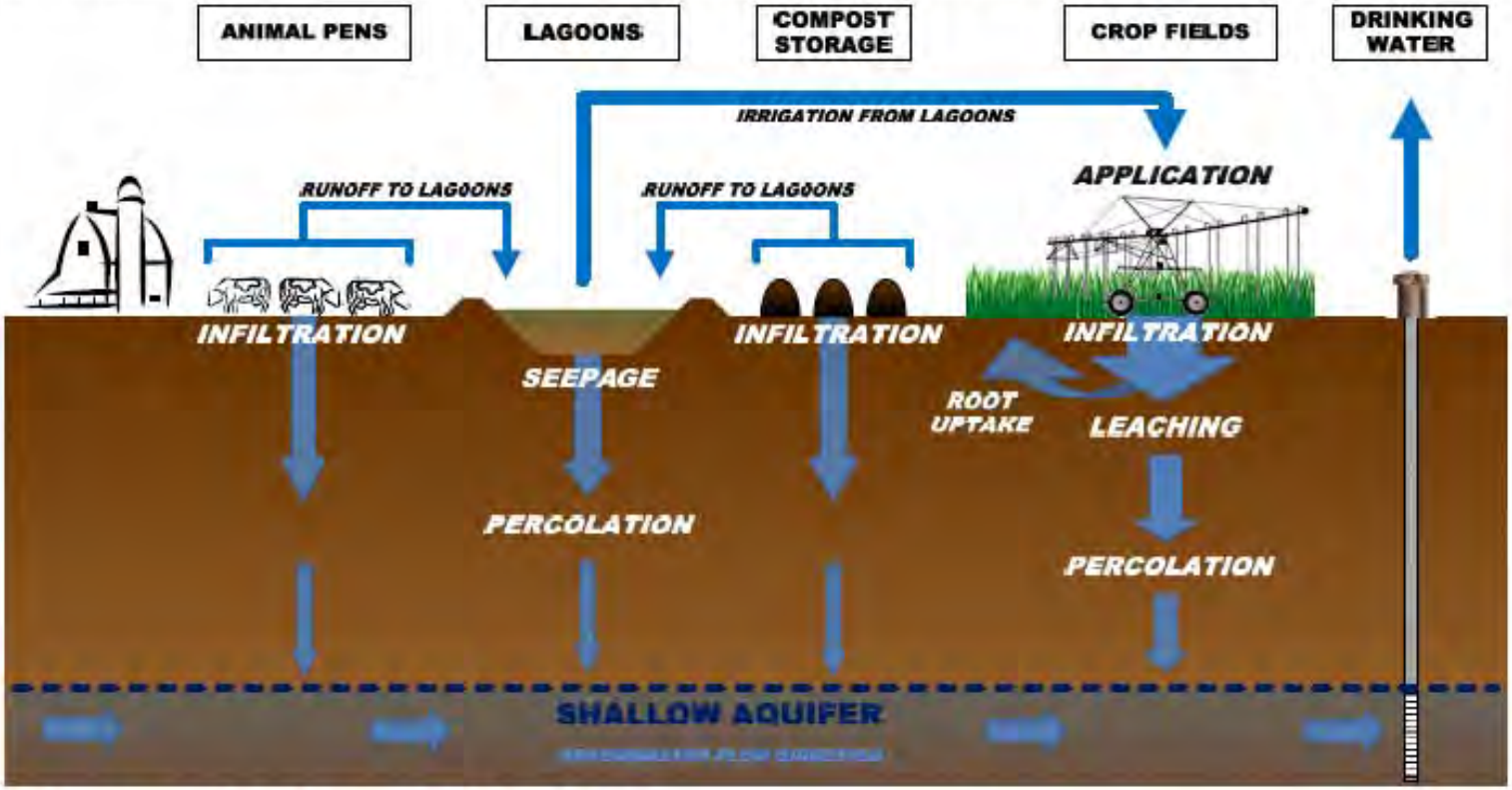

REPRESENTATION ONLY – NOT TO SCALE

YAKIMA VALLEY DAIRIES
SDWA-10-2013-0080
QUARERLY GROUNDWATER MONITORING

CONCEPTUAL SITE MODEL

ARCADIS

FIGURE
5

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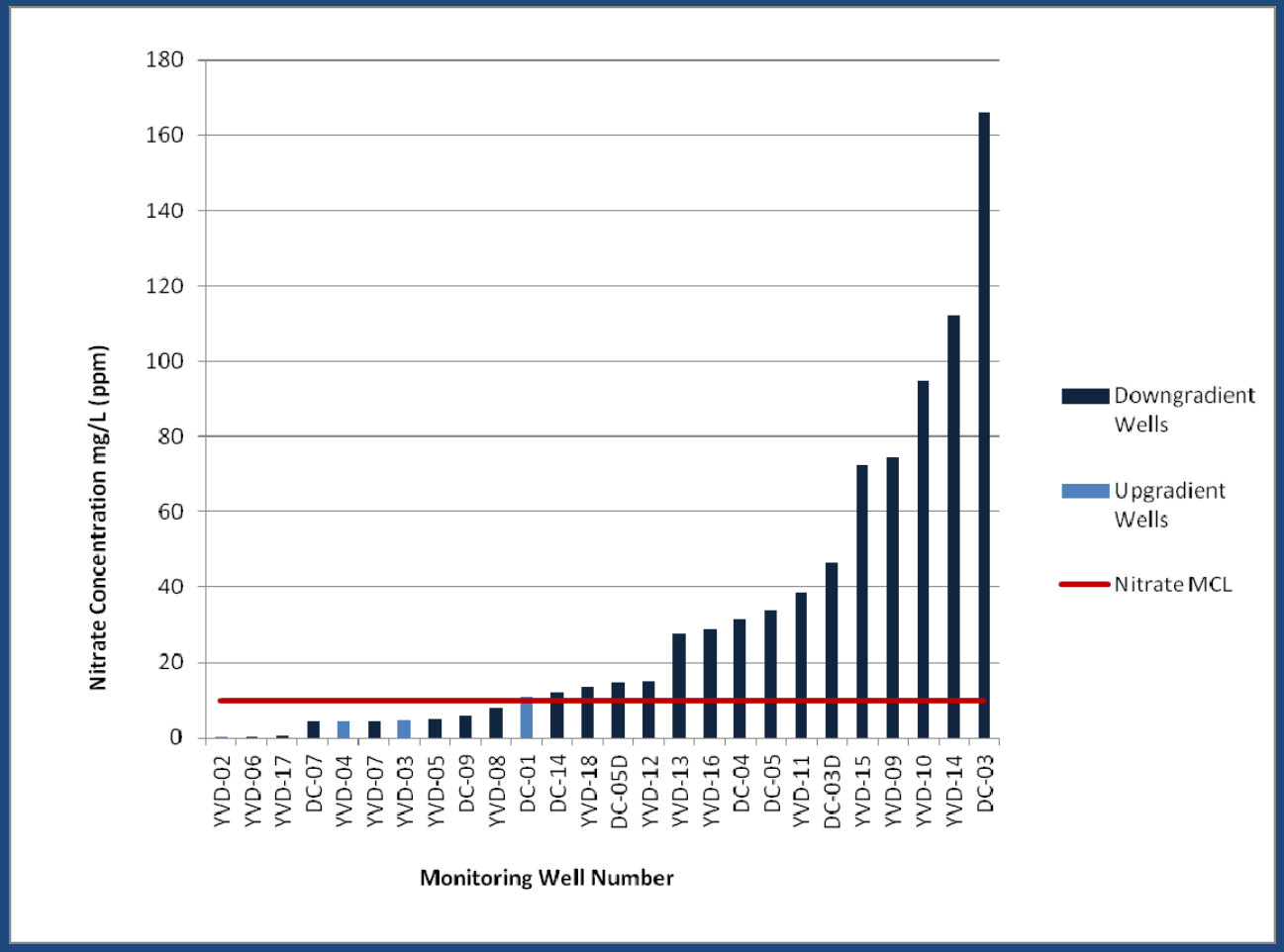
Monitoring Wells

- Monitoring well network to assess effectiveness of source control actions
  - 16 wells in addition to EPA's 7 wells
  - Implement source control actions
  - 8 years of quarterly monitoring
  - Additional source assessment and control actions required if nitrate levels in wells do not decline

– STATUS: WELLS INSTALLED, FIRST FOUR ROUNDS OF QUARTERLY SAMPLING COMPLETED

Monitoring Well Sample Results

Third Quarter 2013



Nitrate Concentrations in Shallow Monitoring Wells: 2014 Second Quarter

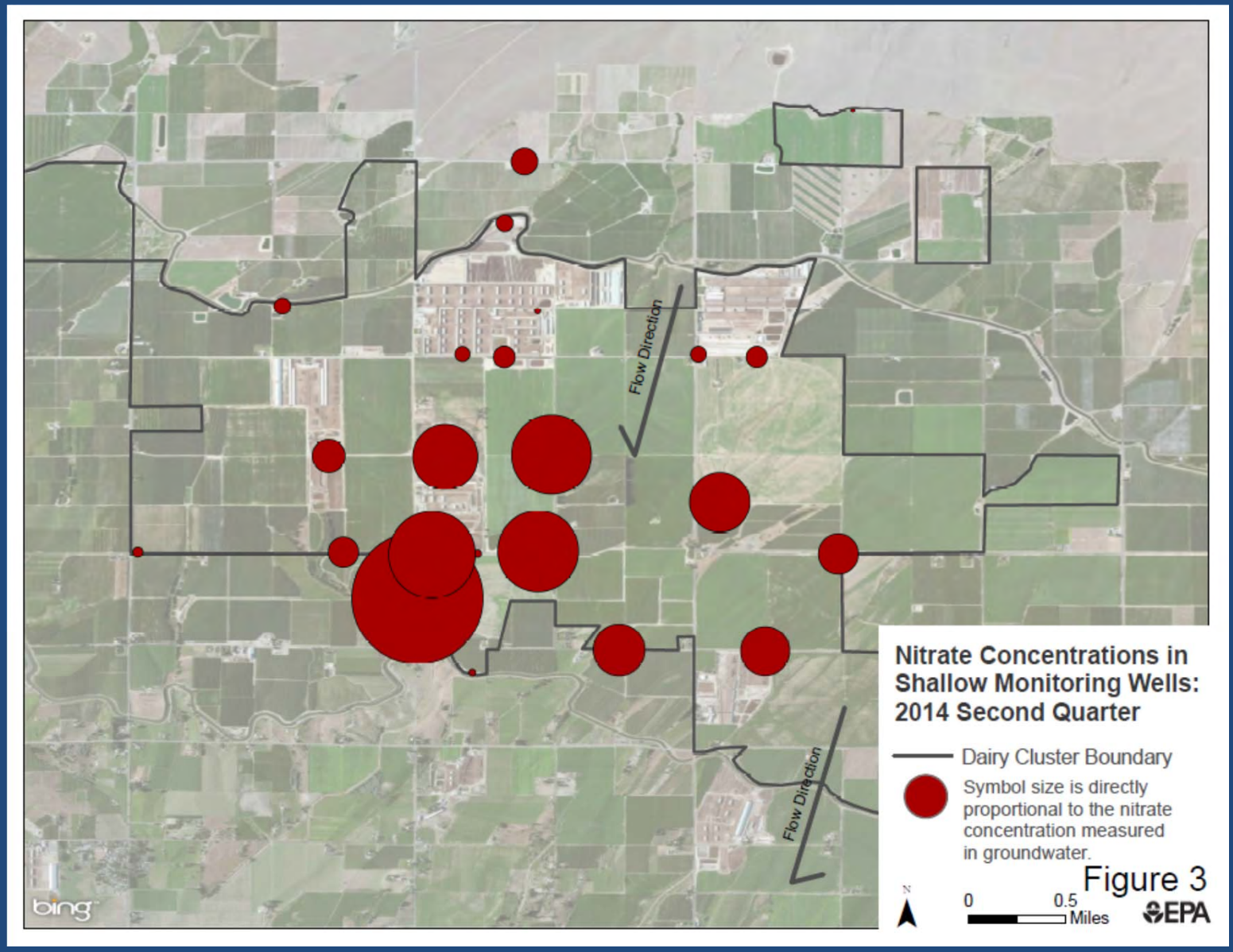
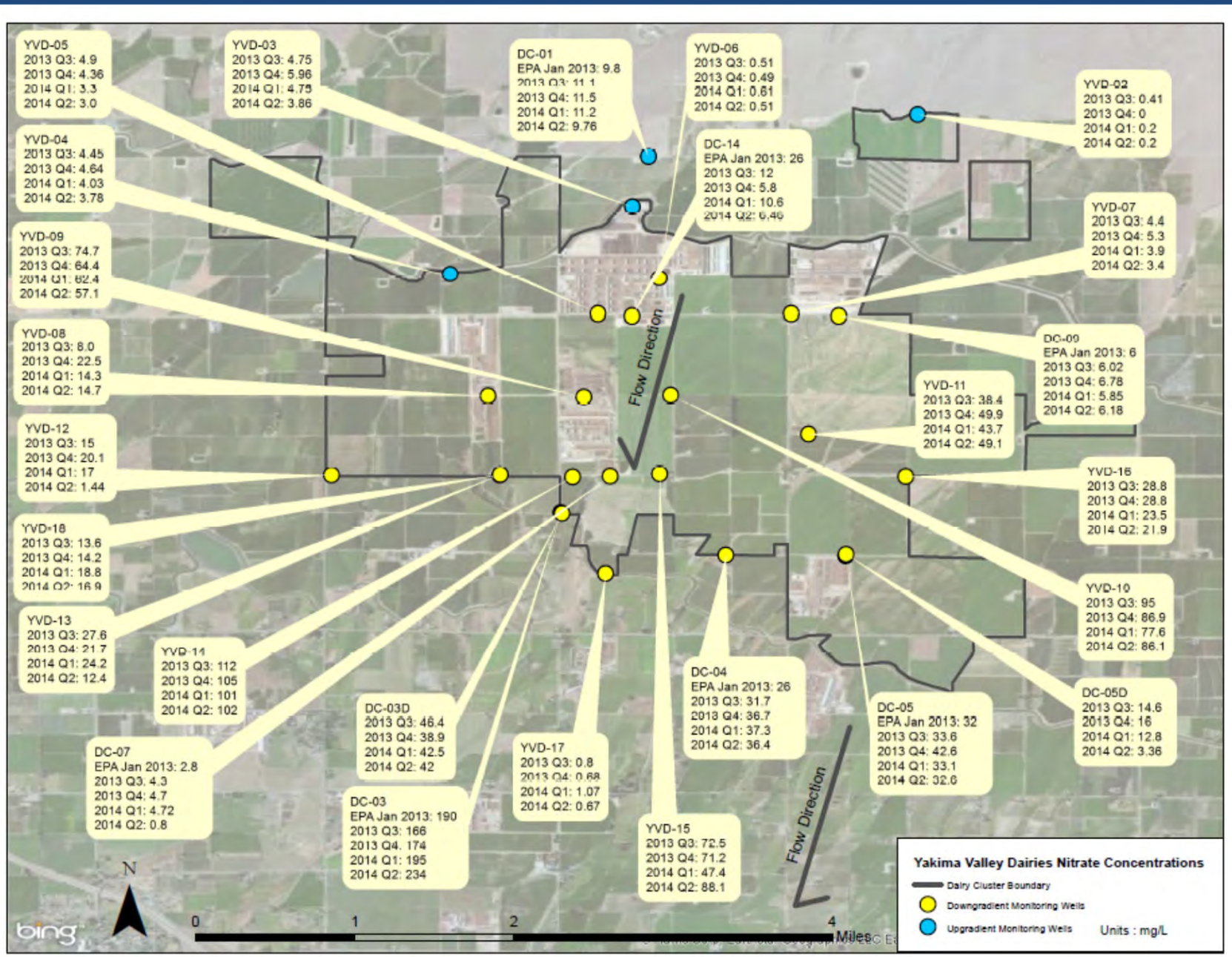


Figure 3


YVD-05
2013 Q3: 4.9
2013 Q4: 4.36
2014 Q1: 3.3
2014 Q2: 3.0
YVD-03
2013 Q3: 4.75
2013 Q4: 5.96
2014 Q1: 4.75
2014 Q2: 3.86
DC-01
EPA Jan 2013: 9.8
2013 Q4: 11.5
2014 Q1: 11.2
2014 Q2: 9.76
YVD-06
2013 Q3: 0.51
2013 Q4: 0.49
2014 Q1: 0.61
2014 Q2: 0.51
YVD-02
2013 Q3: 0.41
2013 Q4: 0
2014 Q1: 0.2
2014 Q2: 0.2
YVD-04
2013 Q3: 4.45
2013 Q4: 4.64
2014 Q1: 4.03
2014 Q2: 3.78
DC-14
EPA Jan 2013: 26
2013 Q3: 12
2013 Q4: 5.8
2014 Q1: 10.6
YVD-07
2013 Q3: 4.4
2013 Q4: 5.3
2014 Q1: 3.9
2014 Q2: 3.4
YVD-09
2013 Q3: 74.7
2013 Q4: 64.4
2014 Q2: 57.1
YVD-08
2013 Q3: 8.0
2013 Q4: 22.5
2014 Q1: 14.3
2014 Q2: 14.7
Flow Direction
DC-09
EPA Jan 2013: 6
2013 Q3: 6.02
2013 Q4: 6.78
2014 Q1: 5.85
2014 Q2: 6.18
YVD-11
2013 Q3: 38.4
2013 Q4: 49.9
2014 Q1: 43.7
2014 Q2: 49.1
YVD-12
2013 Q3: 15
2013 Q4: 20.1
2014 Q1: 17
2014 Q2: 1.44
YVD-16
2013 Q3: 28.8
2013 Q4: 28.8
2014 Q1: 23.5
2014 Q2: 21.9
YVD-18
2013 Q3: 13.6
2013 Q4: 14.2
2014 Q1: 18.8
YVD-10
2013 Q3: 95
2013 Q4: 86.9
2014 Q1: 77.6
2014 Q2: 86.1
YVD-13
2013 Q3: 27.6
2014 Q1: 24.2
2014 Q2: 12.4
YVD-14
2013 Q3: 112
2013 Q4: 105
2014 Q1: 101
2014 Q2: 102
DC-04
EPA Jan 2013: 26
2013 Q3: 31.7
2013 Q4: 36.7
2014 Q1: 37.3
2014 Q2: 36.4
DC-05
EPA Jan 2013: 32
2013 Q3: 33.6
2013 Q4: 42.6
2014 Q1: 33.1
DC-05D
2013 Q3: 14.6
2013 Q4: 16
2014 Q1: 12.8
2014 Q2: 3.36
DC-03D
2013 Q3: 46.4
2013 Q4: 38.9
2014 Q1: 42.5
2014 Q2: 42
DC-07
EPA Jan 2013: 2.8
2013 Q3: 4.3
2013 Q4: 4.7
2014 Q1: 4.72
2014 Q2: 0.8
YVD-17
2013 Q3: 0.8
2014 Q1: 1.07
2014 Q2: 0.67
DC-03
EPA Jan 2013: 190
2013 Q3: 166
2013 Q4: 174
2014 Q1: 195
2014 Q2: 234
YVD-15
2013 Q3: 72.5
2013 Q4: 71.2
2014 Q1: 47.4
2014 Q2: 88.1
Flow Direction
N
0
1
2
4
Miles
Yakima Valley Dairies Nitrate Concentrations
Dairy Cluster Boundary
Downgradient Monitoring Wells
Upgradient Monitoring Wells
Units : mg/L

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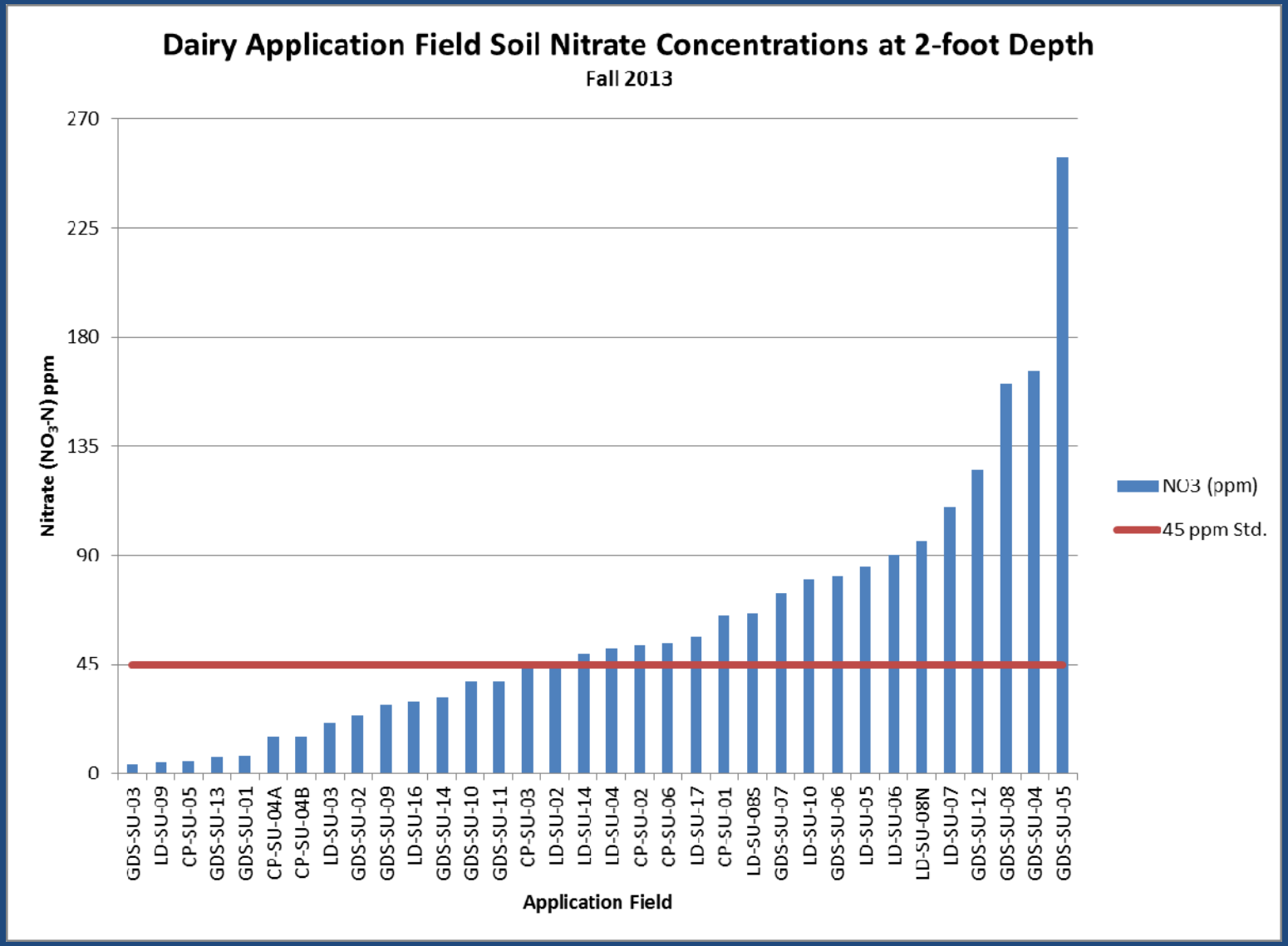
Soil Nitrate Levels in Application Fields

- 34 application fields
- Goal stated in the Consent Order is to maintain soils below 45 ppm soil nitrate at the 2-foot depth
- Consistency with state
- Fall Post Harvest sampling: 1-foot, 2-foot, and 3-foot depth
- Spring Pre-plant: 1-foot and 2- foot depth

Soil Nitrate Levels in Application Fields

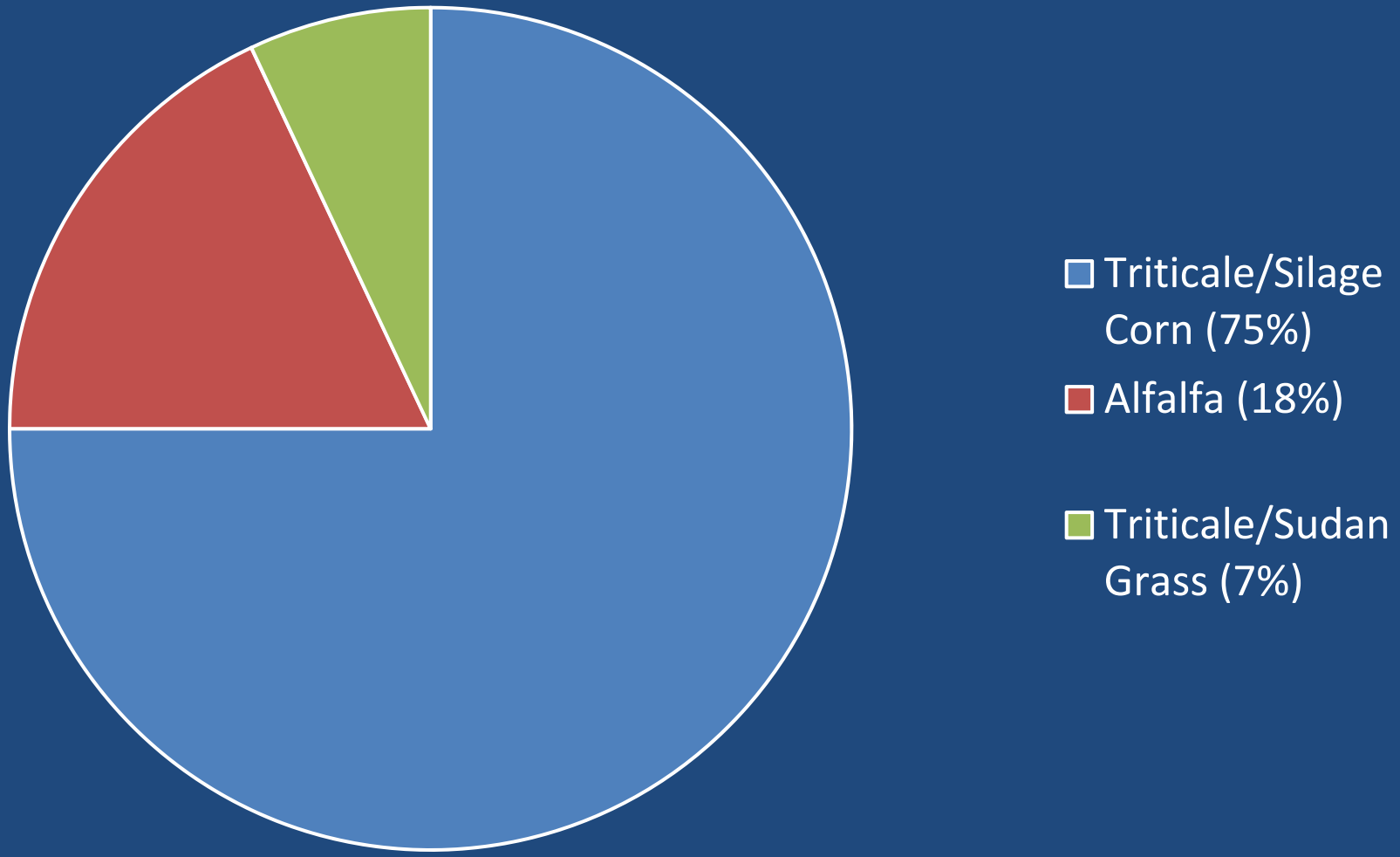


Soil Data Summary

Soil data from 2-foot depth

	Fall 2013	Spring 2014	Both
Number of fields exceeding 45 ppm	20 of 34	15 of 34	12 of 34
Percent of fields exceeding 45 ppm	59%	44%	35%
Percentage of acreage exceeding 45 ppm standard in both Fall and Spring 2014: 52%			

Percent Acreage by Crop Type



Average Soil Nitrate Concentration per Acre by Crop Type

Fall Post-Harvest 2013 Soil Data

	Number of Fields	Percentage of Acreage	1-foot (ppm)*	2-foot (ppm)*	3-foot (ppm)*
Triticale/ Silage Corn	22	75%	99	97	99
Alfalfa	10	18%	20	26	28
Triticale/ Sudan Grass	2	7%	26	27	17
Total	34	100%	--	--	--

Units = parts per million (ppm) = milligrams per kilogram

* Averages are weighted by field size

Pounds of Nitrate per Acre

Estimated averages by crop type

	Corn/Triticale	Alfalfa	Triticale/ Sudan Grass
1-foot depth	396	80	104
2-foot depth	388	104	108
3-foot depth	396	112	68

Units = Pounds per Acre
Fall Post-Harvest 2013 Soil Data

Root Zone Nitrate

Estimated averages by crop type

- Corn/Triticale 784 lbs per acre
- Alfalfa 184 lbs per acre
- Triticale/Sudan Grass 212 lbs per acre

Fall Post-Harvest 2013 Soil Data

Root Zone Nitrate

Post-Harvest 2013

- Corn/Triticale fields 784 lbs per acre

- WSU nitrate fertilizer guideline
  - Corn 150 lbs per acre
  - Triticale 137 lbs per acre
  - Total: 287 lbs per acre

Fall 2013 Soil Summary

- Total acres: 2,306

- Total Nitrate-N

1-foot	310 - 364 tons
2-foot	310 - 365 tons
3-foot	312 - 367 tons

Fall 2013 Soil Summary

- Total acres: 2,306

- Total Nitrate-N

1-foot	310 - 364 tons
2-foot	310 - 365 tons
3-foot	312 - 367 tons

Application Field Management

- Consent Order: Dairies have retained a "certified nutrient management planner, agronomist, or soil scientist with the goal of reducing the soil nitrate level to below 45 ppm at the 2-foot depth."

Proposed Management Changes

• Alfalfa	10 fields
• Other Cropping changes	6 fields
• No application	5 fields
• Reduced application	4 fields

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Irrigation Water Managment

- Soil moisture sensors installed in all application fields below the root zone
- If water detected by sensors, irrigation on that field will stop
- Intended to impede the downward migration of nitrate to the drinking water aquifer

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Lagoons to be Assessed

1 lagoon shown to comply with current NRCS standards

40 lagoons must be evaluated

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Provision of Water Treatment

- 224 residences within 1 mile
- 181 residences tested
  - 63 residences exceeded the MCL
  - Additional 48 already had RO units
- 61% of assessed residences exceeded the MCL
  - Compared to 12 percent across Yakima County
- Water treatment was offered by the Dairies at no charge to all residents whose well exceeded the nitrate MCL

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Status of Source Control Actions

Early source control actions to reduce nitrate loading to the aquifer

- Soil sampling - not to exceed 45ppm nitrate-N below the root zone

  FALL/SPRING SAMPLING COMPLETE
- Test lagoons to ensure they meet current state permeability standard – upgrade

  PLAN UNDER EPA REVIEW
- Automated irrigation water management – water metering and root-zone sensors

  PLAN APPROVED, WATER SENSORS TO BE INSTALLED PRIOR TO 2015 IRRIGATION SEASON

Source Control (cont.)

- Phase out furrow irrigated fields COMPLETE
- Minimize ponding of manure in pens COMPLETE
- Backflow prevention COMPLETE
- Actions to reduce infiltration from solid separator, silage storage COMPLETE
- Assessment of area upgradient of monitoring well DC-03 UNDER DEVELOPMENT

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Looking Forward: Monitoring

- 8 years monitoring to assess downward trend
  - Soil nitrate levels at depth
  - Monitoring wells nitrate

Looking Forward: Additional Source Control

Provision for additional source control measures if groundwater monitoring shows no improvement over time

- Source investigation
- Source control plan(s)


EPA Yakima Dairies website:
http://yosemite.epa.gov/R10/WATER.NSF/GWPU/lyakimagw
AOC plans & reports ftp://ftp.epa.gov/reg10ftp/sites/yakima/

Phase 1: Percent of Nitrogen Produced by Source