

Tuesday, July 1, 2025 at 10:20:53 Pacific Daylight Time

Subject: FW: Washington's soil nitrate numbers
Date: Monday, June 30, 2025 at 12:04:51 PM Pacific Daylight Time
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Attachments: Washington.zip

Hi Sunny,

FYI my correspondence with Carl at DEQ.

Renee

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Subject: Washington's soil nitrate numbers

Hi Carl,

Thank you again for the discussion this morning and for your comments on the rule. Your input is very helpful and appreciated.

Per the information you requested, attached is Washington's Concentrated Animal Feeding Operation General Permit which include the numbers that Washington uses to determine whether a person is applying too much N in the first 12 – 24 inch soil depth (see pp. 30 – 33).

I also include the journal articles that Washington referenced in developing these tables.

Carey B. 2002. Effects of land application of manure on groundwater at two dairies over the Sumas–Blaine surficial aquifer: implications for agronomic rate estimates. Washington State Department of

Ecology, Olympia, Washington. Publication

Number 02-03-007. <https://fortress.wa.gov/ecy/publications/documents/0203007.pdf>

Carey, B. and J. Harrison. 2014. Nitrogen Dynamics at a Manured Grass Field Overlying the Sumas-Blaine Aquifer in Whatcom County. Washington State Department of Ecology, Olympia, Washington. Publication No. 14-03-001.

<https://fortress.wa.gov/ecy/publications/documents/1403001.pdf>

Hopefully talk again soon –

Renee

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Washington
State Department of
Agriculture

Estimated Nitrogen Available for Transport in the Lower Yakima Valley Groundwater Management Area

**A Study by the Washington State
Department of Agriculture
and Yakima County**

WSDA authors:

Gary Bahr, Perry Beale, Margaret Drennan, Jaclyn Hancock,
and Kelly McClain

Yakima County authors:

Cynthia Kozma, Michael Martian, and Vern Redifer, P.E.

June 2018

AGR PUB 103-691 (N/6/18)

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Publication and Contact Information

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Acknowledgements

Dairy producers:

- voluntarily shared manure testing results with South Yakima Conservation District
- invited WSDA NRAS staff onto their farms to sample soil in pens and compost areas
- invited WSDA NRAS staff onto their farms to learn about operational practices

Irrigated Agriculture Working Group

- reviewed irrigated agriculture methodology and assumptions
- grower members of the IAWG supplied production information necessary for calculating triticale double-crop production acres
- Jim Trull, Scott Stephens, and SVID compiled crop nitrogen uptake data
- Jim Davenport and Stu Turner compiled water duty data for crops in this report

CAFO Working Group

- made recommendations on inputs for lagoon calculations

Peer review team:

- Melanie Redding (Department of Ecology)
- Ginny Stern (Department of Health)
- Nancy Darling (Department of Health)

WSDA Dairy Nutrient Management Program

- shared data from their lagoon assessment process
- worked closely with NRAS staff to make sure identification of facilities was as accurate as possible
- reviewed this report to make sure dairy operations were accurately described

South Yakima Conservation District

- collected and anonymized data from dairy producers
- reviewed GIS data for accuracy

Katie Hurlburt, WSDA Natural Resources Assessment Section

- conducted additional crop mapping and QA on the GIS data for this report

Joel Demory, WSDA Natural Resources Assessment Section

- conducted QA on data entry and calculations for this report

Dr. Ranil Dhammapala, Washington State Department of Ecology

- provided information on atmospheric deposition monitoring and recommendations for low, medium, and high potential rates of atmospheric deposition

Jean Mendoza, Groundwater Advisory Committee member

- provided a reference for nitrogen loss to atmosphere from irrigated agriculture

Contents

Contents.....	iv
List of Figures.....	vi
List of Tables.....	vii
Executive Summary.....	1
Introduction and study area	5
Methodology and Limitations	7
1. CONCENTRATED ANIMAL FEEDING OPERATIONS.....	9
Background and literature review.....	9
Pens	10
Lagoons	11
PENS AND COMPOST AREAS	13
Methods, limitations, and assumptions	13
Limitations.....	13
GIS methodology	14
Calculation methodology	15
Results and discussion.....	16
LAGOONS.....	19
Methods, limitations, and assumptions	19
Limitations.....	19
GIS methodology and lagoon identification.....	20
Lagoon dimensions	20
Lagoon nitrogen concentration.....	21
Atmospheric deposition and volatilization in lagoons.....	23
Lagoon liner permeability and thickness.....	23
Calculation methodology	24
Results and discussion.....	25
SETTLING PONDS	27
Conclusions and recommendations	27
2. IRRIGATED AGRICULTURE.....	28
Background.....	28
Methods, limitations, and assumptions	29
Limitations.....	29
Data collection.....	31
Mass balance	32
Determination of inputs, outputs, and transformations.....	33
GIS compilation.....	36
Cover crops.....	37
Results and discussion.....	38
Conclusions and recommendations	49
3. RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SOURCES	51
Background	51
Residential on-site sewage systems.....	51

Methods	51
Nitrogen loading to a ROSS	54
Nitrogen removal by denitrification	55
Nitrogen removal by septage pumping	56
ROSS results	57
Large on-site septic systems	60
Background	60
LOSS results.....	60
Commercial on-site septic systems	61
Background	61
COSS results	61
Residential lawn fertilizer	62
Methods	62
Residential fertilizer use results.....	64
Small-scale commercial and hobby farms	64
Background	64
Methods	65
Small-scale commercial and hobby farms results	65
4. ATMOSPHERIC DEPOSITION	67
Background	67
Methods, limitations, and assumptions	68
Limitations.....	68
Methods	68
Results	69
Conclusions and recommendations	70
Conclusions and recommendations.....	71
References	75
Appendix A: Data sources, uses, and potential concerns	80
Appendix B: Lagoon nitrogen concentration statistical analysis.....	85
Appendix C: Lagoon surface area reduction methodology	86
Appendix D: Darcy's law example calculation	89
Appendix E: Sensitivity analysis on Darcy's law.....	90
Appendix F: Irrigation water use	91
Appendix G: Nitrogen uptake estimates	92
Appendix H: Mass balance example calculation, apples.....	94

List of Figures

Figure 1. Map of Yakima GWMA.....	5
Figure 2. Livestock (cattle and dairy cows) in Yakima County since 1925	9
Figure 3. Average nitrate profile beneath 12 pens in the Yakima Valley. Error bars represent one standard deviation from the mean.....	18
Figure 4. Inputs in the irrigated agriculture mass balance	41
Figure 5. Irrigation types for all GWMA acreage and top 3 commodities with surplus nitrogen inputs (per acre). Due to rounding, categories with 0% are either 0 or values less than 1 that rounded to 0.	42
Figure 6. Map of Yakima GWMA with low range nitrogen availability estimates.....	47
Figure 7. Map of Yakima GWMA with medium range nitrogen availability estimates.....	48
Figure 8. Map of Yakima GWMA with high range nitrogen availability estimates.....	49
Figure 9: Residential on-site sewage systems	53
Figure 10. Density of residential on-site sewage systems.....	54
Figure 11. Low, medium, and high estimates from all sources, over the entire GWMA, with percentage of total for each category.....	72
Figure 12. Boxplots of EPA and SYCD lagoon nitrogen concentration data.....	85
Figure 13. Profile view of typical manure storage lagoon construction. Not drawn to scale; the vertical scale on this diagram is exaggerated to show the side slopes and liquid level clearly.....	86
Figure 14. A typical square manure storage lagoon, with side length and surface area shown at both full and reduced capacities	87
Figure 15. A typical rectangular manure storage lagoon, showing length, width, and surface area at full and reduced capacities	88
Figure 16. Results of sensitivity analysis on Darcy's law.....	90

List of Tables

Table 1. Estimated nitrogen available for transport from all sources in tons/year and % of total	3
Table 2. Estimated nitrogen available for transport per acre from all sources.....	3
Table 3. Dairy lagoon sampling results derived from or used by studies in California and the Yakima Valley	12
Table 4. Total area of dairy CAFO pens, nondairy CAFO pens, and compost areas in	16
Table 5. Potential nitrogen available for transport from dairy and nondairy CAFOs	16
Table 6. Soil sampling results beneath 12 pens in the Yakima Valley	18
Table 7. Estimated high and low loss rates based on Darcy's law	26
Table 8. Top 15 crops and their acreage in the GWMA.....	29
Table 9. Acreage in each commodity, with data collection targets and collection results	32
Table 10. Summary statistics for Yakima River nitrogen concentrations (n=10) (USGS 2012).....	34
Table 11. Summary statistics of organic matter percentage of sampling in the 2015 Yakima Valley deep soil sampling study (n = 108)	35
Table 12. Range of soil organic matter mineralization used for different crops.....	36
Table 13. Summary of fertilizer types used for the top 15 crops by acreage in the GWMA.....	39
Table 14. Ranges of application rates (with weighted average in parentheses) reported for commercial fertilizer, manure, and compost.....	40
Table 15. One year's worth of inputs and outputs for the top 15 crops in the GWMA.....	44
Table 16: Sum of inputs and outputs for the top 15 crops in the GWMA.....	45
Table 17. Maximum hydraulic loading rate	52
Table 18. Input parameters for estimating total nitrogen from ROSS.....	57
Table 19. ROSS nitrogen loading estimate	58
Table 20. Migrant workforce estimate	59
Table 21: Estimated total nitrogen loadings from ROSS drainfields.....	60
Table 22: Estimated loading from LOSS systems	61
Table 23. GWMA CAFO herd size and employee estimate.....	62
Table 24: Estimated loading from COSS.....	62
Table 25. Representative lawn areas in the GWMA	63
Table 26. Residential lawn areas	64
Table 27: Estimated N loading from residential fertilizer.....	64
Table 28. Parcel size and total acres.....	65
Table 29. Percent of fertilizer application by hobby farm size.....	65
Table 30. Total nitrogen loading for hobby farms	66
Table 31. Low, medium, and high atmospheric deposition rates	69
Table 32. Estimated atmospheric nitrogen deposition in the GWMA	70
Table 33. Estimated nitrogen available per acre from all sources at low, medium, and high range ..	71
Table 34. Comparison of EPA and SYCD lagoon nitrogen concentration (mg N/L).....	85

Executive Summary

In recent years, a number of groundwater studies have pointed to concerns about nitrate levels in groundwater in the Lower Yakima Valley. Between 1988 and 2008, 12% of wells tested in the area had nitrate concentrations above the Safe Drinking Water Act Maximum Contaminant Level of 10 mg NO₃-N/L. Another 21% of wells tested were below this level but higher than 5 mg NO₃-N/L (reported in Ecology et al. 2010).

In response, the Washington State Department of Ecology (Ecology) began working with Yakima County to address the issue and provide solutions to prevent nitrate contamination of groundwater in the Lower Yakima Valley. They established the Lower Yakima Valley Groundwater Management Area (GWMA), and in 2011 the Groundwater Advisory Committee (GWAC) was formed.

- The GWMA includes the land area and groundwater located in the lower Yakima Valley from Union Gap to County Line Road in Yakima County, Washington, minus the Yakama Nation. The majority of the GWMA is used for agriculture, including nearly 99,000 acres of irrigated cropland¹ and more than 50 active dairy farms². The remainder of the GWMA land area consists of towns, rural residences, roads, canals, and other nonagricultural lands.
- The GWAC has worked to assess and respond to the groundwater nitrate issues by addressing public education and health concerns, evaluating existing data on groundwater quality, designing new monitoring strategies, evaluating regulatory responsibilities, and determining potential nitrogen availability from the various potential sources.

As partners, Ecology, the U.S. Environmental Protection Agency, Yakima County, the Washington State Department of Agriculture (WSDA), and the Washington State Department of Health have been working to support the GWAC and associated workgroups with educational and scientific products that can assist in decision making to protect groundwater quality.

About the Study

In 2015, the Yakima County Public Services Department and GWAC partnered with WSDA's Natural Resources Assessment Section (NRAS) to conduct a study to provide a scientific baseline estimate of the potential amount of nitrogen available for transport from different nitrogen sources within the GWMA boundaries. Nitrogen available for transport is nitrogen that has the potential to move from the land surface or soil profile into groundwater. The study addressed how much nitrogen could be available, but did not calculate how much is actually transported to groundwater. The processes controlling nitrogen movement through the soil were not evaluated, and loading to groundwater was not estimated.

Nitrogen sources are numerous and can include agricultural, human, natural soil organic matter, and atmospheric deposition. Together, state and local partners estimated potential nitrogen availability in the landscape from 4 distinct categories:

- Concentrated animal feeding operations (CAFOs) - including both dairy and nondairy livestock pens and manure lagoons;

¹WSDA NRAS agricultural land use mapping program, 2015 data.

²WSDA Dairy Nutrient Management Program 2015 registration data.

- Irrigated agricultural activities – by estimating a nitrogen balance from the 15 types of irrigated crops that constitute 87% of the irrigated acreage in the GWMA;
- Residential, commercial, industrial, and municipal (RCIM) sources - including residential onsite septic systems (ROSS), large onsite septic systems (LOSS), commercial onsite septic systems (COSS), residential lawn fertilizers, and hobby and small-scale commercial farms;
- Atmospheric sources - including wet and dry deposition.

Depending on the source (animal agriculture, irrigated agriculture, RCIM, or atmospheric) and calculation method, the nitrogen availability was estimated at the land surface, the bottom of the root zone, or at the end of the treatment zone.

The estimates were completed using locally-derived information wherever possible, and information gaps were filled with data from scientific literature. Methodologies varied, depending on the source of nitrogen being studied. For example, some calculations used data gathered from aerial imagery. Some calculations compared inputs and outputs to determine the mass balance of nitrogen from various irrigated agriculture sources. Atmospheric calculations included adjustments to avoid double counting with other categories that already included atmospheric nitrogen. The body of the report addresses the methodologies used for each source studied.

The study was limited by a number of constraints, primarily the limited availability of local background data, the diversity of local or literature data used, and the various assumptions needed for the calculations in each section of the report. The data used as inputs and the study itself have been reviewed by experts in each field. The data inputs used in each section were reviewed by the relevant GWAC workgroups (Irrigated Agriculture, CAFO, and RCIM). The irrigated agriculture calculations were reviewed by faculty from Washington State University's Department of Crop and Soil Sciences. In addition, the report draft has been reviewed by a peer-review team composed of hydrogeologists from the Washington State Departments of Ecology and Health.

Study Results

The nitrogen available for transport was estimated under 3 scenarios for each nitrogen source category evaluated in this study. Available nitrogen was estimated both in tons and kilograms over the entire GWMA, and on a per-acre basis, providing 2 ways to evaluate nitrogen sources. WSDA and Yakima County results were summarized in associated data spreadsheets and GIS based systems, allowing them to be updated in the future as additional data becomes available.

When the 3 nitrogen availability scenarios were analyzed for all sources over the entire acreage of the GWMA (Table 1), irrigated agriculture, CAFO lagoons, and CAFO pens were the most significant contributors to potential nitrogen availability in each scenario. In scenario A (low), commercial agricultural activities constitute 80% of the estimated total nitrogen available. In the B and C scenarios (medium and high, respectively), agricultural activities constitute 95% and 96% of the estimated available nitrogen. In all 3 scenarios, the nitrogen available from irrigated agriculture is the highest of the sources evaluated. The total acreage of irrigated agriculture (with nearly 86,000 acres evaluated) is much larger than the other nitrogen sources (with the exception of atmospheric deposition).

Table 1. Estimated nitrogen available for transport from all sources in tons/year and % of total

Source		Scenario A (low)		Scenario B (medium)		Scenario C (high)	
		Tons N/year	% of total N	Tons N/year	% of total N	Tons N/year	% of total N
Irrigated agriculture		298	47	2,595	63	7,452	73
CAFO	Pens	70	11	502	12	935	9
	Lagoons	142	22	781	19	1,421	14
RCIM	All septic (ROSS, LOSS, COSS)	47	7	83	2	135	1
	Residential fertilizer	10	2	26	1	41	0
	Small scale farms	4	1	11	0	18	0
Atmospheric deposition		67	11	89	2	268	3

*All numbers in this table have been rounded to the nearest ton (for nitrogen weights), or the nearest whole number (for percentages). Some low but nonzero percentages have been rounded to zero. Percentages may not sum to 100% due to rounding.

When assessed on a per-acre basis (Table 2), the sources with the most nitrogen available differ from the top sources evaluated over the entire GWMA. Summary per-acre nitrogen available was not calculated for irrigated agriculture, instead the range of available nitrogen for all crop types evaluated is shown in Table 2. Nitrogen estimates from irrigated agriculture are the top contributor when assessed over the entire GWMA because of the large number of acres assessed, but the differences in management practices and characteristics for the 15 different crop types mean that estimated nitrogen available from irrigated agriculture varied from crop to crop. Under scenario A, the 3 land uses with the highest estimated available nitrogen per acre are CAFO lagoons, ROSS, and LOSS. Under scenarios B and C, CAFO lagoons are still estimated to make the most nitrogen available on a per-acre basis, followed by CAFO pens and ROSS.

Some land uses have relatively small acreages, but contribute large amounts of nitrogen per acre. For example, the estimated available nitrogen from LOSS for scenario A is one of the top 3 on a per-acre basis, but LOSS have an extremely small total acreage in the GWMA (3 acres), so over the entire GWMA the contribution from LOSS is small. Despite their relatively small acreage, the per-acre estimated nitrogen availability of CAFO lagoons and pens was high enough to make them the second and third highest land uses in all 3 scenarios.

Table 2. Estimated nitrogen available for transport per acre from all sources

Source		Area (acres)	Scenario A (low) (lb/acre-year)	Scenario B (medium) (lb/acre-year)	Scenario C (high) (lb/acre-year)
Irrigated agriculture		85,775	0-58	0-148	0-284
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential fertilizer	4,381	4.7	11.7	18.6
	Small scale farms	2,096	4.3	10.7	17.1
Atmospheric deposition		87,082	1.53	2.05	6.15

Looking Ahead

NRAS has identified a number of next steps and additional data needed for Yakima County and the GWAC to advance these estimates. Both WSDA and Ecology are engaged in work that will aggregate information about lagoon conditions that could potentially be used to refine the lagoon estimates. Calculations could be updated as data becomes available from the WSDA Dairy Nutrient Management Program (DNMP) lagoon liner assessment ratings and Ecology CAFO permit reporting assessments and requirements. Washington State University research on lagoon seepage is beginning that may also provide relevant information. New field research on lagoon seepage could also be conducted if necessary to supply the needed data. The irrigated agriculture mass balance estimates could be compared to current and future deep soil sampling results to improve the accuracy of the analysis. An assessment of additional data for each impoundment classification (lagoon, flush/main lagoon, farm/irrigation pond, settling basin) could be used to apply seepage rates and nitrogen concentrations specific to each use. A statistically-based study of soil nitrogen concentrations beneath pens could be conducted to confirm estimates used in this study that were developed in other regions of the country. Additional areas of inquiry are discussed in each section and in the Conclusions and Recommendations section.

Even though estimates may be refined in the future, this comprehensive study was successful in making an initial estimate of potentially available nitrogen from different sources throughout the GWMA. Per-acre estimates from each source category can be reviewed spatially to identify areas where risk and vulnerability are potentially high. The use of this spatial component allows for more complex future analysis with the inclusion of other relevant data layers such as soil type, depth to groundwater, groundwater nitrate concentrations, soil sampling results, and proximity to public drinking water systems. This smaller-scale spatial analysis is intended to identify initial investigation pathways in specific areas where groundwater contamination is known to occur. It is part of a multi-faceted diagnostic approach to this issue.

Introduction and study area

Yakima County is located in central Washington State. This study focuses on the lower Yakima Valley, located in the southeastern portion of the county and bordered by the Rattlesnake Hills to the north, the Yakama Nation to the west, and Benton County to the east. The Yakima GWMA is shown in Figure 1, with major cities and roads noted. The current population of Yakima County is just over 240,000 people, and the major metropolitan area is the city of Yakima (Census 2010). The population within the GWMA itself (in 2016) was estimated at a little over 56,000 (ESRI 2016). The county's main industry is agriculture, with a 2013 farm gate value of \$1.65 billion (USDA NASS 2014). The major commodities produced are apples, milk, and hay. The lower valley agricultural landscape includes more than 50 active dairy farms³ and approximately 99,000 acres of irrigated farmland⁴. The Yakima River runs through the GWMA, and water for agriculture is collectively managed by 5 different irrigation districts: Roza, Sunnyside, Wapato, Zillah, and Grandview.

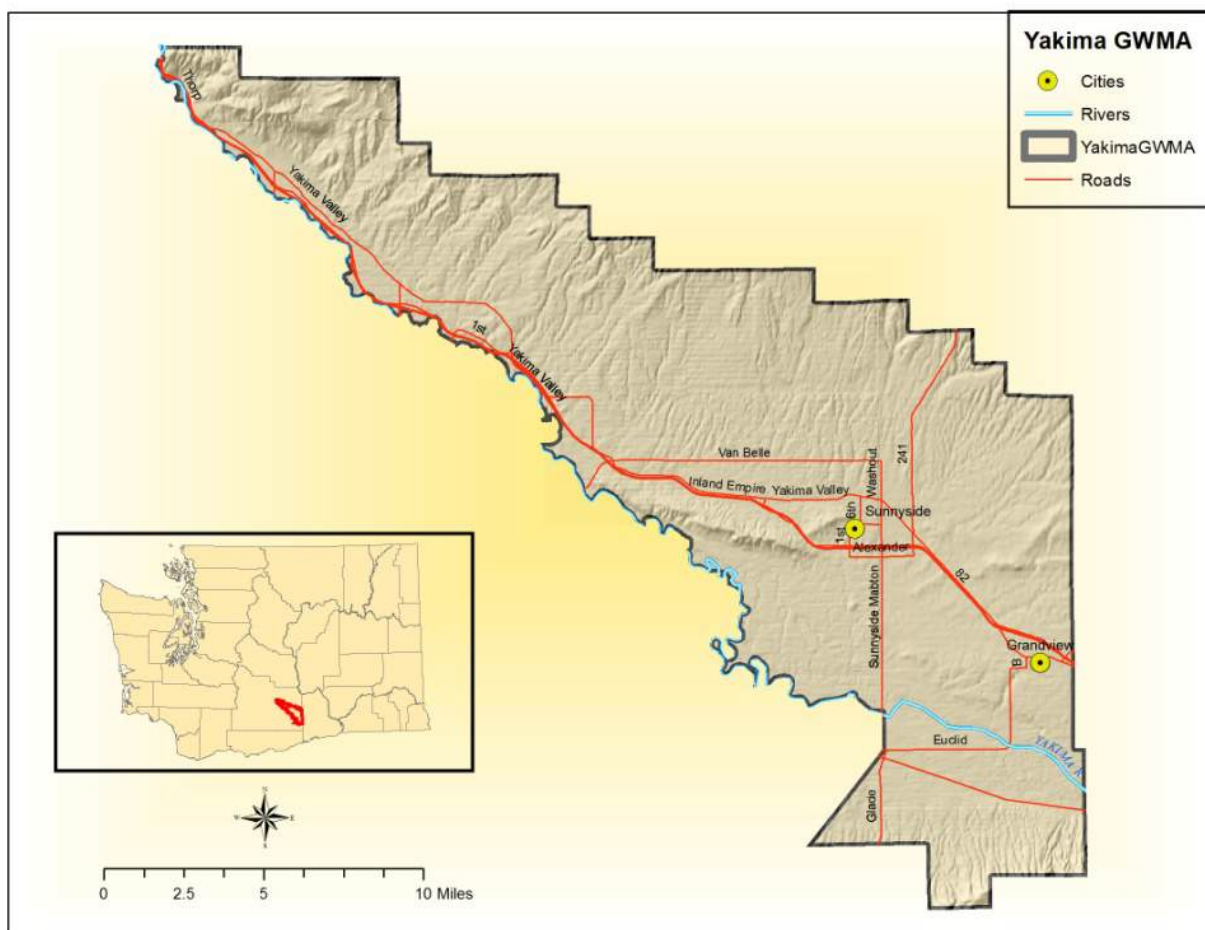


Figure 1. Map of Yakima GWMA

³ WSDA Dairy Nutrient Management Program 2015 registration data.

⁴ WSDA NRAS agricultural land use mapping program, 2015 data.

Within some areas of the GWMA, nitrogen has negatively impacted groundwater quality. Ecology has summarized results from sampling studies conducted by state and federal agencies between the early 1990's and June 2008 (Ecology 2010). A total of 1,726 nitrate testing samples from 453 well sites were summarized. Data sources included nitrate test results from 328 domestic wells, 93 public wells, and 33 wells of other types including some used for irrigation. Of wells with nitrate detections, 67% were less than 5 mg NO₃-N/L, 21% were between 5 and 9.9 mg NO₃-N/L, and 12% were greater than 10 mg NO₃-N/L. The Maximum Contaminant Level set by the US Environmental Protection Agency (EPA) for nitrate is 10 mg NO₃-N/L; concentrations approaching and above this level are of concern due to the potential impact to human health (EPA 2013a, Ecology et al. 2010). Shallower wells (which were more likely to be domestic wells) had more nitrate detections and exceedances than deeper wells (Ecology et al. 2010). An EPA study concluded that agriculture and livestock operations within the GWMA were significant contributors to nitrogen loading to the underlying groundwater (EPA 2013a).

In 2011, Ecology authorized the formation of the lower Yakima GWMA. This group, made up of area residents, representatives from the agricultural industry, and scientists and experts from county, state, and federal government agencies, is focused on identifying potential contaminant sources and preparing a management strategy for the affected area.

EPA conducted a multi-phase study to identify potential nitrate sources and other contaminants. After source identification, EPA conducted groundwater monitoring up- and downgradient from potential sources (including several large dairies) in 2010 (EPA 2013a). As a result of this groundwater sampling, in March 2013, EPA signed an Administrative Order on Consent (Consent Order) with 5 dairies in the lower Yakima Valley (EPA 2013b). The purpose of this consent order was to address sources of nitrate contamination in groundwater downgradient of the dairies' facilities. These dairies have begun additional work to control nitrate sources, collect data, and monitor groundwater quality to assess the effectiveness of the source control actions.

This report is the result of a request in 2015 by the GWMA's Ground Water Advisory Committee for NRAS and the Yakima County Public Services Department to complete an estimate of nitrogen loading potential within different land use classes in the lower Yakima Valley. This report outlines estimated nitrogen available for transport from the following land uses: irrigated agriculture, concentrated animal feeding operations (which includes both dairies, dairy support such as heifer raising, and beef cattle feedlots), residential, commercial, industrial, and municipal sources. The land uses were divided into 3 separate sections for calculations: irrigated agriculture, CAFOs, and RCIM sources. A separate section estimates the potential contribution to groundwater nitrogen from atmospheric deposition of nitrogen. The data was collected from a variety of sources and through different methods, including phone interviews, on-farm data collection, analysis of aerial imagery, ground surveys for spatial analysis, and local zoning and land use information.

This study is the first conducted in the lower valley that uses local information to address the potential pathways for nitrogen loading. It is also the first project completed for the GWMA that pairs estimated nitrogen surpluses with GIS-based land use information. The purpose of this report is to understand available nitrogen from nitrogen sources and enable the GWMA advisory committee to better direct remediation strategies throughout the region.

Methodology and Limitations

The objective of this report was to provide information to the GWAC that could be used to make decisions about the prioritization of limited resources to meet the long-term goals of reducing nitrogen concentrations in groundwater. This report is not intended as a final statement on potential nitrogen contributions from different sources, instead it represents a first step. Recommendations are made for future experimental research to improve estimates, and additional data sets have been identified for future inclusion that are currently available or will become available in the future. These calculations can and should be updated as new information becomes available.

Nitrogen availability was calculated differently in each section (irrigated agriculture, CAFO, and RCIM). Fate and transport of nitrogen through the soil profile to groundwater was not assessed in this document. For each potential source the objective was to determine the total nitrogen available for transport at the end of the 'treatment zone'. This evaluation location was different for different sources,

- for irrigated agriculture available nitrogen was evaluated at the bottom of the root zone, when it can no longer be taken up by plants,
- for lagoons the location was the bottom of the lagoon liner, where nitrogen can enter the soil and move through it under some conditions,
- for pens the location was the bottom of the manure-soil interface layer, where nitrogen can move through the soil profile under some conditions,
- for septic systems the location was the end of the drainfield,
- for residential fertilizer the evaluation location was the land surface, and
- for small scale commercial and hobby farms the evaluation location was also the land surface.

These different nitrogen sources often have areas of overlap. For example, when CAFO lagoons and pens are cleaned, manure (and nitrogen) is removed. This material is often used for crop production (both of dairy support crops like corn and for other crops). Manure is counted as an explicit input in the mass balance that was used to estimate available nitrogen from irrigated agriculture. Atmospheric deposition is included as an input in the irrigated agriculture mass balance, included in the CAFO pen and lagoon estimates because those estimates rely on experimentally-estimated nitrogen concentrations, and also calculated separately in the atmospheric deposition. In area of potential overlap like this, double counting contributions from the same nitrogen sources has been avoided, and potential double counting has been discussed in more detail in each section.

Another challenge for both conducting this study and interpreting and comparing the results in the different sections is the diversity of data sources used for calculations. Data sources included self-reported data from producers, data from peer-reviewed literature, data from state and federal government studies, averaged data, specific local data, general national data, and estimates based on best professional judgment. Examples of just a few of the many data sources used for calculations in this study are:

- fertilizer use practices (local and crop-specific data, self-reported survey of practices of growers and crop consultants),
- analytical results from testing of lagoon nitrogen concentrations (local data, analysis by certified labs, data self-reported by dairy producers, samples not statistically selected),
- analytical results from testing of lagoon nitrogen concentrations (local data, EPA sampling and analysis procedures, sample not statistically selected),
- GIS data derived from ground-based mapping, human analysis of aerial imagery, and automated analysis of aerial imagery with ArcMap tools (local data, accuracy may vary depending on analysis method),
- estimates by experts in different specialties (local data, estimates may vary depending on expert judgment), and
- national- and state- level data and estimates for performance of septic systems (larger-scale data may not be accurate for local conditions).

In addition, in the many data sources used (both peer-reviewed literature and experimental results) many different units of measure and species of nitrogen were reported. Nitrogen can be reported as nitrate, nitrate-N, organic nitrogen-N, total Kjeldahl nitrogen (TKN), ammonia/ammonium, ammonia/ammonium-N, combinations of these, or as total nitrogen, which makes comparison of literature results difficult and sometimes impossible.

This study relies on a wide variety of data sources, which has to be considered when interpreting and using the results. Not all sources will be considered equally credible according to the Water Quality Data Act (RCW 90.48.570-90.48.590, Water...2004). This can make it difficult to compare data sources and calculation results. In order to allow readers to evaluate data sources on a case-by-case basis each data source used, the calculation it was used for, the source, and potential concerns with the data source have been collected in a table (Appendix A: Data sources, uses, and potential concerns). Wherever possible, summary statistics have been presented and a careful choice has been made for what value (mean, median, or an alternative) to use in calculations.

The conclusions section of this report makes suggestions to Yakima County and the GWAC for critical additional research to refine these estimates through additional data collection. The spatial component of this data is extremely important. Wherever possible, nitrogen availability has been presented both as an aggregate over the entire GWMA and on a per-acre basis. This per-acre nitrogen availability can be spatially associated with sources to examine nitrogen availability at different scales and in different regions.

1. CONCENTRATED ANIMAL FEEDING OPERATIONS

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Background and literature review

Over the past 90 years, the number of cattle and dairy farms in Yakima County has been decreasing, according to United State Department of Agriculture (USDA) Census of Agriculture data (Figure 2). During that time, number of cattle and calves (including dairy animals) has increased relatively steadily. The number of dairy cows was relatively stable between 1925 and 1969, but after 1969 the number of dairy cows also began to increase steadily, a trend that has continued through 2012. Between 1969 and 2012 USDA's estimate of dairy operations went from 7,868 cows on 301 farms to 99,532 cows on 97 farms (Commerce 1972, USDA NASS 2014). As the number of dairy farms is decreasing, individual farms are increasing in size. As of 2012, USDA also notes the presence of relatively low numbers of other livestock: hogs and pigs, sheep, goats, horses, and poultry (USDA NASS 2014). This USDA statistical data is available only at the county level.

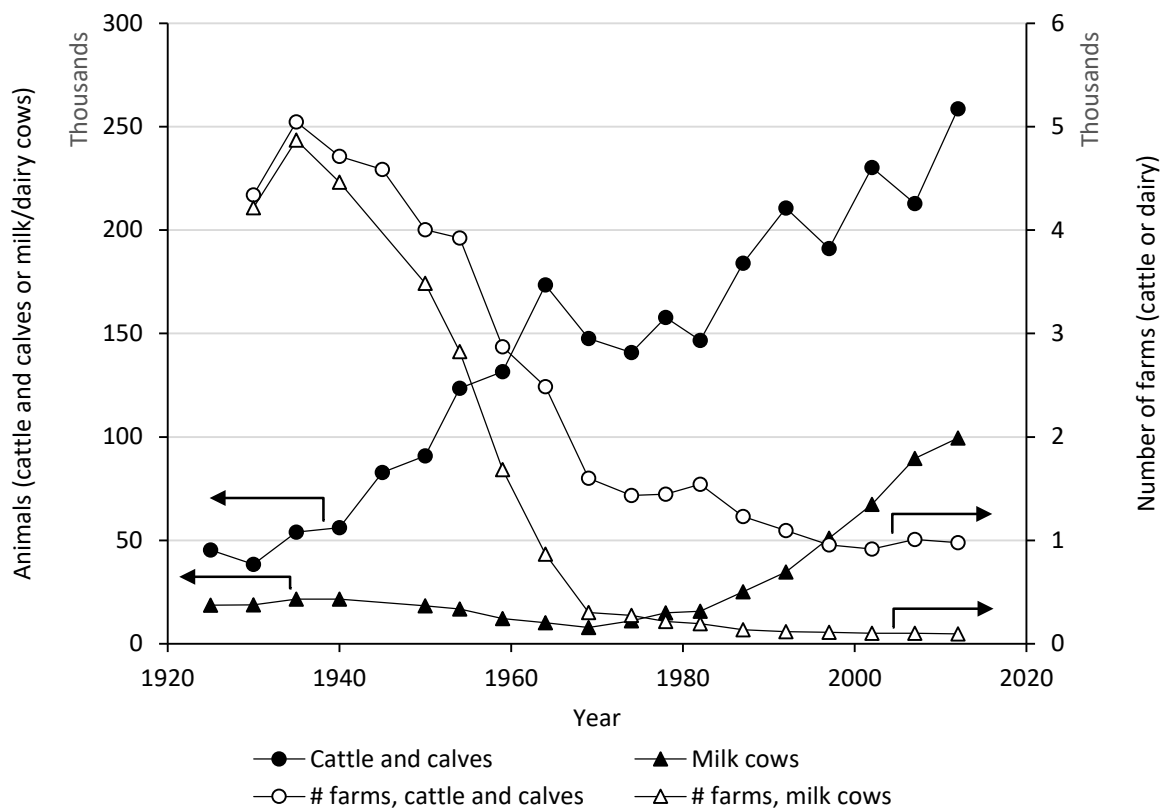


Figure 2. Livestock (cattle and dairy cows) in Yakima County since 1925⁵

⁵ (Commerce 1927, Commerce 1932, Commerce 1936, Commerce 1942, Commerce 1946, Commerce 1952, Commerce 1956, Commerce 1961, Commerce 1967, Commerce 1972, Commerce 1977, Commerce 1981, Commerce 1984, Commerce 1989, Commerce 1994, USDA NASS 1999, USDA NASS 2004, USDA NASS 2009, USDA NASS 2014)

Commercial dairies are the only Washington State livestock operation whose manure management is inspected and regulated by WSDA, in accordance with Washington's Dairy Nutrient Management Act (Dairy, 1998). Dairies are required to register with WSDA's Dairy Nutrient Management Program, develop nutrient management plans, maintain records of manure applications, conduct soil tests, and each dairy's manure management systems are inspected regularly. As a result, dairies are the facilities with the most information available regarding management practices, animal numbers, and structures onsite. Dairy support animals (dry cows, calves, and heifers) are sometimes onsite or in adjacent facilities and sometimes (in the case of calf and heifer raising operations) moved offsite until maturity.

Whether nitrogen or other contaminants move from dairy facilities to surface or groundwater depends on dairy age, management practices, meteorological conditions, soil types, geological conditions, unsaturated zone thickness, and groundwater characteristics. Several studies have attempted to quantify nitrogen loading from entire farms and identify which source (pens, lagoons, or irrigated fields) makes the largest contribution. Two studies in California used monitoring wells up- and downgradient from different potential sources in an attempt to measure nitrogen additions to groundwater from each management unit (Harter et al. 2002, van der Schans et al. 2009). Harter monitored groundwater at 5 dairies for 4 years and found that although it was very difficult to distinguish effects from neighboring sources, the largest nitrogen contributor on dairies was manure-treated cropland. Total contributions from cropland were much larger than pens or lagoons largely because the acreage of cropland was much larger and made it difficult to identify contributions from individual pens and lagoons (Harter et al. 2002). Another study in California used monitoring wells to calibrate groundwater models specific to 2 dairy farms in California. The study identified nitrate-N losses of 486 kg/ha-yr from manure-treated fields, 872 kg/ha-yr from pens, and 807 kg/ha-yr from lagoons (van der Schans et al. 2009). Another study conducted by a University of California at Davis (UC Davis) team assessed nitrate loading to groundwater in prominent agricultural and dairy production areas within the Tulare Lake Basin and Salinas Valley of California. The UC Davis study estimated loading from pens at 75-1,000 kg N/ha-yr. Based on a variety of estimates of seepage rates from manure lagoons and lagoon nitrogen concentrations the UC Davis study estimated nitrogen loading from lagoons at 200-2,000 Mg/year for the entire study area. With a total lagoon area of 1,265 ha this results in a loading rate of 158-1581 kg N/ha-yr (Viers et al. 2012).

Pens

Dairies contain a variety of different structures and facilities dedicated to animal housing, manure management and storage. Some dairies also include irrigated agricultural land used for feed production. Animal holding areas can include concrete-surfaced freestall barns or outside holding areas which are generally constructed with compacted earth surfaces. These are referred to by a variety of names in different studies but will be referred to in this report as pens. Pens at facilities housing dairy support animals have been classified as "nondairy CAFO" pens while pens at facilities housing milking cows have been classified as "dairy CAFO" pens. In addition, pens at 2 facilities identified as cattle feedlots have been classified as "nondairy CAFO" pens.

The combination of weight and compaction due to the presence of cattle with the physical and chemical changes to underlying soil due to the mixing of soil and manure have been observed to form an interface layer under the deposited manure that allows very little infiltration of liquid to the underlying soil (Mielke et al. 1974). At one feedlot site, researchers were not able to record any infiltration during a 20-day period (Mielke et al. 1974). A study of 3 feedlots in Alberta, Canada confirmed that this interface layer formed within 2 months of cattle stocking. In addition, experimentally-determined permeabilities were similar for coarse- and fine-textured soils. However, despite this interface layer and resultant expected low leaching potential, chloride leaching was detected at all 3 feedlots (Miller et al. 2008). Similarly, at feedlots in Kansas, despite apparently limited infiltration, soil testing beneath pens found elevated concentrations of ammonium, organic nitrogen, nitrate, chloride, and phosphorus. This study compared a mass balance approach for estimating nitrogen leaching to subsurface soil testing results. Although elevated concentrations of contaminants were detected, movement of contaminants through the feedlot surface was much lower than what was expected from the mass balance calculation and concentrations were consistent with contaminants moving through the interface layer by diffusion (Vaillant et al. 2009). Seepage rates through feedlot surfaces documented in other studies ranged from 0.005 to 2.4 mm/day (reported in Vaillant et al. 2009). The effectiveness of this manure-soil interface layer is dependent on maintenance and surface conditions. Dry conditions combined with animal hoof action or on-farm practices such as pen scraping can damage the aggregated structures, compromising the interface layer and allowing infiltration or altering subsurface conditions to favor nitrogen transformations and subsequent leaching (Mielke et al. 1974, Vaillant et al. 2009).

The UC Davis report identified 2 large beef cattle feedlots in the study area, with stocking rates of 125 and 300 animals/acre. The dairies in the region had stocking rates of 50 animals/acre, which did not include heifers and calves (Viers et al. 2012). As of the 2014 DNMP dairy registration, dairies in Yakima County had just over 100,000 milking and dry cows (the vast majority of which were located within the GWMA boundary), making for a stocking rate of around 50 cattle/acre, based on the NRAS estimate of pen acreage, similar to that of dairies in the UC Davis study.

The UC Davis study assessed these studies and local soil testing data (unpublished) to choose low and high nitrogen loading rates for pens. The authors chose 75 kg N/ha-yr as the low loading rate, based on a locally-observed recharge rate below corrals of 50 mm/year and soil moisture nitrate concentrations of 675 mg/L (unpublished data referenced in Viers et al. 2012). Citing recharge rates as high as 300 mm/year reported in other studies the UC Davis study used 1,000 kg N/ha-yr as an upper limit for nitrogen loading from pens. However, the authors of that study suggest that the upper bound is an overestimate, potentially as much as an entire order of magnitude too high (Viers et al. 2012).

Lagoons

Depending on the dairy's management practices, manure and urine deposited in freestall barns and pens is transported to storage areas which may be liquid storage impoundments (generally through underground piping and pumping systems) or solids storage and composting areas where solids are dried, stacked, and sometimes composted for further use.

Liquid storage impoundments themselves serve a variety of on-farm uses. Lagoons can provide storage for manure and urine cleaned from barns, but may also capture runoff from roofs and other surfaces and process water from the milking parlor. In addition, lagoon liquid may be recirculated to clean barns with flush systems. Distinguishing between an impoundment primarily used for manure storage and one primarily used for irrigation water storage can be difficult. Contents are transferred between impoundments as needed to meet cleaning, storage capacity, and maintenance needs. The term lagoons is used here to refer to impoundments whose primary purpose is manure storage. In addition to lagoons, some dairies also have dedicated impoundments used for separating solids and liquids. The technical sophistication of these impoundments could range from a pond with a weeping wall to an engineered concrete basin with baffles directing and slowing flow to promote settling.

There is substantial variation both in the composition of solids, liquids, and dissolved constituents, and in seepage rates from lagoons (Ham 2002; Harter et al. 2014). A study of 20 lagoons (14 swine, 5 feedlot, and 1 dairy) found seepage rates between 0.2 and 2.4 mm/day, with an average of 1.1 mm/day (Ham 2002). Groundwater monitoring up- and downgradient from lagoons confirms that contaminants leaching from lagoons contribute to shallow groundwater contamination (Harter et al. 2002, van der Schans et al. 2009, Viers et al. 2012). In one study, testing detected elevated concentrations of TKN (total Kjeldahl nitrogen, a measure of organic N and ammonium/ammonia N combined) outside the edges of 3 dairy lagoons, and the authors estimated a leaching rate of approximately 1 m/year (Harter et al. 2002).

Nitrogen concentrations within lagoons have been tested in a number of studies, and are extremely variable. The UC Davis study conducted extensive literature review as well as modeling of lagoons and the authors used nitrogen concentrations of 500 and 1,000 mg N/L in their estimates (Viers et al. 2012). A survey of lagoon contents in California sampled more than 60 dairies in California's San Joaquin Valley in 1999 and 2000 and found lagoon TKN concentrations of 47-2,420 mg N/L, with an average of 560 mg N/L (Campbell Mathews et al. 2001). A University of California Cooperative Extension publication reported master's thesis research at UC Davis, where 7 California dairy lagoons had a TKN range of 320-1,010 mg TKN/L with a mean of 670 mg TKN/L (Pettygrove et al. 2010). Sampling at 5 Yakima Valley dairies by EPA found total nitrogen concentrations ranging from 290 to 1,800 mg N/L with an average of 1,212 mg N/L (EPA 2013a). These results are summarized in Table 3.

Table 3. Dairy lagoon sampling results derived from or used by studies in California and the Yakima Valley

Citation	Project Location	Actual or estimated nitrogen concentration
EPA 2013a	Yakima Valley, 5 dairies	range 290-1,800 mg N/L average 1,212 mg N/L
Viers et al. 2012	Tulare Lake Basin and Salinas Valley, California	500 mg N/L 1,000 mg N/L
Campbell Mathews et al. 2011	San Joaquin Valley, California	range 47-2,420 mg TKN/L average 560 mg TKN/L
Pettygrove et al. 2010 (reporting UC Davis research)	California	range 320-1,010 mg TKN/L average 670 mg TKN/L

PENS AND COMPOST AREAS

Methods, limitations, and assumptions

Limitations

Every effort has been made in this report to identify facilities and facility uses that are current as of 2015. WSDA's DNMP worked closely with NRAS to correctly identify facilities and onsite structures. However, facilities close and open, and the use of individual pens and impoundments changes. As a result some dairies are included in this analysis that have since closed. Individual pens have been associated with either dairy or nondairy CAFOs, based on DNMP information about most common use at the time this study was conducted. The majority of pens that have been identified as nondairy CAFOs are likely dedicated to raising or housing dairy support animals (calves and heifers). However, individual pens may hold calves during one time period and after those animals are moved out, heifers or adult cows may be moved into that same pen. NRAS has attempted to capture primary uses of different pens but use practices are subject to variation. A small number of the pens identified as nondairy CAFOs are associated with 2 beef cattle feedlots. The calculation used for pens identified as either dairy or nondairy CAFOs is the same, both are based on the methods used by the UC Davis study team (Viers et al. 2012). The same rate was used for both dairy and nondairy CAFOs despite the fact that beef cattle feedlots, dairies, and heifer raising facilities have different characteristics and management practices that would be likely to affect nitrogen loss. Stocking rates, manure volume, manure nitrogen content, animal size, and feed choices would be likely to differ between dairy and nondairy CAFOs, all of which would affect the nitrogen loss at these facilities. NRAS did not have the amount of facility-specific on-site information that would be needed to generate different rates for dairy and nondairy CAFOs. Dividing pens into dairy and nondairy CAFOs would allow these calculations to be updated in the future if more facility-specific information becomes available. This analysis also does not account for any contribution from cattle kept anywhere other than CAFO pens, such as rangeland or pasture. An estimate of nitrogen available for transport from pasture land is included in Section 2. IRRIGATED AGRICULTURE.

Manure composting areas were identified and the acreage was calculated as part of this analysis. Differences between composting areas and pens include surface construction, the lack of animal movement compacting surfaces, and the difference in moisture inputs between composting areas and pens. Due to these differences, as well as the diversity of potential compost management practices, NRAS did not feel use of the dairy/nondairy CAFO pen rate was appropriate for compost areas. The diversity of composting practices could include composting in windrows, composting in bags, spreading material out over a large surface to dry, turning frequency, moisture additions to maintain optimal composting conditions, or the use of a concrete pad for composting. With no information available in scientific literature about potential loading from compost areas, NRAS did not attempt a calculation for these areas. With the locations and dimensions of composting areas already identified, nitrogen loss from compost areas could easily be calculated in the future if new information becomes available.

Potential nitrogen loss from buildings housing animals was not assessed. Animals may spend time in freestall barns and milking parlors. These facilities are built with concrete floors and cleaned

multiple times a day. Although poorly maintained or old concrete may develop cracks that could provide a pathway for contaminants to reach the soil profile, any potential losses from these types of buildings would be orders of magnitude smaller than potential losses from pens and lagoons. Additionally, material removed from these facilities is often transported to lagoons onsite, making an analysis without risk of counting the same material twice challenging.

Calculating storage in corral subsurface soil was beyond the scope of this report. An accurate calculation would require historic information about dairy and beef cattle numbers and management practices. However, other research demonstrates that soil beneath corrals may hold large amounts of nitrogen that could be released when these facilities are turned to other uses and demonstrates the importance of appropriate decommissioning procedures (Vaillant et al. 2009, Viers et al. 2012).

Potential emissions of nitrogen compounds to the atmosphere from pens and corrals have not been estimated in this report. It is unknown what proportion of emissions from GWMA CAFOs may redeposit within the GWMA, as emissions may travel large distances before eventual deposition (Viers et al. 2012). The rates used for the pen calculations are based on leaching rates and soil and groundwater testing results from other studies. The influence of atmospheric nitrogen deposition would be accounted for in those testing results already; any atmospheric nitrogen deposited on pen surfaces and lost to soil or groundwater would contribute to nitrogen detected when soil and groundwater are tested. As a result, the pen acreage was removed from the atmospheric deposition summary calculation conducted in the atmospheric deposition section (4. ATMOSPHERIC DEPOSITION).

GIS methodology

The results of this study were summarized using geographic information systems (GIS). A spatial database called a file geodatabase contains all the GIS data for the livestock section of this study. This database contains both attributes and spatial locations of this data. It contains five feature classes and one table: YakimaGWMA (polygon, GWMA boundary), WSDACrop_2015 (polygons, crop identification), Lagoons (points), Ponds (points), and CAFO_Pen_Compost (polygons, boundaries of pens and compost areas). This database also contains a table, IrrigatedMassBalance, which contained the mass balance calculations and results.

Pen and compost area boundaries represent the locations of dairy and nondairy CAFO facilities including dairy and feedlot pens and manure composting areas. These are displayed as polygons in the geodatabase and attributes include the category (dairy CAFO, nondairy CAFO, or compost), area in acres, and low, medium, and high potential nitrogen loss (if calculated). Polygons were drawn by WSDA staff using published 2014 dairy registration locations as a reference along with 2013 National Agricultural Imagery Program (NAIP) imagery from USDA. Dairy and nondairy CAFO pens were distinguished based on information from WSDA's Animal Services Division (feedlot locations), facility size, and proximity to a known dairy location, which was based on records from WSDA's DNMP. DNMP staff were consulted to assure accuracy of both location and type of operation. Any roofed area likely to be a freestall barn or milking parlor was excluded.

Quality assurance was performed from November 2015 through February 2016 on all components of the geodatabase. This was a 3-step process. First, a random sampling of each dataset was

performed using Excel's random number function and a field survey was conducted of the selected polygons and points in conjunction with USDA NAIP 2013 imagery to ensure the accuracy and location of the data. For the pen and compost boundaries, it was to ensure the operation was a CAFO or compost facility. The last step was to double-check all polygons and points with USDA NAIP 2015 imagery that became available in early 2016, which resulted in several updates due to changes in facility status. All geospatial data used in this study met WSDA data quality error rate of less than 10% (Beale and Baker 2009).

Metadata is included with the GIS database to further describe the additional aspects of the GIS data. This includes information such as the extent, credits, use limitations, scale, processing environment, author, and spatial reference.

Calculation methodology

The pen nitrogen calculation (for both dairy and nondairy CAFO pens) was based on the low and high loading range used in the UC Davis nitrogen loading study (Viers et al. 2012). The loading rates used in the UC Davis study were chosen based on several other research studies. The low range (75 kg N/ha-yr, or 67 lb N/ac-yr) was chosen based on unpublished research conducted by UC Davis study authors in the Tulare Lake Basin that was reported in the UC Davis study (Viers et al. 2012). Meteorological conditions in the GWMA are similar to the Tulare Lake Basin, with 7.55 inches of rain each year, on average, in Tulare, CA, and 6.8 in Sunnyside, WA (mean 1894-2012, WRCC 2012, Viers et al. 2012). The high range used in the UC Davis study (1,000 kg N/ha-yr, or 892 lb N/ac-yr) was based on research conducted in the Tulare Lake Basin and Salinas Valley by the study authors, as well as research in California's San Joaquin Valley (van der Schans et al. 2009) and in Kansas (Vaillant et al. 2009). Meteorological conditions in Kansas are significantly different from conditions in either the Tulare Lake Basin or the Yakima Valley (annual rainfall ranged from 24 to 36 inches at the study sites) (Vaillant et al. 2009). The high rate is likely a significant overestimation of the available nitrogen, due to factors that include lower precipitation and higher evapotranspiration in the Yakima Valley than in the regions where the research this nitrogen loading rate was based on was conducted. The lower precipitation and higher evapotranspiration would result in both lower groundwater recharge and higher losses of nitrogen to the atmosphere, reducing the nitrogen available to move through the pen surface. While this study has attempted to calculate nitrogen available to move through the soil profile, the authors of the UC Davis study were estimating actual nitrogen loading to groundwater. Only a proportion of the nitrogen available to move through the soil to groundwater will actually do so. Additional work that could be conducted to improve these estimates is discussed in the conclusions of the CAFO section.

The calculation itself consisted of multiplying either the low or the high rate by the acreage of each pen. The medium rate for pens was determined by averaging the results of the low and high rates for each individual pen; it has no physical significance. Individual pen results were added to determine estimated losses for all pens in the region. For the following calculation, all significant digits were kept until the final estimate was determined. At that point, calculations were rounded to the nearest lb/ac, kg/ha, ton/year, or 1,000 kg/year.

$$N \text{ loading rate } \left(\frac{\text{lb N}}{\text{acre} \cdot \text{year}} \right) \times \text{Pen acreage (acre)} = \text{Potential N available } \left(\frac{\text{lb N}}{\text{year}} \right)$$

Results and discussion

The total area of pens and compost areas is summarized in Table 4. Areas were categorized as either dairy CAFO (pens associated with a dairy operation), nondairy CAFO (pens believed to be associated with a beef cattle feedlot or used for dairy support animals, housing calves or heifers), or compost (areas at either dairy or nondairy facilities where composting is taking place). Dairy CAFO pens made up 60.7% of the total 2,632 acres identified as pens or composting areas. Nondairy CAFO pens and compost areas made up 18.9 and 20.4% of the total, respectively.

Table 4. Total area of dairy CAFO pens, nondairy CAFO pens, and compost areas in the GWMA, with percent of total

	Acres	%
Dairy CAFO pens	1,597	60.7
Nondairy CAFO pens	499	18.9
Compost	536	20.4
Total (pens and compost)	2,632	100

Based on the low and high rates discussed in the calculation methodology and the acreage of different facilities in Table 4, the following potential nitrogen losses were determined (Table 5). Results were rounded to the nearest lb/ac, kg/ha, ton/yr, or 1,000 kg/yr, to be consistent with the estimated accuracy of these calculations. Available nitrogen was calculated for the 2,096 acres of dairy CAFO and nondairy CAFO pens only, as discussed in the Limitations section above. No calculation was conducted for compost areas. The rates used for this calculation were the low and high rates identified by the UC Davis study, which were based on research conducted in California's Tulare Lake Basin and Salinas Valley (Viers et al. 2012). This study only identified a low and a high rate. In order to generate a medium value for comparison to other potential nitrogen sources, the low and the high were averaged. The medium value in this calculation is for comparison purposes only. This calculation was not based on mass loading, so manure removal during pen cleaning does not appear as a term in the calculation. However, the rates used for the calculation were experimentally derived from subsurface nitrogen concentrations at working livestock pens in California and other regions. Regular cleaning as a management practice influences the experimentally-derived rates that were used.

Table 5. Potential nitrogen available for transport from dairy and nondairy CAFOs

	lb N/ac-yr	kg N/ha-yr	Ton N/yr	kg N/yr
Low rate (Viers et al. 2012)	67	75	70	64,000
Medium rate (average)	480	538	502	456,000
High rate (Viers et al. 2012)	892	1000	935	848,000

The high rate is an entire order of magnitude above the low rate. With the information currently available, WSDA is not able to narrow this range.

Management practices onsite such as maintaining an intact interface layer to inhibit liquid movement through the pen surface, changes in precipitation and evapotranspiration from season to season, and animal stocking rates will all affect potential loading.

The 2 large feedlots in the Yakima Valley have a combined acreage of 291 acres. Because only dairies are required to share animal numbers with WSDA, the numbers of animals on these feedlots is unknown. The total number of cattle and calves in Yakima County is 258,663 as of the 2012 Census of Agriculture by USDA NASS. Also from the 2012 Census of Agriculture, the total number of dairy cows in Yakima County is 99,532, which would include only milking and dry cows, not other dairy support animals (calves and heifers) (USDA NASS 2012). The difference (159,131 animals) would include beef cattle on feedlots, cattle and calves on range, and dairy support animals (for example, calves and heifers at dedicated facilities). Of these animals, cattle on feedlots and dairy support animals are accounted for in the calculations, while cattle on rangeland or pasture are not. The census information is for the entire county rather than specific to the GWMA region, and it is unknown which animals are within the GWMA.

In July 2015, NRAS conducted a soil sampling survey in pens and compost areas at 5 dairies within the GWMA. This data is used here to compare conditions observed beneath pens in the GWMA to conditions observed beneath pens in the Tulare Lake Basin and Salinas Valley, where the loading rates used in the UC Davis study were derived. Similar soil testing results would suggest that the loading rates used in the UC Davis study are appropriate for the GWMA.

Producers who participated in this study allowed NRAS staff to come onto their property, dig large pits to sample at depths up to 6 feet, and sample multiple locations on the property. Project quality assurance documentation (such as standard operating procedures or a quality assurance project plan) was not developed before sampling, and as a result this data is not considered credible under the requirements of Washington's Water Quality Data Act (RCW 90.48.570-90.48.590, Water...2004). This data should not be used for decision making and it was not used to develop the nitrogen loss rates used in this report. NRAS believes that there are 2 main potential sources of bias or error in this data set. The first is the lack of a statistically-based sampling procedure, meaning that the results may not be useful for assessing the subsurface nutrient concentrations at all the dairies in the GWMA, just at the dairies that were sampled. The second is the potential for sample cross-contamination due to sample transfer on equipment, meaning that making conclusions based on individual sample results is not recommended. Samples were analyzed at an accredited lab (Northwest Agricultural Consultants, Kennewick, WA). NRAS has used these results (in the aggregate) to gain a better understanding of nitrogen movement and retention in the soil underlying dairy pens and composting areas in the region. These data were compared to subsurface conditions reported in the literature that potential nitrogen loading rates were drawn from. The soil testing results were not used to identify specific rates to use, however, similarities between soil testing results from GWMA dairies and literature results give more confidence that these rates are appropriate for this study.

Pen samples were collected from 12 locations at depths of 0 (surface) to 6 feet in 1-foot intervals. The table below displays the range in nitrate concentrations found in pens at each 1-foot depth interval (Table 6). Nitrate concentrations from different samples at the same depth were extremely variable. The average concentration decreased throughout the soil profile from 273.3 mg NO₃-N/kg at the surface to 30.4 mg NO₃-N/kg at a depth of 6 feet. The average nitrate concentrations by depth were also plotted in a nitrate profile in Figure 3.

Table 6. Soil sampling results beneath 12 pens in the Yakima Valley

Depth in pen (ft)	0	1	2	3	4	5	6
Minimum (mg/kg NO ₃ -N)	22.6	21.8	10.6	8.3	6.1	6.5	3.8
Maximum (mg/kg NO ₃ -N)	962.6	409.7	199.2	186.5	109.6	93.4	124.7
Average (mg/kg NO ₃ -N)	273.3	165.9	98.5	71.2	45.7	36.7	30.4
Median (mg/kg NO ₃ -N)	118.6	153.8	89.9	63.6	38	29.6	17.1
Standard dev. (mg/kg NO ₃ -N)	308.6	115.3	54.5	45.9	31.1	26.4	36.8

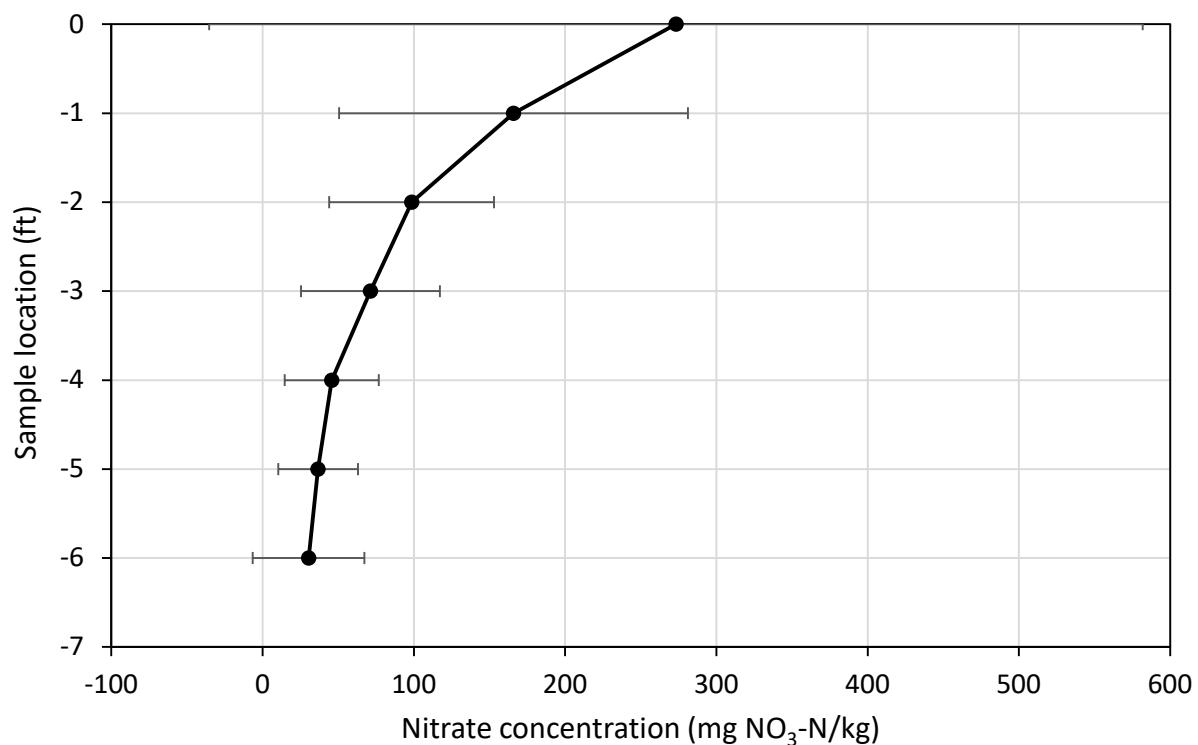


Figure 3. Average nitrate profile beneath 12 pens in the Yakima Valley. Error bars represent one standard deviation from the mean.

Pen soil samples were elevated at the surface and decreased with increasing depth. Soil sampling results are generally compared to a reference number to identify the depth at which numbers return to background levels; no such reference is available in this case. The trends in these results are consistent with those found by Viers et al. (2012) where soil nitrate concentrations were around 200 mg NO₃-N/kg near the surface with a slow decrease to 20-50 mg NO₃-N/kg at depths of 10-15 m. A more detailed comparison is impossible because individual core results, aggregated data, and intermediate depths were not reported in that study. Another study that published soil testing results sampled soil to depths ranging from 1.8 to 4.7 m at 4 beef cattle feedlots in Kansas (Vaillant et al. 2009). A total of 18 soil cores were taken, of which 12 were below their chosen background level (4.1 mg NO₃-N/kg) for the entire core. The remaining 6 cores had elevated nitrate

in the top meter of the core ranging from 10.7 mg NO₃-N/kg to 510 mg NO₃-N/kg and a return below the background concentration with increasing depth. Again, the soil testing results from GWMA dairies are similar to these results in magnitude of nitrate concentration, although the nitrate levels at depths greater than 1 m (3.28 feet) were higher in the GWMA soil sampling results than the Kansas feedlot results. Since this study (Vaillant et al. 2009) was the source that the UC Davis researchers (Viers et al. 2012) relied on to identify their high range loading rate of 1,000 kg N/ha-yr, similarity with these results gives us another indicator that this rate is appropriate for use in the GWMA. One large challenge in reviewing literature and comparing results in this field is the diversity of units and species of nitrogen reported in papers. Reporting of nitrogen as nitrate, nitrate-N, organic nitrogen-N, TKN, ammonia/ammonium, ammonia/ammonium-N, combinations of these, or as total nitrogen is common and makes comparison of literature results difficult and sometimes impossible. Next steps for field research in the GWMA to improve estimates of loading rates from pens should include development and execution of a credible statistical sampling program whose results could be used to develop a GWMA-specific rate with a narrower range.

LAGOONS

Methods, limitations, and assumptions

Limitations

As with the pen identification, every effort has been made in this section to identify facilities and facility uses that are current as of 2015. It can be difficult to distinguish between a lagoon, a settling basin, a settling pond, or an irrigation pond. Different professionals in this industry use different terms for different manure storage impoundments, and different impoundments may be used for different purposes at different times of year. In addition, producers may mix manure and water in impoundments before land application. NRAS has identified impoundments which are primarily used for storage of manure, as opposed to impoundments which are primarily used for storing irrigation water or which are used for mixing manure and water for land application. These impoundments (primarily used for storing manure) will be referred to as lagoons in this report. This difficulty in classification may result in impoundments being placed in the wrong category, despite NRAS's efforts at accuracy.

Lagoon nitrogen concentrations depend on animal housing and facility cleaning practices as well as local environmental conditions. Variations can include the use of flush versus scrape systems to clean barns, the type and efficiency of solids separation systems used, whether and where irrigation water is mixed with manure for land application, and seasonal effects such as precipitation and evaporation rates. Lagoon nitrogen concentrations used in this report are based on 2 data sources. The first is a relatively large subset of farms in the GWMA (approximately 20) whose operators voluntarily shared lagoon nitrogen testing results with NRAS for this study. The second was EPA's lagoon testing results from 5 dairies sampled in 2010 (EPA 2013a). All testing results from these 2 sources were combined and averaged. The resulting nitrogen concentration is higher than lagoon nitrogen concentrations reported in other studies.

Calculating storage in lagoon subsurface soil was beyond the scope of this report. An accurate calculation would require historic information about dairy and beef cattle numbers, management practices, and lagoon construction practices. However, other research indicates that soil beneath lagoons holds large amounts of nitrogen that could be released and emphasizes the importance of appropriate decommissioning at the end of use (Viers et al. 2012).

GIS methodology and lagoon identification

Lagoon points included in the geodatabase represent locations for both dairy and non-dairy lagoons. Point locations were derived using latitude and longitude locations from the DNMP database in conjunction with aerial imagery from Google Maps and USDA NAIP 2013 imagery. Identified lagoon points were compared with DNMP lagoon assessment data followed by direct consultation with DNMP staff to ensure accuracy. Lagoon area is an attribute and was determined using aerial imagery technology (area = length X width), known dimensions from DNMP (length, width), or using the polygon area (calculated area using GIS) from the DNMP assessment. Depth is also an attribute; depth used was the design depth of the impoundment. Lagoons where the design depth was unknown were assigned an estimated depth, which was the average of all depth measurements for lagoons with known depths. Whether depth was the actual design depth or an estimate was documented in an additional Depth Method attribute with values of Actual or Estimate.

The quality assurance procedure conducted for the lagoon points was the same as that for pens and compost areas. Randomly selected points were field surveyed to confirm the identification and accuracy of the lagoon location. Any errors were corrected, and all points were checked against USDA NAIP 2015 imagery.

Lagoon dimensions

WSDA's DNMP conducted a lagoon assessment project in 2015 according to the methods in Natural Resource Conservation Service (NRCS) Technical Note 23 (USDA NRCS 2013). DNMP staff visited every lagoon on a licensed dairy, with the exception of the Consent Order dairies, either 2 or 3 times in 2015 in order to assess each lagoon both when it was near full and near empty. During these assessments staff recorded design length, width, storage capacity, and depth. Length, width, and depth of lagoons were determined from existing nutrient management plans and were likely measured at the time of lagoon construction. If DNMP did not have access to the design dimensions, staff used ArcGIS Collector to delineate the lagoon perimeter. These measurements (both design length and width and polygons) were taken along the lagoon embankment and are the dimensions at maximum capacity. Surface area was calculated from the polygon or the length and width measurements.

NAIP imagery was utilized to identify additional lagoons that were not included in this assessment process. This included the Consent Order dairies. DNMP staff were consulted to determine if the impoundments identified in the aerial imagery were lagoons, ponds, or neither. Only polygons identified as lagoons were included in this analysis. NRAS staff used NAIP 2015 imagery to measure the length and width of these lagoons. NRAS staff then randomly selected a population of these lagoons for quality assurance checks. Staff visited each of these randomly selected lagoons to confirm identification and location.

Individual lagoon design depths were used when this data was available. The average design depth of the 105 lagoons with known depths was 11.3 ft. This average design depth was used as the depth for lagoons that did not have a measured design depth.

In addition, for the lagoons that were part of the NRCS assessment, at each visit DNMP staff estimated the percentage of the lagoon's total capacity in use, and categorized each lagoon as either empty or full. The percentage of lagoon capacity utilized (and as a result, the liquid depth and surface area) varies depending on both season and on-farm management practices. The same farm may have several lagoons that transition from full to empty and back again throughout the year, while another is consistently full; farms may also use lagoons to store irrigation water in addition to manure or use lagoon contents to operate flush systems. During the lagoon assessment process, DNMP staff visited each lagoon either 2 or 3 times in an attempt to view each lagoon both while it was full and while it was empty.

In an attempt to capture a reasonable average yearly liquid depth and surface area to use, NRAS staff used the information recorded by DNMP staff on repeated lagoon visits during the lagoon assessment process. The total number of lagoons visited in 2015 was 115, of which 102 were visited twice and 13 were visited 3 times. Lagoon utilization (% full) varies dramatically depending on the season, so DNMP generally visited each lagoon during both the summer and the winter to account for seasonal variability. The percentage of total capacity utilized at successive visits to the same lagoon was averaged for each of the 115 unique lagoons visited to generate an average capacity used for each lagoon. This average utilization for each lagoon was then averaged across all lagoons, resulting in an average percent capacity used for 2015 visits of 43%. The depth used in the Darcy's law calculations is 43% of the actual or estimated design depth.

This percentage depth reduction was also used to adjust the surface area of the lagoons. Surface area of the lagoons was determined based on one of the methodologies discussed above (lagoon assessment or aerial imagery). Because of the side slope of lagoons, a reduction in depth results in a corresponding reduction in surface area. The surface areas used for calculations were adjusted based on NRAS's estimation that a lagoon with a working depth of 43% of its design depth would have a corresponding surface area reduction to 73% of the design surface area. The basis for this estimate is described in Appendix C: Lagoon surface area reduction methodology.

Lagoon nitrogen concentration

WSDA relied on pre-existing sources of information on lagoon nitrogen concentration for this study. One source of lagoon total nitrogen concentrations was the EPA's sampling in 2010, which was published in their 2013 report (EPA 2013a). This data set consists of 15 lagoon samples from 5 dairy farms (at each farm, 1 sample was taken at the inflow to the farm's lagoon system, and 2 samples were taken at the outflow of the farm's lagoon system). Influent concentrations were slightly higher than outflow concentrations, but a statistical comparison was not conducted (EPA 2013a). The average of the 5 influent concentrations was 1,317 mg N/L and the average of the 10 outflow concentrations was 1,159 mg N/L. The range of sample concentrations was 290- 1,800 mg N/L with a mean of 1,212 mg N/L (EPA 2013a).

Another source of lagoon nitrogen concentration data was lagoon testing conducted by the dairy producers themselves. Dairy producers are required to take yearly samples of lagoon content and

have them analyzed by an accredited laboratory. This is regulatory data used by WSDA's DNMP to assess whether or not producers are making nutrient applications at agronomic rates. The South Yakima Conservation District (SYCD) asked dairy producers to voluntarily share lagoon testing results with NRAS for use in this assessment; SYCD collected testing results from producers, anonymized them, and forwarded the information to NRAS. A total of 23 lagoon total nitrogen testing results were provided. The exact number of dairy farms that shared data is not known; SYCD staff estimated the number at 20 farms. The sample concentrations ranged from 180 – 3,624 mg N/L with a mean of 949 mg N/L. More detailed analysis of these data sources is presented in Appendix B: Lagoon nitrogen concentration statistical analysis.

The mean of the SYCD data set is lower than the mean of the EPA data set. There are many potential reasons for this difference. Neither data set was collected using a statistically-based sampling procedure. The SYCD data was voluntarily shared with WSDA; producers with high lagoon nitrogen concentrations may not have been comfortable sharing their testing results. The EPA study was an effort to identify potential contributors to groundwater contamination; dairies identified for sampling were large, far from other potential nitrate sources, in areas with consistent groundwater flow, and close to drinking water wells with known high nitrate levels. Details of on-farm practices at the dairies in both data sets are unknown. Flush or scrape cleaning systems and the presence and scale of solids separation may affect in-lagoon nitrogen concentrations. At a flush dairy, separated lagoon water is often recirculated to clean barns, while at a scrape dairy, lagoon contents are not generally recirculated. The degree of solids separation depends on the system (and corresponding removal of nitrogen contained in or bound to solids) and also affects lagoon nitrogen concentration.

NRAS consulted supplemental data provided by DNMP to gain additional information about the types of dairy operations within the GWMA boundary. Of the 52 dairies in the data set, 12 were flush dairies, 39 were not flush dairies, and 1 was out of business. Most (83%) of the dairies had some type of solids separator system on site. A minority of the dairies (25%) relied solely on settling basins for solids separation, while 58% of the dairies had secondary processes including slope screen separators, centrifuges, barrel screen roller presses, screw presses, and gravity flow separation. A small number (15%) of dairies had no solids separation systems.

Total nitrogen concentration data used in other studies varies greatly. The UC Davis report used concentrations of 500 and 1,000 mg N/L for different calculations and estimates (Viers et al. 2012). Dairies in California's San Joaquin Valley have lagoon TKN concentrations between 47 and 2,420 mg N/L (Campbell Mathews et al. 2001). Lagoon TKN concentrations from another study in California were reported in a University of California Cooperative Extension publication; of the 7 lagoon results published the range was 320-1,010 mg N/L with an average TKN of 670 mg N/L (reported in Pettygrove et al. 2010). Local data was chosen over non-local literature data in an attempt to use the most accurate values. In addition, this provides a more protective estimate since local values were higher than those utilized in the literature. The SYCD voluntarily shared testing results were combined with the EPA results from testing of the Consent Order dairy lagoons, resulting in an average total nitrogen concentration of 1,053 mg N/L (n = 38); this is the value that will be used in the calculations in this section. Calculations in this section can be updated if additional data is made available.

Atmospheric deposition and volatilization in lagoons

The lagoon nitrogen concentration used for calculations in this report was derived from analysis of lagoon samples. Any nitrogen present in the lagoons due to atmospheric deposition onto the lagoon surface affect the testing results. As a result, these testing results already include the effects of atmospheric deposition. No information was available about the age of the material being tested (for example, how many days before testing the lagoon was most recently filled, emptied, or cleaned). During storage, nitrogen concentration in lagoons typically drops due to volatilization to the atmosphere. Without information about when the material was added to the lagoon and how long it was retained, it would be impossible to determine whether the tested nitrogen concentration represented material that had not yet experienced storage losses or had already experienced storage losses. It was assumed that the nitrogen testing results included a range of fresh and aged manure and that the sample would provide enough variety to be representative.

Since this data already accounts for atmospheric deposition to lagoons, the total area of all lagoons was removed from the atmospheric deposition analysis in section 4. ATMOSPHERIC DEPOSITION. The area that was deducted from the total acreage of the GWMA was the lagoon design surface area.

Lagoon liner permeability and thickness

Current NRCS standards for lagoon liners depend on site characteristics, proximity to wells, depth to groundwater, and soil and aquifer characteristics. Depending on conditions, a site may be considered too vulnerable for lagoon construction or may require the use of a synthetic, compacted clay, or potentially no liner. Rather than specifying hydraulic conductivity or permeability required of liners or underlying soils, current guidelines require that lagoon construction meet required specific discharge rates. These specific discharge rates have been based on historically used permeability of 1×10^{-7} cm/s, with an assumed order of magnitude reduction in permeability due to manure sealing, allowing liner permeability to be 1×10^{-6} cm/s (USDA NRCS 2009). Lagoon liner permeability options were also discussed with some GWMA workgroups in 2015. The groups agreed that 2 liner permeability scenarios should be considered in lagoon seepage calculations. Based on these discussions and limitations in the data available, liner permeabilities of 1×10^{-7} and 1×10^{-6} cm/s were used to determine a low and high rate seepage estimate, respectively.

Construction dates for lagoons in the GWMA are unknown. Without information on how many lagoons were constructed before the 2004 standard, it is impossible to say how many lagoons may have permeabilities higher than 1×10^{-6} . The current NRCS Engineering Handbook and other documentation outlines historic practices and guidance published by NRCS (USDA NRCS 2009, USDA NRCS 2016a, USDA NRCS 2016b).

- Prior to 1990: manure sealing was assumed to significantly reduce seepage from lagoons.
- Late 1980s: A guidance document (South National Technical Center (SNTC) Technical Guide 716) was released specifying that relying on manure sealing to reduce seepage in a finished lagoon was insufficient and specified some site conditions when clay liners should be used.
- 1993: SNTC Technical Guide 716 was updated and reissued. All waste storage ponds are required to have a 1-foot liner and soil must meet certain characteristics (percent fines).

- 1998: Agricultural Waste Field Management Handbook is issued containing material from SNTC Technical Guide 716.
- December 2004, Practice Standard 313 is updated, still requiring a minimum 1-foot liner thickness and adding a required permeability less than 1×10^{-6} cm/s.

Clearly lagoons constructed prior to the current guidance documents are unlikely to meet current NRCS standards. However, no information is available about what seepage might be for lagoons constructed before 1990, or between the 1993 guidance and the 2004 guidance. As a result, it is impossible to estimate what the permeability endpoint would be to estimate a high seepage rate. In addition, lagoon liners can be damaged through inappropriate operation and maintenance activities, which would result in increased leakage rates. The only experimental data on lagoon water loss found was Ham's study of Kansas feedlot and swine lagoons, which identified a seepage rate of 1.1 mm/day. The authors used this rate and experimentally determined depths and liner characteristics of lagoons to calculate a liner permeability of 1.8×10^{-7} cm/s (Ham 2002). A top priority for additional research on potential nitrogen loss from lagoons would be to conduct similar water balance lagoon seepage measurements to determine typical rates for GWMA lagoons. This information could be used to narrow the large range of these estimates.

Although the date of construction is not known, the type of liner was known for most of the lagoons that were part of the DNMP lagoon assessment process. Liner types of the lagoons assessed (n=115) were bentonite amendment (45, or 39%), compacted clay (58, or 50%), flexible membrane (10, or 9%), and unknown (2 or 2%). Current NRCS standards for minimum liner thickness are based on the normal full pool storage depth. The average design depth of lagoons visited by DNMP was calculated to be 11.3 feet. For lagoons with depths of 16 feet or less, the minimum liner thickness required is 1 foot (USDA NRCS 2016a). The average liner thickness of several lagoons studied in Kansas was approximately 1 foot (Ham, 2002). No local data was used to support the 1 foot liner thickness used in the seepage calculations. Based on the current NRCS standard, WSDA has chosen to use the minimum liner thickness required for lagoon seepage calculations.

The DNMP lagoon assessment process identified 10 lagoons with flexible membrane liners, of which 8 were positively identified in the geodatabase. This information was added to the geodatabase with a new attribute (Liner) noting the lagoons with flexible membrane liners. Lagoons with flexible membrane liners will have much lower permeabilities (potentially even permeabilities of 0 cm/s) than lagoons with compacted clay or bentonite liners. However, performance even for flexible membrane liners relies on condition and maintenance. Without information about current condition and maintenance history, NRAS did not change the permeability for these lagoons. This attribute does not reflect the current status of Consent Order dairy lagoons with flexible membrane liners installed since 2015, but the 2015 status. This attribute can be updated in the future to reflect information about more recent flexible membrane liner installations.

Calculation methodology

Potential seepage from dairy lagoons was calculated using Darcy's law. Darcy's law is the method described by NRCS in the Agricultural Waste Management Field Handbook to calculate needed liner composition, permeability, and thickness for lagoons of different depths (USDA NRCS 2009). This

approach relied both on assumptions derived from the literature (liner permeability and thickness) as well as local information (GWMA lagoon surface areas, depths, and nitrogen concentrations). The result of these calculations is the amount of nitrogen expected to pass through the liner, which is then available to move through the soil profile under some conditions. Transport and fate of nitrogen through the soil profile after exiting the lagoon liner was not within the scope of this study.

For the following calculations, all significant figures were kept until the final nitrogen loss estimate was determined. At this point, calculations were rounded to the nearest lb/ac, kg/ha, ton/year, or 1,000 kg/year. The medium rate for lagoons was determined by averaging the results of the low and high rates for each individual lagoon (the low and high permeabilities used in Darcy's Law); it has no physical significance.

First, the volume of fluid leaving the lagoon was estimated using Darcy's law, then multiplied by the total N concentration to determine the nitrogen loss from lagoons within the GWMA.

$$Q = k * \frac{(H + d)}{d} * A$$

Where

Q = the calculated volumetric flow rate (L³/T)

k = coefficient of permeability (hydraulic conductivity, 1x10⁻⁷ or 1x10⁻⁶ cm/s) (L³/L²/T)

d = thickness of soil liner (estimated at 1 foot) (L)

H = vertical distance between top of liner and top of liquid storage (L)

A = lagoon area (L²)

L = length

T = time

$$N \text{ Loading} = Q * C$$

C = Total N concentration, 1053 mg N/L

Results and discussion

Potential loading was calculated for each individual lagoon within the GWMA boundary. Actual measurements for lagoon depth and surface area were used when available. Estimates for these parameters were used when actual measurements did not exist as discussed above. An example calculation can be found in Appendix D: Darcy's law example calculation.

This calculation was not based on mass loading, so manure removal from lagoons during regular operations (for use in crop growth or during cleaning) does not appear as a term in the calculation. However, the inputs to the calculation include typical lagoon utilization identified during the DNMP lagoon assessment process. This typical utilization, or percentage of capacity in use, was determined from repeated visits by DNMP staff to operating lagoons. At each visit, the percentage of capacity in use was recorded. Lagoons may have been full on one visit and empty on a subsequent visit. Some lagoons were full or empty on every visit. This observation of capacity in use was used to develop a typical utilization, which was used to reduce the design depth and surface area of each

lagoon to a working depth and surface area that were used in the Darcy's law calculation. While not appearing as an explicit term in the calculation, manure removed from lagoons for crop production would show up (as lagoons with a low utilization when visited by DNMP staff) and be accounted for in the final estimate.

Darcy's law calculations were run using the 2 different permeabilities discussed above (1×10^{-7} and 1×10^{-6} cm/s) to determine a low and high range estimate. Since this is the only parameter that differed between the calculation scenarios, the estimated loss for high and low differs by a factor of 10. The medium rate was calculated by averaging the low and high rates. Table 7 displays the results from these calculations. The rate per area was determined by dividing the total loss by the total design surface area of lagoons in the GWMA.

Table 7. Estimated high and low loss rates based on Darcy's law

	Low	Medium	High
N Loss (lb N/ac-year)	1,354	7,448	13,542
N Loss (kg N/ha-year)	1,518	8,348	15,178
N Loss (ton N/year)	142	781	1,421
N Loss (kg N/year)	129,000	709,000	1,289,000

These estimates are much higher than those calculated in the UC Davis study (Viers et al. 2012). The totals are not comparable because of the much larger geographic area studied by the UC Davis authors, but the results can be compared on a per-acre basis. In the UC Davis study, the authors identified several different potential loading rates, including several upper limits via different methods and an expected range for loading under typical circumstances. The UC Davis report determined an upper and an alternative upper value for nitrogen loading of 5,100 tons N/year and 1,100 tons N/year, respectively. Using the total area of lagoons identified in the UC Davis study (3,126 acres) to calculate the loading rates on a per-acre basis give upper limits of 0.35 – 1.63 tons N/ac-yr, or 700 – 3,260 lb N/ac-yr. These upper limits were chosen based on liquid loss rates and lagoon nitrogen concentrations from research reviewed here: Ham 2002, van der Schans et al. 2009, Campbell Mathews et al. 2001, and Pettygrove et al. 2010. This research was conducted in Kansas and California. In addition to these upper limits, the authors of the UC Davis study also chose an estimated loading range based on unpublished data from the Tulare Lake Basin and Salinas Valley of 220 – 2,200 tons N/year. Making the same adjustment for lagoon area of 3,126 acres in the UC Davis study, this results in a loading rate range of 0.07 – 0.70 tons N/ac-yr, or 141 – 1,407 lb N/ac-yr (Viers et al. 2012).

The expected loading range for the UC Davis study is much lower than the range expected in GWMA lagoons from the Darcy's law calculation. The high end of the UC Davis expected loading range is similar to the low end of the GWMA expected range. Even the upper limits of the UC Davis expected loading are extremely low compared to the range identified for GWMA lagoons. One contributing factor is the difference in lagoon nitrogen concentrations between the UC Davis study and this calculation. The UC Davis study estimates were largely based on lagoon nitrogen concentrations of 500 mg N/L, although a lagoon nitrogen concentration of 1,000 mg N/L was discussed in that study also. In contrast, the Darcy's law calculations use a much higher lagoon nitrogen concentration of 1,053 mg N/L, which results in a large increase in estimated losses. In addition, the UC Davis estimates are based on experimentally determined rates, while the Darcy's law calculations are

based on a theoretical model that, while it includes real world data on lagoon characteristics, is not calibrated with experimental data on lagoon seepage.

SETTLING PONDS

Some challenges of identifying settling ponds have been discussed above, in the lagoon limitations. Distinctions between impoundment functions may be difficult to identify and impoundment functions themselves can fluctuate. Different industry experts classify impoundments based on different criteria and experience. In addition, there are a wide variety of different construction techniques and operational techniques for settling ponds and basins. Some are earthen ponds that are drained and cleaned as needed. Some are concrete lined, engineered basins, which would make using permeabilities for a clay lined impoundment inappropriate. The lack of information about the diversity of settling basins and their construction techniques makes it impossible to make reasonable assumptions for calculation. The work involved in correctly identifying and characterizing settling ponds or basins well enough for an accurate calculation makes addressing settling ponds beyond the scope of this report.

Conclusions and recommendations

This work is intended to be used as a planning and management tool for the GWMA when determining where to use limited resources. Although the best available information has been used to assess nitrogen available for transport, many of these calculations are partially based on literature values and assumptions due to a lack of local data. Current and new work by state agencies may provide additional information about lagoon conditions that could be used to adjust the permeabilities chosen for the Darcy's law calculation: WSDA's DNMP assessment of Yakima County lagoons through the Natural Resources Conservation Service's Technical Note 23 (USDA NRCS 2013) and the CAFO permit recently issued by the Washington State Department of Ecology, which requires producers to assess lagoons by the process in Technical Note 23. However, translating these condition ratings into a functional permeability that could be used in Darcy's law may be challenging.

WSDA has identified several next steps to refine these estimates:

- measuring lagoon seepage rates in the GWMA would contribute the most useful information to improve this estimate and refine the range of permeabilities used for the lagoon calculation,
- both lagoon and corral estimates could be improved through additional statistical sampling of total nitrogen concentrations in lagoons and statistical sampling of soil nitrogen concentrations below pens,
- and any lagoon condition ratings should be incorporated when they become available.

2. IRRIGATED AGRICULTURE

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Background

This section covers irrigated agricultural production, including estimates of nitrogen inputs from commercial fertilizer, manure, and compost. Cropland associated with dairies is discussed here instead of the CAFO section of the report. Nitrogen available for transport from irrigated agriculture in the GWMA was estimated using a mass balance technique, in which all inputs and outputs of nitrogen were accounted for. The largest and most complicated inputs in this mass balance are crop fertilizer applications. Fertilizer applications are influenced by crop type, crop nitrogen needs, application recommendations, and expected yields. Other inputs and outputs (potential nitrogen fixing, nitrogen removal through crop harvest, irrigation water use, and plant residual removal or incorporation) are also crop dependent. Because of the large number of different crops grown in the GWMA (50 different crop types), WSDA NRAS staff identified the top 15 crops by acreage (based on 2014 WSDA crop data) within the GWMA boundary⁶. NRAS staff then interviewed commodity-specific experts to obtain a typical range of use rates for commercial fertilizer, manure, and compost for each of these top 15 commodities. These top 15 commodities represent 87% of the irrigated agricultural land within the GWMA, and irrigated agriculture makes up 56% (approximately 99,000 acres) of the total land area within the GWMA boundary⁷. A significant proportion of the acreage of these top 15 commodities (33,033 acres or 38%) is dedicated to crops and land uses (corn, triticale, pasture, and alfalfa) that support livestock operations. The other main crops in the region are tree fruit, grapes (both juice and wine), hops, wheat, mint, and asparagus. These top 15 commodities and their acreage are listed in Table 8.

⁶ WSDA NRAS agricultural land use mapping program, 2014 data.

⁷ WSDA NRAS agricultural land use mapping program, 2015 data.

Table 8. Top 15 crops and their acreage in the GWMA

Crop	Acreage
Apple	17,333
Corn (silage)	16,778
Triticale	10,780
Grape (juice)	10,257
Alfalfa	7,989
Pasture	6,731
Cherry	6,336
Hops	5,961
Grape (wine)	5,126
Pear	3,331
Mint	1,418
Wheat	1,283
Corn (grain)	1,166
Asparagus	854
Peach/Nectarine	843

Methods, limitations, and assumptions

Limitations

This assessment is not intended to evaluate the practices of individual farming operations within the GWMA. Information about commercial fertilizer, manure, and compost was collected voluntarily from crop consultants and growers. Growers are not obligated to share fertilizer or soil amendment application information with outside entities (like WSDA) unless required by statute or legal discovery. The objective was to identify the range of commonly used nitrogen application rates for the top 15 crops by acreage grown within the GWMA boundary. The data is grouped by commodity; this allows as much anonymity as possible to agronomists and growers who provided nutrient application information. Information was gathered from crop consultants and growers with the goal of targeting experts who could provide information about a large percentage of the acreage for each crop. As a result, for each crop the number of experts consulted may be relatively small. Although for most crops a large proportion of the acreage was covered, in some cases only one consultant was responsible for most of the acres of a commodity, meaning if that consultant's recommendations or practices were atypical, that may have a large influence on the accuracy of the results.

Data was summarized here for the top 15 crops within the GWMA by acreage, which were identified from 2014 agricultural land use mapping. The top 15 crops will change from year to year, based on weather, economic pressures, and other factors.

This report does not explicitly associate information on irrigation methods with the crop types and mass balance. Irrigation practices can affect the likelihood of nitrogen leaching through the soil profile. In addition, nitrogen removed from the field by irrigation water and traveling with

irrigation return flows is a potential output that was not included in this mass balance. In managed irrigation systems, water can be used as many as 4 or 5 times before being discharged from the system. Nitrogen concentration of this water will be increased by repeated use; accurately estimating this was beyond the scope of this study. In addition, it is possible for nitrogen-containing water to leak from unlined irrigation canals; an assessment of this potential was also beyond the scope of this study.

Results from this study were not compared to the Yakima county deep soil sampling results: that was beyond the scope of this study. Grower responses about application practices and soil organic matter content were the only deep soil sampling results used in this study. An analysis of the deep soil sampling results for comparison to the mass balance would provide a valuable opportunity to calibrate and adjust the mass balance results.

Timing of fertilizer applications, plant uptake, irrigation applications, and crop residue incorporation was not part of this study. Timing of these events as well as timing of weather events such as rainfall, snowfall, and freezing temperatures can all affect whether or not nitrogen in the soil will be taken up by plants, be likely to move with runoff, or be available to leach through the soil profile. In addition, this study does not account for the timing of nitrogen availability from the different nitrogen sources. Commercial fertilizers are formulated to release a specific amount of nutrients at a specific rate over a certain period of time. In contrast, a large amount of the nitrogen present in an application of manure or compost fertilizers is organic nitrogen, which is not immediately available for plant growth. This organic nitrogen will mineralize over time, making more nitrogen available for plant growth for several years after the initial application. The actual nitrogen available in the first and subsequent years depends on the nitrogen source, weather and temperature conditions, and the breakdown rate of the organic matter containing the nitrogen. NRAS did not attempt to account for these nuances of nitrogen availability from different sources; all nitrogen contained in any fertilizer application is assumed to be immediately available in the first year after application, regardless of source.

Pasture was included as a crop in this assessment, and grower applications of commercial fertilizer, manure, and compost were part of that assessment. However, manure and urine deposition by livestock in pastures was not assessed. Adding this information would improve the estimate of available nitrogen from irrigated agriculture.

No estimate of nitrogen fixing by alfalfa was calculated because of the variability in crop behavior due to differences in management practices, pH, nutrient availability, and the presence of rhizobia bacteria throughout the GWMA. Also, the majority of survey respondents indicated that fertilizer was applied to alfalfa which would limit nitrogen fixing.

This assessment is based on 2015 agricultural land use data. Crops may go through rapid expansion or decline of acreage due to economic pressure, changes in weather patterns, or other factors. Similarly, technological innovations and changes in cropping systems or irrigation systems may result in rapid change in crop management characteristics such as planting density (with resultant changes in yield per acre) or the volume of water needed for irrigation. In order to maintain consistency and comparability across the 4 sections of this report, 2015 data was used throughout. Information can be updated uniformly when new information becomes available.

Data collection

WSDA's NRAS maps irrigated agriculture statewide, including the area within the Yakima GWMA boundary. This statewide data was clipped to the Yakima GWMA boundary to limit the dataset to only those crops grown within the GWMA. It was also updated with the 2015 crop mapping data. NRAS did additional mapping work for field corn to distinguish between grain and silage corn acreage for this project. The crop data is captured in the GIS database as polygons with attributes that include locations, crop type, irrigation method, acres, date surveyed, and if it was documented as organic according to WSDA organic program GIS data. In addition, acreage double cropped with field corn and triticale was identified.

Fertilizer application data was collected via telephone survey. In order to increase participation, respondent's identities were not recorded; the goal was to gather enough data to develop a typical use range, not connect application rates to specific farming operations. Data was collected for the top 15 crops (representing 87% of the total irrigated acreage in the GWMA) for applications of commercial fertilizer, manure, and compost.

In order to develop an estimate for each crop, WSDA's goal was to survey enough producers and crop consultants to get nutrient application data covering a minimum of 30% of the acreage for each target commodity. Because there are thousands of individual farms operating within the GWMA, collecting information from individual farmers would be extremely time consuming. Crop consultants or agronomists are used by the majority of commercial farms operating in the valley. There are only a few companies that do this type of work, limiting the number of interviews required to access information. While these consultants are not usually farmers, they create prescriptions for fertilizer applications across multiple crops on many different farms. All respondents were asked to provide both typical use rates and a range of use rates, if applicable, for commercial fertilizer, manure, and compost. In addition, respondents were asked how many acres of each crop they work with or represent.

Data about fertilizer use practices was also drawn from the surveys conducted through the deep soil sampling process. These responses cover much smaller acreages than the information from crop consultants, but provide useful additional information. These two sources of survey information could be compared to identify discrepancies or potential inaccuracies. Unfortunately for most of the commodities surveyed, the majority of the responses are from either professional crop consultants or the deep soil sampling surveys, making a statistical comparison between the two sources impossible.

The data collection goal of 30% of acreage was met for all commodities, with the exception of pasture, for which information on only 11% of the GWMA acreage could be collected. In total, NRAS gathered information about more than 58,000 acres of the 15 targeted commodities, or 68% of the acreage dedicated to those commodities in the GWMA (Table 9).

Table 9. Acreage in each commodity, with data collection targets and collection results

Commodity	Total acreage of commodity in GWMA	30% goal (acres to collect)	Acreage collected	Percent of total acreage collected
Apple	17,333	5,200	14,165	82%
Corn (silage)	16,778	5,033	11,480	68%
Triticale	10,780	3,234	7,696	71%
Grape (juice)	10,257	3,077	3,849	38%
Alfalfa	7,989	2,397	6,194	78%
Pasture	6,731	2,019	725	11%
Cherry	6,336	1,901	3,826	60%
Hops	5,961	1,788	3,760	63%
Grape (wine)	5,126	1,538	2,500	49%
Pear	3,331	999	1,741	52%
Mint	1,418	425	780	55%
Wheat	1,283	385	490	38%
Corn (grain)	1,166	350	348	30%
Asparagus	854	256	506	59%
Peach/Nectarine	843	253	630	75%

Mass balance

In a mass balance (in this case, focused on nitrogen) all material moving into or out of a system is accounted for. In this case, the system was defined as a 1-acre crop field. Inputs, or additions of nitrogen to the field, were categorized as positive (+). Outputs, or removals of nitrogen from the field, were categorized as negative (-). In addition, processes that transform nitrogen may be significant, resulting in either an increase (+) or decrease (-) of available nitrogen in the field. All known inputs, outputs, and transformations are summed, and the sign and magnitude of the resulting sum can be used to determine whether there is a net accumulation or a net loss of material in the field, or whether there are unknown material flows or transformations.

$$N \text{ accumulation or loss} = \text{Inputs} \pm \text{Transformations} - \text{Outputs}$$

In this case, the list of inputs and transformations includes:

- commercial nitrogen applications (lb N/ac-yr) (evaluated at low, weighted average, and high values);
- manure nitrogen applications (lb N/ac-yr) (evaluated at low, weighted average, and high values);
- compost nitrogen applications (lb N/ac-yr) (evaluated at low, weighted average, and high values);
- atmospheric nitrogen deposition (lb N/ac-yr) (evaluated at low, medium, and high values);
- irrigation water nitrogen (lb N/ac-yr);
- calculated residual nitrogen incorporated (lb N/ac-yr) (evaluated at low, average, and high for some crops and one value for others);

- soil organic matter conversion (lb N/ac-yr) (evaluated at low, average, and high values).

The outputs (or nitrogen losses) are:

- crop nitrogen uptake, removed through harvest (lb N/ac-yr) (evaluated at low, average, and high for some crops and one value for others); and
- nitrogen loss to atmosphere (lb N/ac-yr).

Determination of inputs, outputs, and transformations

Commercial, manure, and compost nitrogen applications: Growers and agronomists reported use of commercial fertilizer, manure, or compost, as well as application rates and acreages. In order to account for the use of multiple nitrogen sources, within each commodity the proportion of acres each source was used on was a weighting factor in the final calculation. This weighting factor appears as a multiplier for each nitrogen source and was calculated separately for each commodity and nitrogen source. It was generated by calculating what proportion of acres that nitrogen source was used on out of the total acres of that commodity surveyed. For example, in apple production commercial nitrogen application was reported on 86.3% of the total surveyed acres, so 0.863 is used as a multiplier whenever inputs to apple production from commercial nitrogen applications are calculated. This weighting allows the survey data to be scaled from the hundreds of acres for which applications were reported to the theoretical 1-acre field the mass balance is calculated for and make standardized comparisons between crops and other nitrogen sources.

The low, medium, and high application rates were drawn directly from the survey results. The low and high rates used were the lowest and highest reported application rates for each nutrient source and commodity. The medium application rate was a weighted average of all single application rates reported where each reported rate was weighted by the acreage that survey respondent controlled before averaging.

Commercial fertilizers are formulated to release nutrients at a specific rate over a certain period of time. The nitrogen in compost or manure is released over a longer period of time at a lower rate, and these products are often applied to improve soil health in addition to providing fertilization. In soils with a history of regular manure applications, the breakdown of organic matter from applications in previous years combines with the available nitrogen from the current year's application to make the full applied amount of nitrogen available during that growing season. For this calculation, NRAS has assumed that growers using manure or compost have been applying manure or compost regularly and the nitrogen content from those materials is considered to be immediately available because of the nitrogen contributions from previous applications.

Atmospheric nitrogen deposition: This input is the same for every crop assessed. The low rate for atmospheric deposition for the lower Yakima Valley was taken from the most recently reported (2012) wet and dry atmospheric deposition at the Mt. Rainier National Atmospheric Deposition Program (NADP) station; 1.53 lb N/ac (EPA 2016). The medium deposition rate is the result of a 5-day modeled average from December 2015; 2.05 lb N/ac. To estimate a high rate, the medium atmospheric deposition was multiplied by a safety factor of 3 to account for potential higher

deposition during weather conditions resulting in decreased circulation and poor air quality⁸. More details on the methodology and assumptions for atmospheric deposition can be found in Section 4. **ATMOSPHERIC DEPOSITION.**

Irrigation water nitrogen: The nitrogen input from irrigation water is also unique to each commodity. It is based on the nitrogen content of the lower Yakima River and the irrigation water duty for each commodity. Yakima River nitrogen concentration was taken at the U.S. Geological Survey station on the Yakima River at Kiona during the 2012 irrigation season (April through September) (USGS 2012). This time period was chosen to represent the typical time frame during which irrigation water would be withdrawn for use, including both high flow conditions during the late spring (when nitrogen concentration would be low) and low flow conditions during the late summer (when nitrogen concentration would be high). Summary information about this data set was calculated, and the mean (0.809 mg N/L) of the 10 samples was used in the mass balance (Table 10).

Table 10. Summary statistics for Yakima River nitrogen concentrations (n=10) (USGS 2012)

Minimum (mg N/L)	0.42
Maximum (mg N/L)	1.26
Mean (mg N/L)	0.809
Standard deviation (mg N/L)	0.366
Median (mg N/L)	0.675

Although the sampling location is located in the mainstem of the Yakima River and downstream of the irrigation districts serving the GWMA agricultural lands, NRAS believes that it serves as a good surrogate for potential irrigation water nitrogen levels in the area. The majority of the irrigation water in the lower Yakima Valley is surface water. Very little groundwater is used for irrigation with the exception of drought years when use of emergency drought wells is permitted. However, variation in nitrogen between different irrigation water sources, and in the same irrigation water source from year to year is expected. A detailed analysis of sources of irrigation water was not within the scope of this project.

The second part of this input includes commodity specific irrigation water duty for the 15 commodities included in the mass balance. It also takes into account total precipitation and effective precipitation. The data was drawn from the Washington Irrigation Guide and reviewed by the Irrigated Agriculture Working Group (IAWG) of the GWMA. The water duty (in inches) values for apples and cherries were reflective of current use patterns, and were edited by Stu Turner, agronomist and member of the IAWG (Appendix F: Irrigation water use).

Calculated residual nitrogen: Calculated residual nitrogen is the nitrogen taken up during the growing season that is left in the plant after harvest. This term is based on plant nitrogen uptake during the growing season (which appears in the mass balance as an output) and the amount of nitrogen removed when the crop is harvested. As a result, it is different for each commodity. The

⁸ Medium and high deposition values were recommended by Dr. Ranil Dhammapala, an atmospheric scientist with Washington State Department of Ecology's Air Quality Program, during a meeting on November 3, 2016.

components of the residual nitrogen calculation were estimated by the Jim Trull and Scott Stevens, as well as the IAWG and Sunnyside Valley Irrigation District and were based on regularly used resources. Depending on the crop type, the residual nitrogen taken up during the growing season but remaining after harvest may be left in the field and incorporated (as in the case of annual crops) or that residual nitrogen may be retained in the plant, in the new growth of vegetation during the season (as in the case of perennial crops). For perennial crops, some of this new growth will be removed during pruning and through seasonal leaf loss and will eventually still return to the soil, and some may be retained on the plant and not return to the soil. For this analysis, it was assumed that calculated residual nitrogen should be wholly counted as an input to the system for all crop types, despite the fact that some crops may differ in that regard; this is an input that can be varied as more information becomes available. Estimates of nitrogen removed during harvest and the inputs used are presented in Appendix G: Nitrogen uptake estimates. This appendix includes data on typical crop yields, nitrogen removed through harvest, nitrogen uptake by the plant during its growing cycle, and estimates of nitrogen applied.

Soil organic matter conversion to nitrate: This term represents the breakdown of organic matter (containing nitrogen) to nitrate-nitrogen available for both crop uptake and leaching below the crop root zone. This input was the same for every commodity analyzed. The native organic matter content of most lower Yakima Valley soils is around 1% but when these soils have a history of organic inputs such as manure, it can increase by 2 to 3 times⁹. This was confirmed by a review of the deep soil sampling results. WSDA reviewed results from the fall and spring sampling of 2015 (Table 11) and decided to use the average organic matter content of 2.17% from this set of sampling results to represent these soils.

Table 11. Summary statistics of organic matter percentage of sampling in the 2015 Yakima Valley deep soil sampling study (n = 108)

Minimum (%)	0.84
Maximum (%)	4.24
Mean (%)	2.17
Standard deviation	0.69
Median (%)	2.15

In general, organic matter in soils can mineralize to provide between 20 and 65 lb N/ac per 1% organic matter. In soils with no history of manure applications the mineralization is expected to be 20-40 lb N/ac per 1% organic matter. In soils with a history of manure applications the mineralization is expected to be 40-65 lb N/ac per 1% organic matter¹⁰. In this mass balance, WSDA used 2.17% organic matter (based on the deep soil sampling results) and soil mineralization rates that varied for different crops based on the expected history of manure applications (Table 12).

⁹ Personal communication, based on experience and best professional judgment of Virginia 7Prest, WSDA Dairy Nutrient Management Program manager and agronomist

¹⁰ Based on the recommendation of Dr Haiying Tao, Department of Crop & Soil Sciences, Washington State University

Table 12. Range of soil organic matter mineralization used for different crops

Organic matter mineralization range (lb N/ac per 1% organic matter)	Crops
20 (L), 30 (M), 40 (H)	Apple, juice grape, cherry, wine grape, pear, mint, asparagus, peach/nectarine
40 (L), 52.5 (M), 65 (H)	Silage corn, triticale, alfalfa, pasture, hops, wheat, grain corn

Manure represents only one potential source for this soil organic matter content, and the average 2.17% organic matter content of the soil tested during the deep soil sampling may be due to a history of manure applications on those fields. However, there are a number of agricultural practices that producers use to increase the organic matter content of their soil. Direct seed and no-till practices both leave the soil undisturbed, preventing the rapid decomposition of organic matter that takes place when the upper layers of the soil profile are exposed to the atmosphere. Cover cropping can also be used to increase soil organic matter content.

Crop nitrogen uptake: This is the amount of nitrogen taken up by the plant from the soil during the growing season. The crop nitrogen uptake is also part of the calculation for residual nitrogen above. This output is unique for each commodity, and was estimated by the IAWG. This output represents the amount of nitrogen taken up by the crop during the growing season; the estimates, ranges, and sources are detailed in Appendix G: Nitrogen uptake estimates.

Loss to atmosphere: The numbers used in this output of the mass balance equation were taken directly from Table 36, pages 117-118 of the 2006 NRCS publication “Model Simulation of Soil Loss, Nutrient Loss, and Change in Organic Carbon Associated with Crop Production” (Potter et al. 2006).

The full equation, with all inputs and outputs, is:

$$\begin{aligned}
 & \text{Est. N Loading per year} \\
 &= \left(((\text{Comm N} \times \text{proportion}) + (\text{Compost N} \times \text{proportion}) \right. \\
 & \quad + (\text{Manure N} \times \text{proportion}) \\
 & \quad + (\text{Atmos N Dep} + \text{Irrigation Water N} + \text{Calculated Residual N} \\
 & \quad + \text{N Soil Conversion})) - ((\text{Crop Uptake N} + \text{N Loss to Atmosphere})) \Big) \\
 & \quad \times (\text{Total Commodity Acres})
 \end{aligned}$$

This calculation was used for each individual commodity of the top 15 identified.

GIS compilation

The GIS data for the irrigated agriculture section of this study is stored in a file geodatabase that contains both attributes and spatial locations of this data. It contains 6 feature classes and one table: YakimaGWMA (polygon, GWMA boundary), WSDACrop2015 (polygons, crop identification), TriticaleDoubleCrop2015 (polygons, crop identification), Lagoons (points), Ponds (points), and CAFO_Pen_Compost (polygons, boundaries of pens and compost areas). This database also contains a table, IrrigatedMassBalance, which contained the mass balance calculations and results.

Metadata is included with the GIS database to further describe the additional aspects of the GIS data. This includes information such as the extent, credits, use limitations, scale, processing environment, author, and spatial reference.

Cover crops

Cover crops are plants grown to manage weeds, reduce erosion, improve soil quality, retain water, and prevent pests and diseases; they may help prevent nutrient leaching¹¹. Although cover crops benefit soil health and can provide nutrients for future crops, an in-depth analysis of behavior, cultivation, and nitrogen influence of different cover crops used in cropping systems was beyond the scope of this study due to their highly variable use and the limited research available.

The most common area where cover crops are grown in the Yakima GWMA is in alleys between rows used for cultivation of tree fruit, grapes, and hops. Depending on the cropping system and management practices, these cover crops may or may not be fertilized. Cover crops are typically mowed (with the residue left onsite) or reincorporated, so the nitrogen is recycled rather than removed through harvest. This practice increases the organic matter content of soils in the alley over time.

In orchards, the tree row is approximately 30% of the area while the alley is 70%. With dwarfing trees, approximately 80% of the roots are in the rows with 20% in alleys. In older orchards, tree roots extend into the alley. In one orchard study (in Quincy, Washington), with grass used as an alley cover crop, there were 4 cuttings each year, with the nitrogen recycled each time into regrowth. With 8-foot wide alleys in the orchard, the cover crop provided 30-60 lb N/ac-yr¹². Of the orchard cover crops in the valley, 95% are grasses, with some volunteer clover. Straight legume cover crops are not used in the Yakima area.

The historic orchard fertilization practice was to broadcast over the entire tree row and alley cover crop, but practices have generally changed in recent years and now typically the tree row receives a banded fertilizer application. This leaves the alley cover crop nitrogen starved which results in a scenario with minimal nitrogen available for leaching (Granatstein et al. 2017). In older orchards, tree roots extend into the alley with grass cover crops and broadcast fertilization may be practiced. Tree roots will utilize some of the N in the alleys but the cover crop is often shaded and not very productive, and thus less effective at N scavenging to prevent leaching.

In juice (Concord) grape vineyards, fertilizer is applied only on the vineyard row (through drip or banded) and not in the alley¹³. Juice grapes may or may not have cover crops as bare dirt alleys are common. The historically used cover crop was cereal rye, but due to costs this is no longer common. The primary cover crop currently used is resident vegetation (native grasses, forbs and weeds). Cover crops can vary depending on whether or not the operation is organic. Common cover crops in organic juice grape systems are vetch and Austrian pea (about 5-6% of the juice grape acreage in

¹¹ Personal communication 5/4/2017, Harold Crose, cover crop and soil health specialist, USDA Natural Resource Conservation Service, retired.

¹² Personal communication 5/4/2017, 8/14/17 David Granatstein, Sustainable Agriculture Specialist, Washington State University Center for Sustaining Agriculture and Natural Resources, Wenatchee Washington

¹³ Personal communication 5/8/2017, Dr. Joan Davenport, Washington State University Irrigated Agriculture Research & Extension Center, Prosser, Washington

the Yakima Valley is organic ¹⁴) which can produce 118-130 lb N/ac-yr, but contribute very little excess nitrogen^{12,13} (Bair et al. 2008).

In wine grapes and hops cereal grains may be used as cover crops, but they are not typically fertilized and are primarily drip irrigated so are unlikely to elevate the risk of nitrogen loss¹³.

Because of the variability in which orchards and vineyards have cover crops, which cover crops are used, the age of the planting, the management practices used, and the low risk of nitrogen loss in cover crop cultivation, the influence of cover crops was not included in this estimate.

Results and discussion

During the data collection phase of the irrigated agriculture component of this report, interviewees were asked what percentage of their acreage were fertilized with commercial fertilizer, manure, or compost. Table 13 shows the results from this survey; the most commonly used product is commercial fertilizer. The only exceptions are silage corn and triticale where more acres are fertilized with manure than with commercial fertilizer. In this table, crop acres fertilized with multiple products appear more than once. As a result, for some crops the percentages sum to more than 100%. For example, all acres grown (100%) of wine grapes were fertilized with commercial fertilizer. In addition, 20% of the acres of wine grapes were fertilized with compost. As a result the total acres fertilized for wine grapes adds up to 120%: 20% of the acres were fertilized with 2 different products. The only crops where growers or crop consultants reported use of all 3 fertilizer products were hops and triticale. The percentage of acres on which multiple sources were used is calculated in the last column.

¹⁴ Personal Communication 5/8/2017 Mike Concienne, Manager, National Grape Cooperative Association, Grandview Washington

Table 13. Summary of fertilizer types used for the top 15 crops by acreage in the GWMA

Crop	Commercial fertilizer (% of acres)	Manure (% of acres)	Compost (% of acres)	Acres using multiple sources (%)
Apple	86.3	0	13.7	0
Corn (silage)	49.6	53.9	0	3.5
Triticale	27.2	74.8	0.8	2.8
Grapes (juice)	91.0	0	11.6	2.6
Alfalfa	91.8	8.2	0	0
Pasture	97.2	2.8	0	0
Cherry	80.5	0	19.5	0
Hops	97.3	2.7	16.0	16
Grapes (wine)	100.0	0	20.0	20
Pear	76.6	0	23.4	0
Mint	100.0	0	0	0
Wheat	93.9	22.4	0	16.3
Corn (grain)	71.3	62.6	0	33.9
Asparagus	100.0	0	0	0
Peach/Nectarine	81.0	0	19.0	0

Application rates reported by growers are presented in Table 14. The range of application rates is first, followed by the weighted average (used for the medium rate calculations) in parentheses. For several crops (apples, alfalfa, and pears), some growers reported using no commercial fertilizer during some years. For almost all crops, the range spans an order of magnitude between low and high. This indicates the diversity of practices used by different growers. It also suggests that some growers are customizing application rates to crop needs each year, based on soil testing results.

Table 14. Ranges of application rates (with weighted average in parentheses) reported for commercial fertilizer, manure, and compost

Crop	Commercial fertilizer (lb N/ac)		Manure (lb N/ac)		Compost (lb N/ac)	
Apple	0-150	(60)	0	(0)	15-100	(47) (47)
Corn (silage)	40-434	(214)	20-324	(203)	0	(0)
Triticale	60-225	(107)	20-350	(104)	170	(170)*
Grapes (juice)	0-100	(80)	0	(0)	21.5-90	(64)
Alfalfa	0-210	(74)	10-300	(161)	0	(0)
Pasture	50-200	(120)	17	(17)*	0	(0)
Cherry	20-125	(56)	0	(0)	15-72	(52)
Hops	25-225	(192)	132	(132)*	30	(30)*
Grapes (wine)	15-40	(25)	0	(0)	36.6-54.9	(46)
Pear	0-100	(57)	0	(0)	15-80	(58)
Mint	80-300	(269)	0	(0)	0	(0)
Wheat	60-120	(106)	90-240	(131)	0	(0)
Corn (grain)	100-300	(214)	50-220	(135)	0	(0)
Asparagus	40-100	(99)	0	(0)	0	(0)
Peach/Nectarine	30-80	(51)	0	(0)	15-30	(28)

*When no range was reported only a single value is presented in this table.

To better understand the role different nutrient sources play in the amount of nitrogen available for transport, the mass balance inputs were examined (Figure 4). All inputs other than nutrient applications were categorized together ("Other"). The "other" category includes atmospheric deposition, irrigation water concentration, calculated residual nitrogen, and soil organic matter conversion; these inputs are not directly influenced by fertilizer applications. The magnitude of this category is largely determined by calculated residual nitrogen and soil organic matter conversion. Calculated residual nitrogen is unique to the individual crop type, while soil organic matter conversion is related to soil properties and the same calculation was used for all crops. For most crops, fertilizer applications consist mostly of commercial fertilizer. Some exceptions are corn (silage and grain) and triticale, some of which consistently receive manure applications and are often grown to support dairy operations.

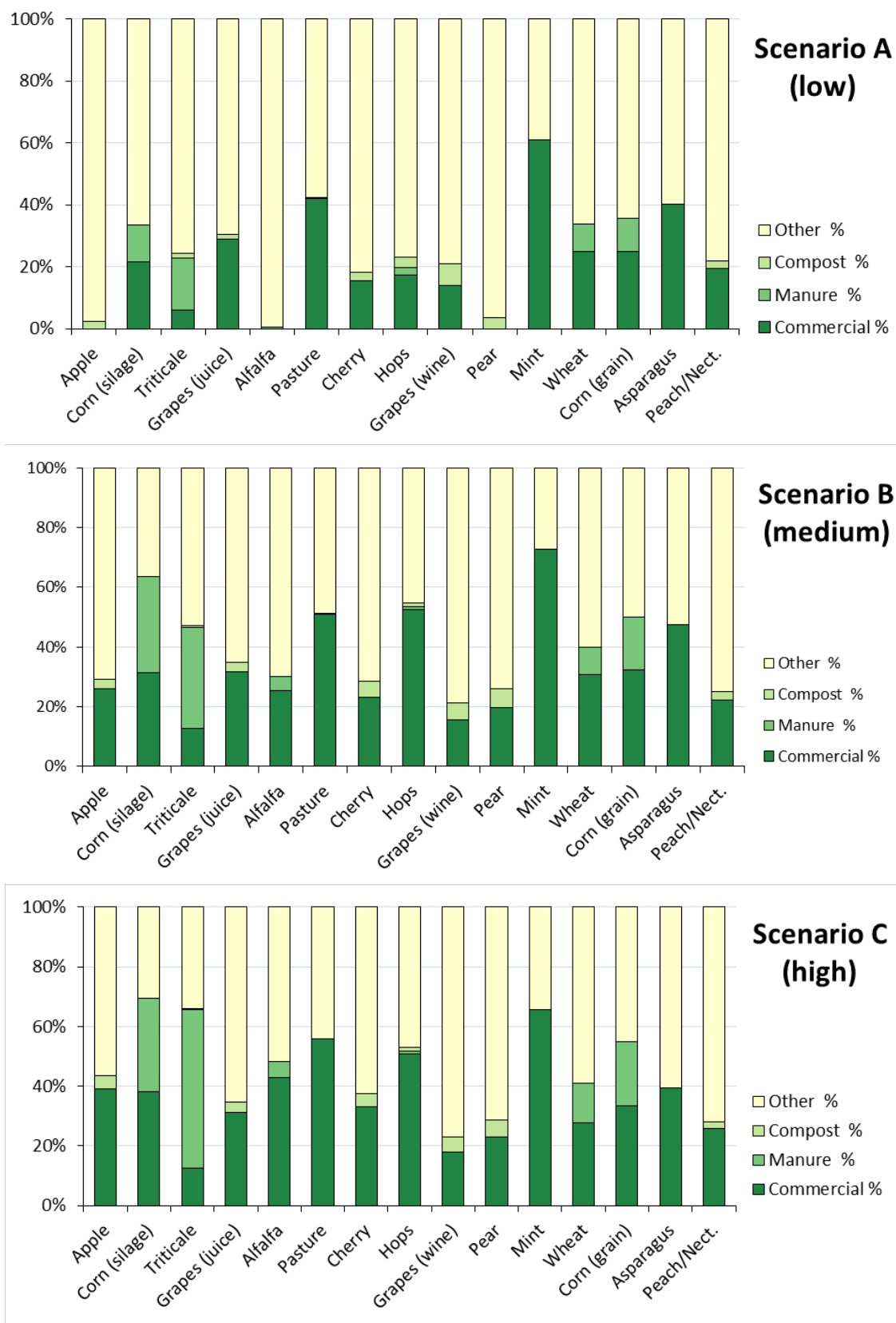


Figure 4. Inputs in the irrigated agriculture mass balance

Data on irrigation practices was collected through WSDA's agricultural land use mapping (Figure 5). For this report irrigation types were divided into 4 main categories based on whether the irrigation type is likely to result in water loss through the soil and contribute to available nitrogen: sprinkler, micro, macro, and miscellaneous. This information is summarized for both all the irrigated acreage in the GWMA and for the top 3 crops in terms of nitrogen surplus per acre (identified in Table 15).

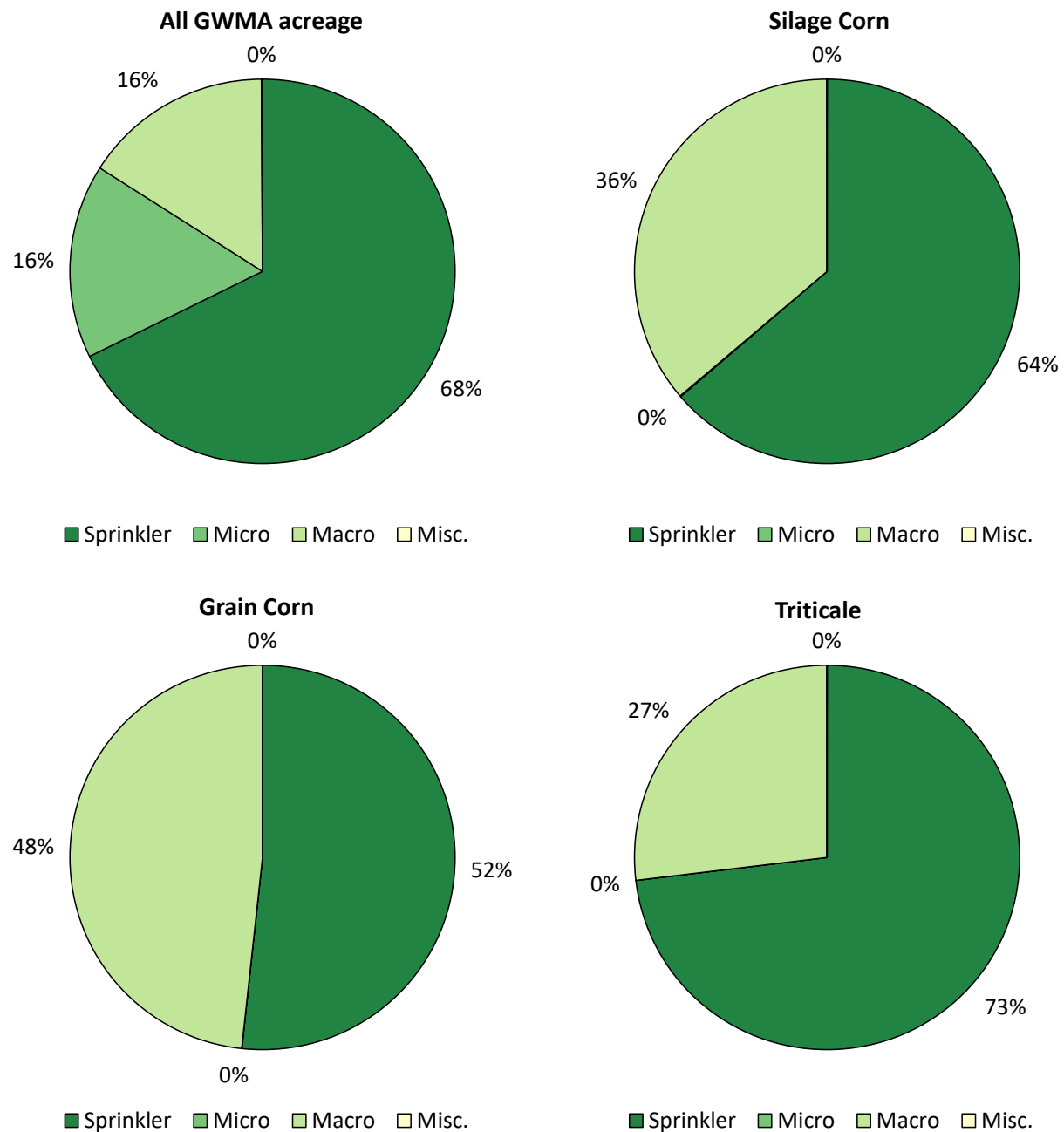


Figure 5. Irrigation types for all GWMA acreage and top 3 commodities with surplus nitrogen inputs (per acre). Due to rounding, categories with 0% are either 0 or values less than 1 that rounded to 0.

The most used irrigation type in the GWMA's irrigated acreage was sprinkler irrigation, which includes center pivot, big gun, sprinkler, wheel line, and combinations of these. Of the total irrigated acreage in the GWMA, sprinkler irrigation was used on 68%. Micro irrigation was the second most common and accounts for about 16% of the irrigation. Micro irrigation includes drip, micro sprinkler, drip/sprinkler, and combinations. The third most common was macro irrigation which includes flood, rill, and combinations with the sprinkler group; macro irrigation accounted for almost as much acreage as micro irrigation, accounting for over 15% of the GWMA acreage (these values have been rounded in Figure 5). The miscellaneous group included irrigation by hand or acreage for which the irrigation type is unknown; this group made up less than 1% of the irrigated acreage in the GWMA.

Because of the potential for irrigation type to affect nitrogen leaching, the irrigation types for the top 3 crops with nitrogen surpluses on a per acre basis (silage corn, grain corn, and triticale) were also analyzed individually. For each of these crops, over 50% of the acreage was irrigated with sprinklers. For silage corn, the second most common technique is macro irrigation (the most likely to result in excess water application and leaching), which accounts for approximately 36% of the acreage. Macro irrigation is also the second most commonly used irrigation type for both grain corn and triticale, used on 48% and 27% of the acreage, respectively. Micro irrigation and miscellaneous irrigation types were used on less than 1% of the acreages of silage corn, grain corn, and triticale. Without detailed information about water loss through excess application, nitrogen content of lost water, and soil testing results, WSDA was unable to specifically relate the individual irrigation practices to any potential nitrogen surpluses.

The results of the mass balance equation are shown below for the 15 commodities evaluated (comprising 87% of the total irrigated agricultural acreage in the GWMA). These values represent the estimated nitrogen surplus resulting from one year of inputs and outputs. These estimates do not account for nitrogen already present in the soil before fertilization. Values shown in Table 15 include low, average, and high potential nitrogen surplus in lb/ac-yr for each commodity resulting from one year's worth of applications and removals. Negative values represent a localized removal of nitrogen and do not offset excess nitrogen from other crops or areas within the GWMA. An example mass balance calculation for scenario B (medium) for the estimate of potential nitrogen surplus for apples is presented in Appendix H: Mass balance example calculation, apples.

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

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

At the low end of the range, the sum of one year's worth of inputs and outputs for many crops is less than zero. The survey results these calculations are based on include both typical year-after-year application practices and a range of practices which should encompass both a producers best possible year (where high nitrogen in a pre-plant soil test allowed a producer to make very low or even no nitrogen applications) and worst possible year (where a producer needed to make high nitrogen applications to meet crop growth needs). In addition, a net negative sum from a year's worth of inputs and outputs doesn't mean that there is no nitrogen loss during the year – losses may still take place after fertilizer applications if heavy rainfall or irrigation applications take place before plant growth uses the applied nutrients. However, the presence of these low values in the range of practices suggests that producers are responsive to the information in pre-plant soil tests and work to tailor nutrient applications to crop growth needs as possible. Successive years with a net nutrient deficit are likely to be followed by higher nitrogen applications to maintain yields.

Table 16 has been shaded to illustrate which commodities, based on the mass balance, have agricultural practices that may remove nitrogen (green) or add excess nitrogen (yellow) to the system. Commodities that have a negative value for the sum of the inputs and outputs are displayed with a dashed line to reduce confusion. Practices used on these crops are not making nitrogen available for transport (considered over the course of a year) nor are they removing excess nitrogen available from fertilization practices of another commodity. Only positive values are summed for the totals estimated in the low, medium, and high scenarios.

Table 16: Sum of inputs and outputs for the top 15 crops in the GWMA

Commodity	Estimated total N surplus in GWMA (ton N/yr)		
	Low	Medium	High
Apple	-	551	1427
Corn (silage)	-	390	2029
Triticale	-	69	1346
Grapes (juice)	78	538	730
Alfalfa	-	-	-
Pasture	-	-	209
Cherry	87	248	495
Hops	-	296	337
Grapes (wine)	103	171	261
Pear	-	108	197
Mint	-	32	73
Wheat	-	28	72
Corn (grain)	-	86	165
Asparagus	25	55	67
Peach/Nectarine	5	23	44
Total	298	2,595	7,452

A nonzero result in a mass balance (Table 16) can indicate either unknown inputs, outputs, or transformations, or net accumulation or loss. Of the 15 crops assessed, 10 did not have a yearly nitrogen surplus when evaluated at the low range estimates. Only juice grapes, cherries, wine grapes, peaches/nectarines, and asparagus had calculated nitrogen surpluses at the low range. At the high level, the majority of crops had calculated excess nitrogen. The only crop that did not was alfalfa.

Alfalfa was not estimated to have a nitrogen surplus at any evaluation level (low, medium, or high). Alfalfa is a complex perennial crop. It removes large quantities of nutrients from the soil (Koenig et al. 2009). It can meet most of its nitrogen needs from the atmosphere through nitrogen fixation, but is dependent both on the presence of rhizobia bacteria in the soil and on whether or not supplemental nitrogen is added. Alfalfa is considered a “lazy” plant and will use nitrogen from other sources such as manure or commercial fertilizer if given the chance. The practice of nitrogen supplementation on alfalfa does occur within the GWMA. However, agricultural practices used for perennial crops like alfalfa and pasture remove the majority of the plant residue from the field during harvest (hay/silage) or through grazing, which may contribute to the fact that these crops largely did not have calculated nitrogen surpluses. Due to the variability in the crop behavior depending on the presence of rhizobia bacteria, pH, and nutrient availability, and the variability in management practices in the GWMA, no estimate of nitrogen fixing of alfalfa was calculated.

One of the reasons for differences in the excess nitrogen for different commodities lies in the unique cultivation practices for each crop. The orchard and vineyard crops listed above (apples, grapes, cherries, pears, and peaches/nectarines) are permanent crops. Producers of these crops do not have access to options like crop rotations or fumigation to deal with disease and pest pressure and as a result may rely on tools like high nutrient applications or applications of multiple nutrient sources in order to improve soil health and maximize fruit production. In addition, producers of crops intended for human consumption may be reluctant to make manure and compost applications because of concerns about pathogen transfer, reducing their fertilization options

further. The majority of manure and compost applications observed were taking place on crops intended for animal feed or prior to planting permanent crops.

Annual crops such as silage corn, grain corn, triticale, and wheat use both commercial nitrogen and manure throughout the GWMA. Triticale is double-cropped (2 crops in one growing year) with silage corn, and triticale cultivation occurs on almost all sprinkler or center pivot irrigated fields in the GWMA. Triticale cultivation rarely occurs on rill irrigated fields. In this case, triticale is planted in the fall, harvested in the spring (April-May) with silage corn, wheat, or oats seeded immediately afterward and harvested late summer or fall (August-September). Generally, the nitrogen application for this corn/triticale cropping system is split – 1 application in the fall and 1 in the spring. Corn (silage and grain) use fairly even amounts of commercial nitrogen and manure on most of the acreage.

The crops with the highest estimated total nitrogen surplus (over the entire GWMA) are not necessarily the crops with the highest surpluses per acre. The top 4 crops in terms of nitrogen surplus are also the 4 crops with the highest cultivated acreage. There are crops with comparable or higher nitrogen surpluses per acre (cherries, grain corn, and asparagus) but these crops are cultivated on far fewer acres. They may still represent localized risk to groundwater.

The mass balance sums at low, medium, and high range were combined with WSDA's cropland data layer to generate maps showing which areas of the GWMA have nitrogen surpluses under low, medium, and high range scenarios (Figure 6, Figure 7, and Figure 8). In these maps, commodities have been shaded according to the estimated nitrogen surplus in lb N/ac-yr; commodities where the estimate was less than zero have been grouped and represented as 0 lb N/ac-yr).

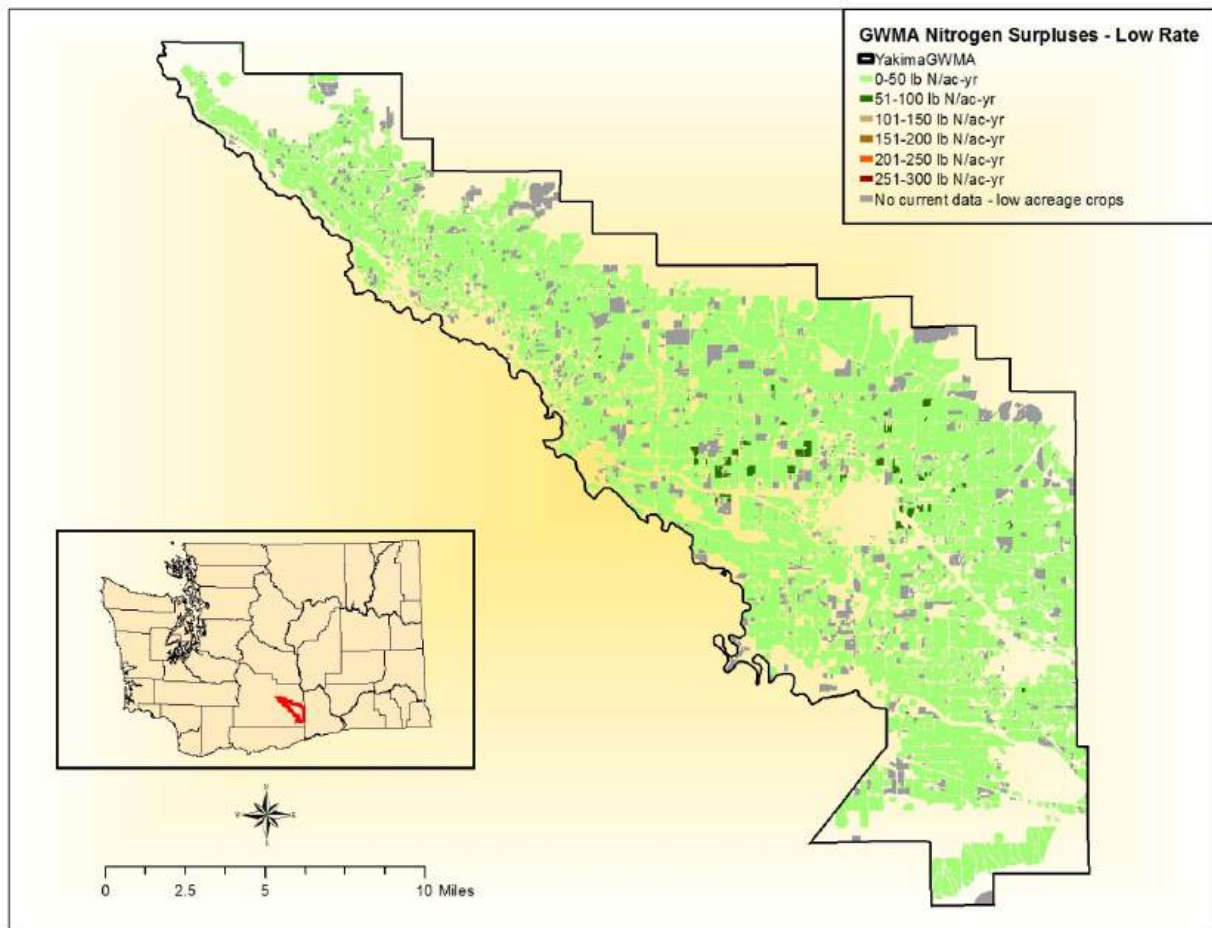


Figure 6. Map of Yakima GWMA with low range nitrogen availability estimates

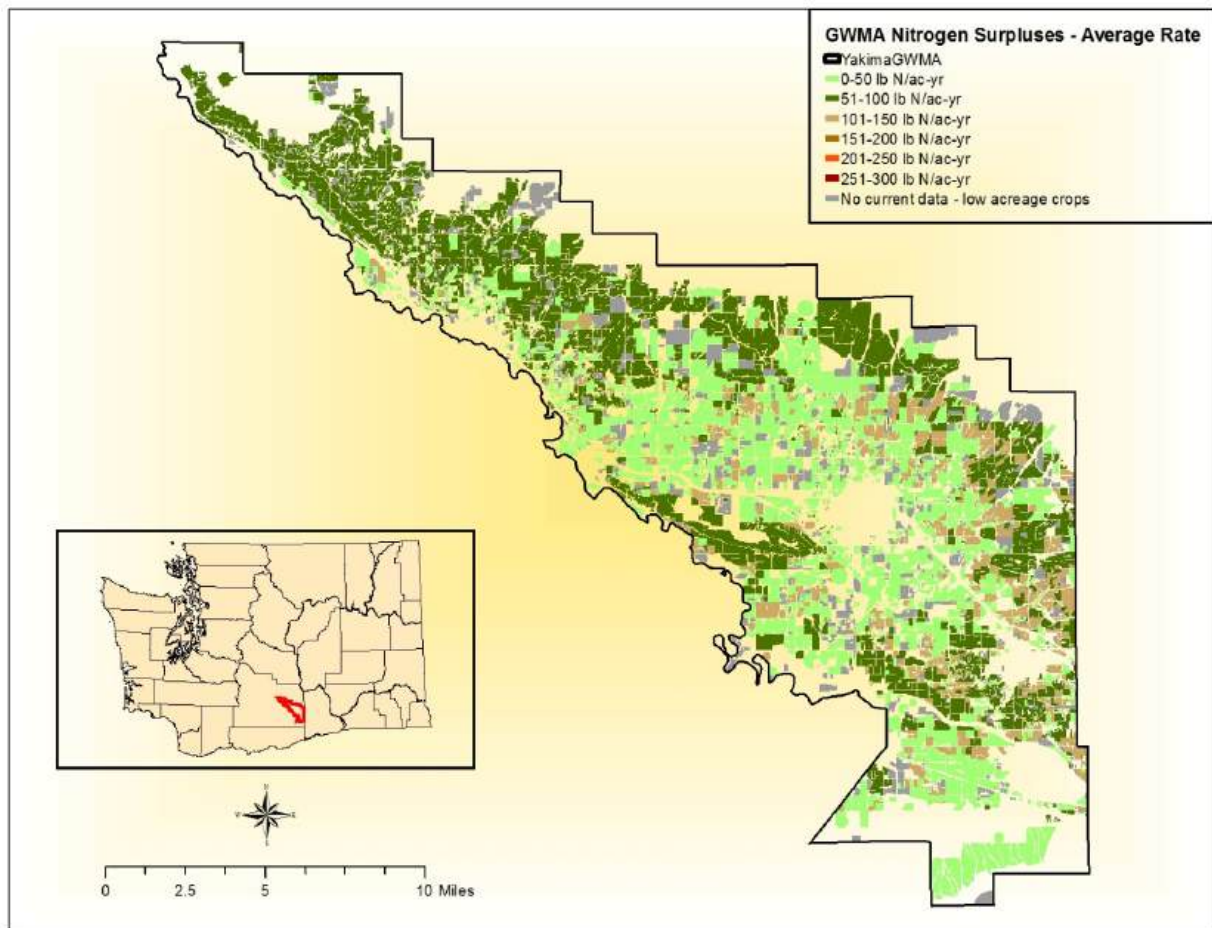


Figure 7. Map of Yakima GWMA with medium range nitrogen availability estimates

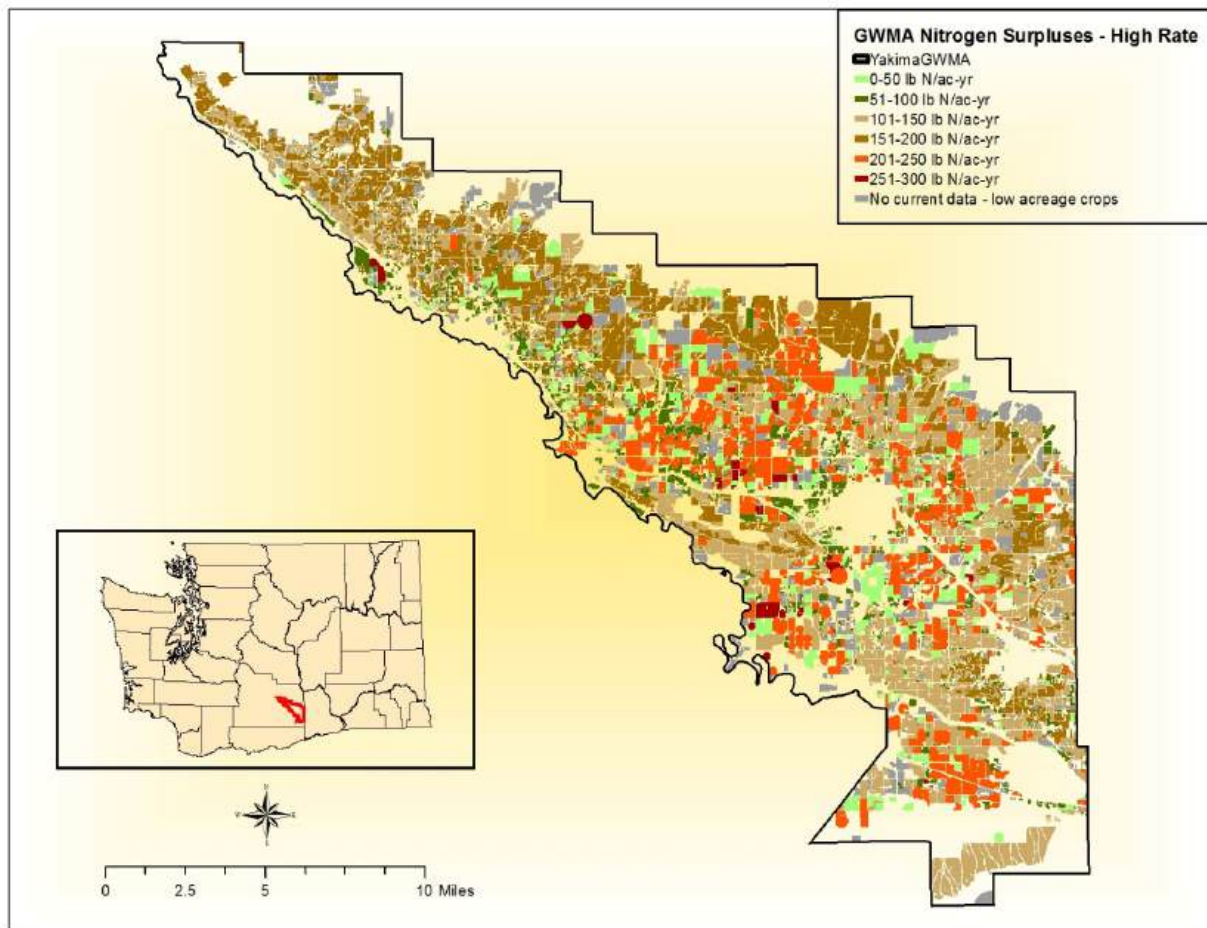


Figure 8. Map of Yakima GWMA with high range nitrogen availability estimates

Based on the information gathered through the survey and crop mapping, it is impossible to identify which part of the range (low, medium, or high) is the most likely scenario. It is likely that there are producers and crop types whose application practices occupy all parts of the range (some making low range applications, some making high range applications). Nutrient application decisions are complicated and depend on expected crop pricing, anticipated yields, recommendations from crop consultants and fertilizer guides, historical practices, and practices of other growers in the community. This variability, in combination with effects of fertilizer types used, irrigation type and practices, and nutrient application timing, will all affect whether or not any fertilizer application will result in a nitrogen surplus. Additional variation comes from soil type and organic matter content, soil nutrient content, manure nutrient content, handling, and storage before application, organic carbon cycling and mineralization, and fertilization and nitrogen fixing in alfalfa.

Conclusions and recommendations

Based on this initial survey data, NRAS has identified specific commodities where nitrogen surpluses could result in available nitrogen that could move from the soil profile into groundwater

in the lower Yakima Valley. This information can be used to identify crops and practices where excess nitrogen is high. In addition, NRAS has identified both next steps to improve this study and recommendations for research that would supply useful information to growers making nutrient management decisions.

- It will be easier and more accurate to account for double-cropped acreage if an extra record is created in the mass balance for field corn/triticale double-cropped acres so that inputs and outputs can be customized for that specific land use.
- The estimated nitrogen surpluses from different commodities from the mass balance should be compared to the deep soil sampling results for validation and improvement of the nitrogen mass balance.
- If information becomes available about animal stocking numbers on pasture, input estimates for pasture should be adjusted to account for manure and urine deposition by pastured livestock.
- With new permit requirements, information may be available about soil nitrogen content in some crops that could be used to calibrate the mass balance calculations.
- Most Washington State University Extension fertilizer guidance dates to the 1970's; updating and expanding this guidance would make a valuable information source available to growers. Information on considerations when combining nutrient applications from commercial sources with manure and compost applications should be included.
- Field research on the following topics would provide growers with information about the fate of fertilizer applications, plant uptake, and nitrogen availability from different fertilizer sources:
 - in-depth evaluation of potential nitrogen surpluses on higher risk and larger acreage crops and crops that receive applications of commercial fertilizer, manure, and compost combined;
 - research on manure nutrient content, manure application strategies, and the subsequent fate of nitrogen, other nutrients, and salts;
 - research to better understand organic matter in soils including plant nitrogen availability;
 - the long-term agronomic, environmental, and economic feasibility of available sustainable management practices.

3. RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SOURCES

Yakima County authors: Cynthia Kozma, Michael Martian, Vern Redifer, P.E.

Background

Yakima County GIS Department was tasked with evaluating the nitrogen loading potential from non-agricultural sources within the GWMA boundaries. For this this assessment, the analysis was divided into five distinct categories:

1. Residential Onsite Sewage Systems (ROSS)
2. Large Onsite Septic Systems (LOSS)
3. Commercial Onsite Septic Systems (COSS)
4. Residential Lawn Fertilizers
5. Hobby Farms

This also includes a separate analysis for migrant worker impacts within the ROSS category.

Residential on-site sewage systems

The Yakima County GIS Department developed a model to determine the nitrogen loading from individual residential on-site sewage systems located within the GWMA.

Methods

The Yakima County GIS Department incorporated all data sources having a geographical or spatial aspect into the county's GIS. The following was determined using geospatial analysis:

- There are 6,044 households within the GWMA that discharge wastewater to a ROSS.
- Figure 9 shows the location of each ROSS. The relative density of ROSS within the GWMA is shown in
- Figure 10.
- The average number of persons per household for each household discharging to a ROSS was obtained from census tract data provided by (OFM 2010). The household size used in the loading calculations for each ROSS is equal to the average household size for the census tract containing the household. The average household size for households discharging wastewater to a ROSS is 3.5 persons per household. The average household size ranges from 2.72 persons per household to 4.16 persons per household.
- The approximate location of each ROSS was determined. A ten foot buffer was graphically drawn around the building footprint to provide the best estimation of where a ROSS for each building would be located. If a parcel did not have a building footprint available, then a point was generated in the center of the parcel.
- The soil type underlying the approximate location of each ROSS was determined using (USDA NRCS 2014). Using GIS, the specific soil type was determined at each residential property within the GWMA and then each soil type was classified according to description to determine its corresponding maximum hydraulic loading rate based on Table VIII of

WAC 246-272A-0234. Table 17 shows the soil classifications, infiltration rate for each soil classification, and the number of ROSS within each soil classification (On-Site...2005)

Table 17. Maximum hydraulic loading rate

Soil type	Soil textural classification description	Loading rate for residential effluent (gal/sq. ft-day)	Number of ROSS
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding soil types 5 & 6, all soil types with greater than or equal to 90% rock fragments.	1.0	
2	Coarse sands.	1.0	
3	Medium sands, loamy coarse sands, loamy medium sands.	0.8	
4	Fine sands, loamy fine sands, sandy loams, loams.	0.6	
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate structure or strong structure (excluding a platy structure).	0.4	5,961
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.	0.2	69
7	Sandy clay, clay, silty clay and strongly cemented firm soils, soil with a moderate or strong platy structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays ¹	Not suitable	14

- Using the approximate location of each ROSS, a land elevation was determined at each site using the GIS land elevation contours. It is important to note that the GIS land elevation model was derived by interpolating between 10 foot contours developed by aerial photogrammetry.
- The estimated depth to groundwater measured from the land surface at the approximate location of each ROSS. It is important to note that GIS groundwater elevation model was derived by interpolating between 25 foot contours developed by (Vaccaro et al. 2009).

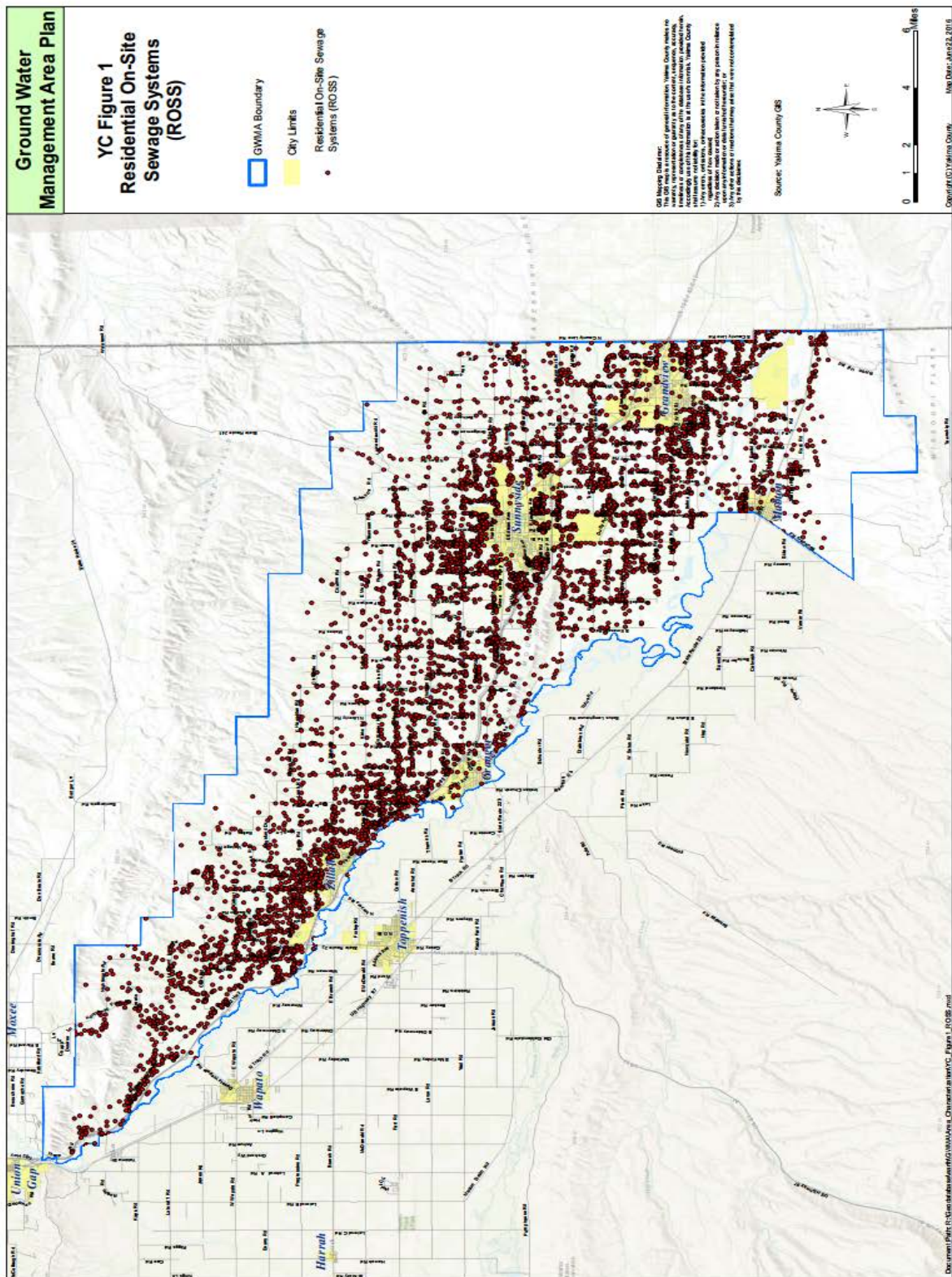
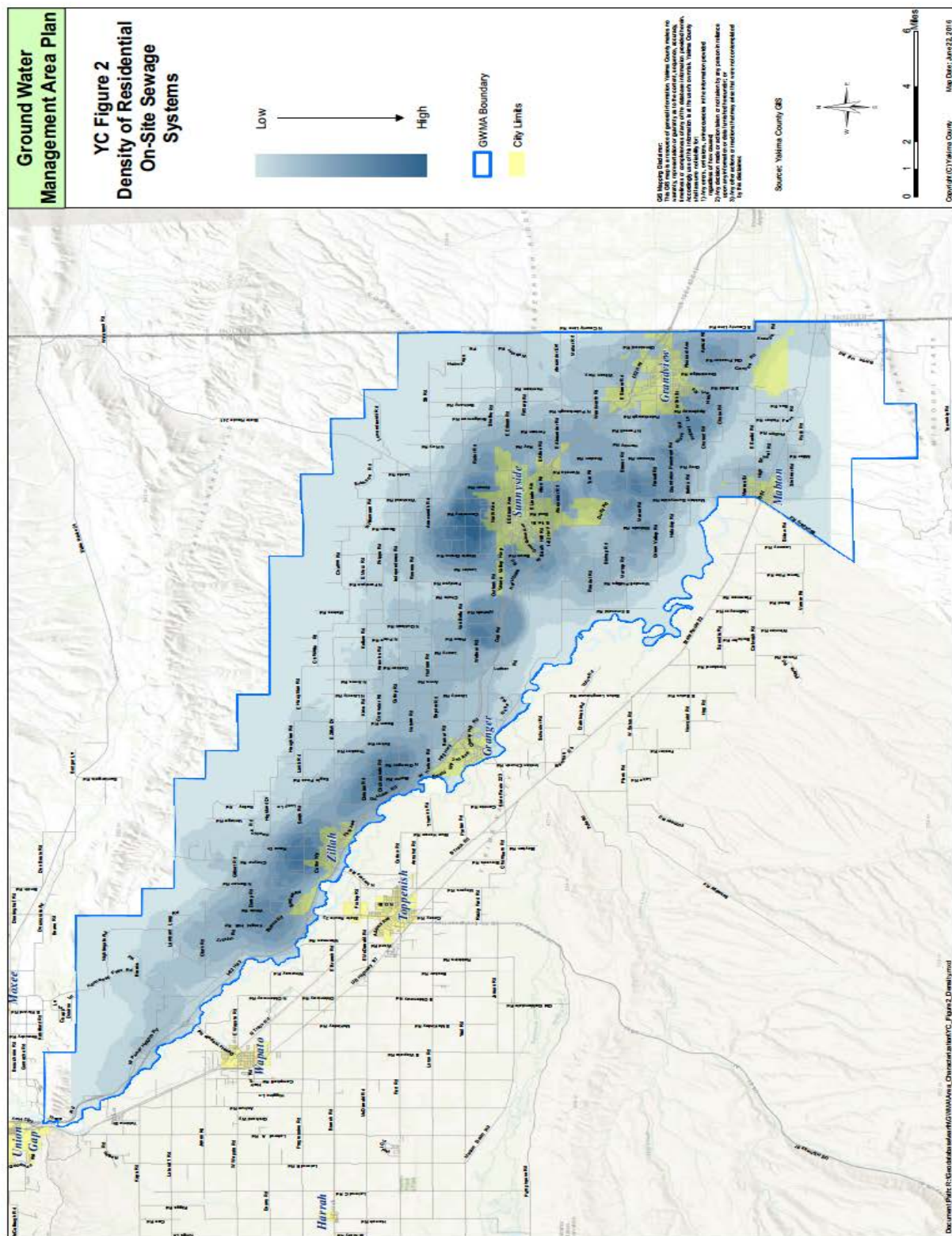


Figure 9: Residential on-site sewage systems

Figure 10. Density of residential on-site sewage systems *Nitrogen loading to a ROSS*

Nitrogen in residential wastewater is mainly generated from human body wastes and food materials from kitchen sinks and dishwashers. The amount of nitrogen present in the wastewater is typically expressed as a concentration in milligrams per liter (mg/L) and/or as a mass loading in grams/person/day. This assessment of nitrogen loading from on-site sewage systems utilizes the mass loading approach.

Table 3-7 of (EPA 2002a) reports that the total nitrogen (TN) loading to a ROSS ranges from six to seventeen grams per person per day and assumes a water use of 60 gallons/person/day (227 liters per person per day). Table 4.4 of (EPA 1992) reports the total nitrogen loading to a ROSS is approximately 11.2 grams per person per day. The nitrogen mass loading assessment for the residential on-site sewage systems within the GWMA utilizes a high, medium, and low approach. Accordingly, this ROSS assessment assumes a nitrogen loading of 17, 11.2, and 7 grams TN per person per day. These mass loading rates equate to TN concentrations of 26.4, 49.3, and 74.8 mg/L respectively assuming a water use of 227 liters/person/day Note: WAC 246-272A-0230 *Design Requirements-General* under section (2) (E) (ii) requires that designs for on-site systems, other than systems for single-family residences, be designed in accordance with (EPA 2002a) (On-Site...2005).

Nitrogen removal by denitrification

Wastewater discharged to a ROSS is subject to several biological processes including nitrification and denitrification. These processes can take place depending on the environmental conditions and occur most effectively when the soil is unsaturated because the wastewater is forced to percolate over the soil particle surfaces where treatment can take place and air is able to diffuse through the soil. Whether these processes occur and their effectiveness in treatment depends on the physical characteristics of the soils and the environmental conditions of the soil through which the wastewater percolates. Wastewater parameters, such as levels of nitrogen are removed to varying degrees. Organic or ammonia nitrogen is readily and rapidly nitrified biochemically in aerobic soil and some biochemical denitrification can occur in the soil, but without plant uptake, 60 to 90 percent of the nitrate enters the ground water. Under anaerobic soil conditions, nitrification will not occur, but the positively charged ammonium ion is retained in the soil by adsorption onto the soil particles. The ammonium may be held until aerobic soil conditions return allowing nitrification to occur (EPA 1992).

Factors found to favor denitrification are fine-grained soils (silts and clays) and layered soils (alternating fine-grained and coarser-grained soils with distinct boundaries between the texturally different layers), particularly if the fine-grained soil layers contain organic material. However, it is difficult to predict removal rates for wastewater-borne nitrate or other nitrogen compounds in the soil matrix (EPA 2002a). Table 3-17 (EPA 2002a) provides examples from studies conducted in 1976 and 1977 that showed that 10 to 40 percent of the total nitrogen can be removed by denitrification by soil infiltration in a conventional drainfield. In 1990, Jenssen and Siegrist found in their review of several laboratory and field studies that approximately 20 percent of nitrogen is lost from wastewater percolating through soil (EPA 2002a).

The predominant soil type underlying the ROSS drainfields located within the GWMA are characterized as very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate structure or strong structure (Table 17). The estimated depth

to groundwater is equal to or greater than 10 feet at approximately 90% of the ROSS locations. When considered together, this information is useful to the extent that it is reasonable to assume that the environmental conditions underlying the drainfields are conducive to some level of denitrification. Accordingly, taking a conservative approach and relying on (EPA 2002a), this nitrogen mass loading assessment, in keeping with a high, medium, and low approach, uses denitrification percentages of 10, 15, and percent respectively. Plant uptake for this assessment is assumed to be zero.

Nitrogen removal by septage pumping

WAC 246-272A-0010 defines a septic tank as “a watertight treatment receptacle receiving the discharge of sewage from a building sewer or sewers, designed and constructed to permit separation of settleable and floating solids from the liquid, detention and anaerobic digestion of the organic matter, prior to discharge of the liquid.” “The mixture of solid wastes, scum, sludge, and liquids pumped from within septic tanks, pump chambers, holding tanks, and other OSS components.” is defined as septage (On-Site...2005).

The total nitrogen content of septage generated in the GWMA is not available. However, Table 2-2 *Characteristics of Septage Conventional Parameters (1)* contained in (EPA 1994) reports that the average Kjeldahl nitrogen in septage is 588 mg/L with a range from 66 mg/L to 1060 mg/L. Accordingly, this assessment uses an average concentration in septage of 588 mg/L total nitrogen.

WAC 246-272A-0232 establishes the minimum liquid volume for a septic tank serving a single family residence as 900 gallons for a residence containing 3 or fewer bedrooms, 1,000 gallons for a four bedroom residence, and an additional 250 gallons per bedroom for each bedroom over four. The actual septic tank size at each OSS within the GWMA is unknown. For analysis purposes, this assessment assumes that the tank size at each ROSS meets, and is equal to, the minimum WAC requirements of 900 gallons (3,407 liters) (On-Site...2005).

The amount of nitrogen removed by pumping a 900 gallon tank when it is full using TN = 588 mg/L and a 900 gallon (3,407 liters) septic tank is 2.0 Kg (4.417 pounds). The effective annual rate of TN removal by septic tank pumping can be estimated by taking the TN removed by pumping and dividing by the length of time in years between pumping events. Similarly, the reduction in TN concentration in wastewater entering the septic tank compared to the wastewater leaving the septic tank can be estimated by taking the TN removed by pumping and dividing by the total water entering the septic tank during the time between pumping events. Doing so, using an average household size of 3.5 persons and a per capita water use of 60 gallons per day, results in TN concentration reductions of 2.3 mg/L, 1.4 mg/L, and 0.7 mg/L for 3, 5, and 10 year pumping events respectively.

WAC 246-272A-0270 makes the owner of a ROSS responsible for operating, monitoring, and maintaining their ROSS including the requirement to employ an approved pumper to remove the septage from the tank when the level of solids and scum indicates that removal is necessary (On-Site...2005). The frequency of septic tank pumping at each ROSS in the GWMA is unknown. However, the Groundwater Advisory Committee for the GWMA initiated a “*Well Assessment Survey*” that was conducted by the Yakima Health District for 458 households within the GWMA. That survey included the question “Have you had your septic tank pumped recently?” Of the 458 surveys

completed, 82% of the respondents answered “yes” and 18% of the respondents answered “no” or “I don’t know.” This survey, though not a valid statistical sampling (survey respondents volunteered and were not necessarily geographically dispersed), does provide information that indicates that the majority of households within the GWMA are more than likely having their septic tanks pumped periodically. Typical maintenance guidelines recommend that a septic tank be pumped every 3 to 5 years (EPA 2002b). Accordingly, this nitrogen mass loading assessment, in keeping with a high, medium, and low approach, assumes septic tank pumping occurs every 10, 5, and 3 years respectively.

Model input summary

Table 18 summarizes the inputs used for estimating the nitrogen loading from residential septic tanks:

Table 18. Input parameters for estimating total nitrogen from ROSS

Parameter	Units	Low	Medium	High
Household Size	Persons / Household	Census Tract Average	Census Tract Average	Census Tract Average
TN Loading to ROSS	gm/person/day	7	11.2	17
Denitrification	Percent	20	15	10
Septic Tank Size	Liters	3,407	3,407	3,407
TN in Septage	gm/L	0.588	0.588	0.588
TN in Septic Tank When Pumped	gm	2,003	2,003	2,003
Septic Tank Pumping Frequency	Years	3	5	10

ROSS results

Model output summary

The low, medium, and high estimated net nitrogen loads from all of the ROSS within the GWMA using the input factors contained in Table 18 are 43.7 tons, 79.2 tons, and 130.3 tons respectively. The estimated nitrogen loads are summarized in Table 19.

Table 19. ROSS nitrogen loading estimate

	Units	TN Generated by 6,044 Households	Denitrification	Average Annual TN Removed by Pumping	Total N
LOW	Grams/Year	54,636,835	(10,927,367)	(4,035,377)	39,674,091
	Lbs/Year	120,454	(24,091)	(8,896)	87,466
	Tons/Year	60.23	(12.05)	(4.45)	43.73
MEDIUM	Grams/Year	87,418,937	(13,112,840)	(2,421,226)	71,884,870
	Lbs/Year	192,726	(28,909)	(5,338)	158,479
	Tons/Year	96.36	(14.45)	(2.67)	79.24
HIGH	Grams/Year	132,689,457	(13,268,946)	(1,210,613)	118,209,898
	Lbs/Year	292,530	(29,253)	(2,669)	260,608
	Tons/Year	146.27	(14.63)	(1.33)	130.30

About the model

The model created for this assessment is maintained by the Yakima County Public Services Department. It has been designed such that it provides the ability to estimate the nitrogen loading from ROSS within the GWMA by changing any or all of the input parameters. As an example, using a denitrification rate of 15%, a TN Loading to a ROSS of 11.2 gm/person/day, and a septic tank pumping frequency of 4 years results in a TN of 78.3 tons.

Migrant worker effect on ROSS nitrogen loading

The number of persons living within the GWMA has a direct effect on the nitrogen loading from septic tanks and the above ROSS assessment only accounts for those persons living within the GWMA boundary on a permanent basis. Yakima County agricultural producers supplement their work force during peak periods by hiring migrant workers. A migrant worker is defined as a farm worker whose employment requires travel that prevented the worker from returning to his/her permanent place of residence the same day (USDA NASS 2014). In 2012 there were 9,598 migrant workers employed by agriculture throughout all of Yakima County (USDA NASS 2014). It is not known precisely where these migrant workers were employed or where they lived. However, it is possible to estimate the number of migrant workers working in the GWMA boundary by prorating the total number of migrant workers for the county by acres of crop land in Yakima County. This approach assumes that the estimated amount of migrant workers working within the GWMA also resided within the GWMA.

There are 360,906 acres of crops in Yakima County with 99,976 (28%) of those acres located within the GWMA (WSDA 2016). Prorating the number of migrant workers by crop acres results in a GWMA migrant worker population of 2,687 migrant workers (28% of 9,598). (USDA NASS 2014) does not provide information relative to the amount of time each migrant worker worked - a worker working just one day is recorded as one migrant worker and a worker working 30 days is also reported as one migrant worker. On the other hand, (ESD 2015), reports the total number of agricultural workers by month employed, but does not report the number of migrant workers. Nonetheless, by assuming that the monthly migrant workforce reported by (USDA NASS 2014)

follows the same trending pattern as the total monthly agricultural workforce reported by (ESD 2015), an estimate of an annualized migrant population can be derived. Doing so results in an average annual migrant population within the GWMA of 224 persons (2,687 person months $\div$ 12 months = 224 persons). Table 20 shows the calculations for the estimated migrant worker population. Consequently, employing the same methodology used for residential ROSS, the estimated additional TN loadings per year from migrant workers using the low, medium, and high format are 0.50 tons, 0.90 tons, and 1.40 tons respectively.

Table 20. Migrant workforce estimate

Month (A)	Total County Ag Workers / Month (B)	Monthly Distribution of Total County Ag Workers / month by % of Total ('C)	Prorated Migrant County Ag Workers / month = (B) X ('C) (D)	Prorated GWMA Migrant Ag Workers / yr = ('C) X 28% $\div$ 12 (E)
Jan	20,120	0.058	555	13
Feb	22,540	0.065	622	15
Mar	23,220	0.067	640	15
Apr	25,540	0.073	704	16
May	26,410	0.076	728	17
Jun	38,550	0.111	1,063	25
Jul	39,920	0.115	1,101	26
Aug	33,080	0.095	912	21
Sep	38,440	0.110	1,060	25
Oct	35,720	0.103	985	23
Nov	24,320	0.070	671	16
Dec	20,130	0.058	555	13
Totals:	347,990	1	9,598	224

Nitrogen Loading from ROSS per Land Area

Nitrogen loading estimates per land area were determined using the OSS design requirements contained in WAC 246-272A-0230 as a means of comparing the nitrogen loading from ROSS with other potential nitrogen sources that are typically land area based. According to the WAC, the design flow for an OSS is determined by multiplying the number of bedrooms by 120 gpd based on an occupancy of 2 persons per bedroom. This results in a design load of 60 gpd per person per day. The design flow for each ROSS is estimated by multiplying the household size by 60 gpd (a household size of 4.16 persons would have a design flow of 250 gallons per day). It is important to note that the minimum design flow established by the WAC is 240 gallons per day (On-Site...2005).

The area of the drainfield for a ROSS is used to estimate the land area where nitrogen discharged from a septic tank is applied. The size of this area for each ROSS is estimated by first dividing the design flow for the ROSS by the infiltration rate for the soils underlying the drainfield. A household with a design flow of 250 gpd in a soil having an infiltration rate of 0.45 gallons/ft²/day would have

an estimated infiltrative surface of 556 ft². Second, taking a simple approach, the size of the drainfield can be approximated by assuming that infiltration trenches are one foot wide and 60 feet long (60ft²/ trench) and that the lateral separation between trenches is five feet resulting in the need for 10 trenches and a drainfield size of 60 feet by 45 feet or 2,700 ft². Finally, the nitrogen loading per land area can then be estimated by dividing the annual nitrogen load for the ROSS by the area of the drainfield. If the above household has a TN discharge of 28 lbs/yr, then the annual nitrogen loading per land area is 0.01 lbs/ft² (436 lbs/acre).

The size of each ROSS drainfield was estimated using the above methodology resulting in a total drainfield area for all of the ROSS in the GWMA of 398 acres. Consequently, the TN loadings summarized in Table 21 result in low, medium, and high land application rates of 223 lbs/acre, 403 lbs/acre, and 662 lbs/acre respectively. Total loadings from ROSS drainfields are summarized in Table 21.

Table 21: Estimated total nitrogen loadings from ROSS drainfields

	Low	Medium	High
Loading (lb N/acre)	223	403	662
Loading (kg N/hectare)	249	452	743
Loading (ton N/year)	44.2	80.1	131.7
Loading (kg N/year)	40,131	72,663	119,461

Large on-site septic systems

Background

A Large Onsite Septic System is a septic system having a design volume over 3,500 gallons. The design and operation of LOSS are overseen by the Washington State Department of Health (WDOH). WDOH records show that there are 2 LOSS located within the GWMA. The design capacity, location, and times of use of both of the LOSS were provided to the GIS Department by WDOH.

LOSS results

One LOSS site is located outside of Zillah (Zillah LOSS) with a design capacity of 5,000 gallons. This LOSS serves the employees of a large fruit packing operation and warehouse. The LOSS is used by employees throughout the year with peak use during the fruit packing season. It is presumed that the loading to the LOSS is predominantly human waste from toilet flushing. The average loading generated by toilet flushing is 16.2 gallons/capita/day with a nitrogen loading of 8.7 grams/capita/day (EPA 1992) at Tables 4-2 and 4-4. WAC 246-272 B 06450(4) (b) requires that the size of a LOSS septic tank be equal to 3 times the daily design flow (Large...2011). As such, the design flow for the 5,000 gallon tank is 1,667 gpd. Dividing the design flow by 16.2 g/cap/day equates to 103 persons per day. The annual nitrogen loading from 103 persons, using the ROSS methodology and substituting a TN loading of 8.7 grams/capita/day, is a low of 575 lbs/year, a medium of 612 lbs/year, and a high of 649 lbs/year or 0.29 tons/year, 0.31 tons/year, and 0.32 tons/year from the Zillah LOSS. Of note is that this estimate is based on the peak loading during the packing season and does not reflect a smaller work force during the remainder of the year.

The second LOSS site is located outside of Granger (Granger LOSS) with a design capacity of 4,850 gallons. The design flow is 1,620 gpd (one third of the size of the tank). This LOSS serves migrant workers for approximately 30 days each year during the cherry harvest season. It is presumed that the migrant workers reside at this site and that the loading to the LOSS is typical of the loading to ROSS. Accordingly, the number of persons this LOSS was designed to serve is 27 persons. Using the same methodology used to calculate the total nitrogen load for ROSS, a nitrogen load for the LOSS was determined. This results in a low of 9 lbs/year, a medium of 16.0 lbs/yr and a high 27 lbs/year of total nitrogen from the Granger LOSS. Results from LOSS systems are summarized in Table 22.

Table 22: Estimated loading from LOSS systems

	Low	Medium	High
Loading (lb N/acre)	195	209	225
Loading (kg N/hectare)	218	235	252
Total loading (ton N/year)	0.29	0.31	0.34
Total loading (kg N/year)	265	285	307

Commercial on-site septic systems

Background

The term “Commercial” Onsite Septic Systems, as used in this report, refers to septic systems that are used for employees working at agricultural businesses that operate year-round and are not classified as a LOSS by WDOH. The most likely location for these facilities within the GWMA are at confined animal feeding operations (CAFOs).

COSS results

The Washington State Department of Agriculture reported that there were 52 operating CAFOs located within the GWMA in 2014. Each CAFO was classified by WSDA by herd size ranges as shown in Table 23. Presumably, each CAFO provides a restroom facility for its employees. It is not known if the facilities are a COSS or some type of portable facility. This nitrogen loading assessment for COSS assumes that there is a COSS at each CAFO location.

It is assumed that the loading to the COSS is predominantly human waste from toilet flushing. The number of employees at each CAFO is unknown but can be estimated using a paper published by the University of California in 2004 titled “*For Wages and Benefits, Bigger Dairies May be Better*” written by Barbara Reed (Reed 1994). The following is extracted from that paper:

Number of employees: Larger dairies had a higher cow-to-employee ratio than smaller dairies. Dairies of more than 700 cows averaged 151 cows per employee; dairies with fewer than 250 cows averaged 82 cows per employee. Dairies with fewer than 250 cows employed 3.5 workers on average; dairies with more than 700 cows employed 12 workers. The largest number of employees reported for any dairy was 31 (1,900 cows).

This assessment uses a cow to employee ratio of 82 for CAFOs smaller than 700 cows and a cow to employee ratio of 151 for CAFOs larger than 700 cows. The number of cows is assumed to be the highest number in the range, with 8,000 cows used for the largest CAFOs. This methodology is represented in Table 23.

Table 23. GWMA CAFO herd size and employee estimate

Mature Herd Range (cows)	Number of CAFOS	Employees/ CAFO	Total Employees
200 to 699	14	9	126
700 to 1699	18	11	198
1700 to 2699	10	18	180
2700 to 3699	4	25	100
3700 to 4699	1	31	31
4700 to 5699	1	38	38
5700 to 6839	2	45	90
6840 and above	2	53	106
Total	52		869

The average loading generated by toilet flushing is 16.2 gallons/capita/day with a nitrogen loading of 8.7 grams/capita/day (EPA 1992) at Tables 4-2 and 4-4. The annual nitrogen loading from 869 persons, using the ROSS methodology and substituting a TN loading of 8.7 grams/capita/day, is a low of 4,865 lbs/year, a medium of 5,170 lbs/year, and a high of 5,475 lbs/year. Results from COSS are summarized in Table 24.

Table 24: Estimated loading from COSS

	Low	Medium	High
Loading (lb N/acre)	163	173	183
Loading (kg N/hectare)	182	194	205
Total loading (ton N/year)	2.43	2.59	2.74
Total loading (kg N/year)	2207	2345	2483

Residential lawn fertilizer

Methods

The overall nitrogen loading assessment includes an estimate of nitrogen from fertilizers applied to residential lawns located within the GWMA. The GIS Department developed a method for approximating the area of maintained lawn areas. This method involved the use of ArcMap Spatial Analysis and color infrared orthophotography to determine “green” spaces within the residential areas of the GWMA. The infrared photography shows actively growing vegetation as variations of red on the orthophotography.

A classification tool in ArcGIS was “trained” to search for these red spots and identify them as grass, trees, or shrubs. These areas represent a “green” layer within the GIS and are considered areas where fertilizer may be applied. Using the green layer, four representative areas within the GWMA were examined to determine the percentages of land area that were green. Each of the areas were

one square mile in size and the buildings and crop lands were subtracted from the green areas. The four areas examined were:

- An urban area located within the City of Sunnyside city limits (Urban) representing urban density properties. The average parcel size for this urban area is 0.28 acres and the amount of green area is 33.4% of the total acreage resulting in an average green area per parcel of 0.09 acres.
- A suburban area located outside the City of Sunnyside, but within the Sunnyside Urban Growth Boundary (Suburban), representing suburban density properties. The average parcel size for this suburban area is 4.95 acres and the amount of green area is 25.2% of the total acreage resulting in an average green area per parcel of 1.25 acres.
- A rural area that encompasses the unincorporated community of Outlook (Rural High) representing rural properties within the GWMA that are relatively small in size. The average parcel size for this suburban area is 4.90 acres and the amount of green area is 13.0% of the total acreage resulting in an average green area per parcel of 0.64 acres.
- A rural area within the County (Rural Low) representing rural properties within the GWMA that are relatively large in size. The average parcel size for this rural area is 23.7 acres and the amount of green area is 3.1% of the total acreage resulting in an average green area per parcel of 0.73 acres.

Table 25 summarizes the representative areas.

Table 25. Representative lawn areas in the GWMA

Representative Area	Average Parcel Size (acres)	Green Area (acres)	Percent Green	Green Area per parcel (acres)	Green Area per parcel (sf)
Urban	0.28	20.04	33.4%	0.09	4,074
Suburban	4.95	161.28	25.2%	1.25	54,337
Rural High Density	4.9	83.2	13.0%	0.64	27,748
Rural Low Density	23.7	19.84	3.1%	0.73	32,004

Residential lawn areas for the entire GWMA were approximated using Table 25 values and the following criteria:

- Each residential parcel located within an incorporated City was given a lawn area of 0.09 acres.
- Each residential parcel located within an urban growth boundary and outside of an incorporated city was given a lawn area of 1.25 acres.
- Each residential rural parcel (outside of an urban growth boundary) that had a total parcel area equal to or less than 5.0 acres was given a lawn area of 0.64 acres.
- Each residential rural parcel (outside of an urban growth boundary) that had a total parcel area greater than 5.0 acres was given a lawn area of 0.73 acres.

Table 26 summarizes the approximated total lawn area within the GWMA using the above criteria:

Table 26. Residential lawn areas

Representative Area	Application	Green Area per Parcel (acres)	Number of Parcels	Green Area in GWMA (acres)
Urban	All parcels located in incorporated cities	0.09	7,180	646
Suburban	All parcels located in UGA outside of cities	1.25	892	1115
Rural high density	All rural parcels <= 5 acres	0.64	3,285	2102
Rural low density	All rural parcels > 5 acres	0.73	709	518
Totals			12,066	4,381

The lawn care practices used by residents within the GWMA are unknown relative to the amount of nitrogen applied to their lawns each year. Anecdotal evidence indicates that some residents fertilize their lawns regularly and some do not fertilize their lawns at all. Consequently, this estimate for the amount of nitrogen used on lawns within the GWMA is entirely based upon the assumption that residents that do fertilize their lawns do so once each year using a typical commercial lawn fertilizer such as Scotts® Turf Builder. This product's application guidelines equate to the application of 23.3 pounds of nitrogen per acre for each application. (13.35 lb. bag, 20-0-8 analysis, covers 5,000 sf).

Residential fertilizer use results

In keeping with the high, medium, and low approach, it is assumed that the percent of residents who fertilize are 80, 50, and 20 percent respectively. Accordingly, the high nitrogen loading estimate is 40.8 tons, the medium estimate is 25.5 tons, and the low estimate is 10.2 tons. It is important to note that this lawn loading assessment does not take into consideration any nitrogen lost to plant uptake, denitrification, and volatilization as is normal practice. Given the coarseness of the assumptions contained in the assessment already, it is believed that any further refinement is unjustified. Table 27 shows the low, medium, and high estimated loading from residential fertilizer use.

Table 27: Estimated N loading from residential fertilizer

	Low	Medium	High
Loading (lb N/acre)	4.7	11.7	18.6
Loading (kg N/hectare)	5.2	13	20.9
Total loading (ton N/year)	10.2	25.5	40.8
Total loading (kg N/year)	9,260	23,152	37,043

Small-scale commercial and hobby farms

Background

“Small-scale commercial and hobby farms” is a term used in this report to represent residential land uses other than lawns that may contribute nitrogen to the GWMA area. These land uses are

attributable to relatively small parcels that are not included in the Washington State Department of Agriculture's Crop inventory. Nitrogen contributions on these parcels may come from individual gardens, pastures, pets, and other animals.

Methods

The GIS Department developed an ArcGIS model to determine the potential number of hobby farms in the GWMA. To do so, using the GWMA parcel information, all parcels located within the city limits were removed, all parcels greater than 10 acres were removed, non-residential properties were removed, and parcels that overlapped with the WSDA's Cropland Data Layer were removed. The remaining parcels were then categorized into 3 size categories - (1) Acres $0 \leq 2.5$, (2) Acres ≥ 2.51 and Acres ≤ 5.00 , and (3) Acres ≥ 5.01 and Acres ≤ 10.0 . Once the parcels were categorized, the parcels were matched to the residential lawn data in order to remove the lawn area from the parcel area and to eliminate double counting of nitrogen loading. In addition, a building allowance of 2,000 ft² for each parcel was also deducted from the parcel area to arrive at an effective area for hobby farms.

Small-scale commercial and hobby farms results

The analysis yielded the results shown in Table 28.

Table 28. Parcel size and total acres

Parcel Size Range of Small-Scale Farm (acres)	Number of Parcels	Total Parcel Area (acres)	Lawn Area (acres)	Building Allowance @ 2,000 sf/parcel (acres)	Effective Area (acres)
0 to 2.5	2335	2,481.5	1,804.1	107.2	570.2
2.51 to 5.0	311	1,075.6	223.0	14.3	838.4
5.1 to 10.0	110	776.1	83.3	5.1	687.7
Totals	2756	4,333.2	2,110.4	126.5	2,096.3

The recommended amount of fertilizer applied to each of these groups as proposed by the GWMA's RCIM Work Group is shown in Table 29. In keeping with the high, medium, and low approach, it is assumed that the percent of residents who fertilize are 80, 50, and 20 percent respectively similar to the assumption for residential lawn fertilizer.

Table 29. Percent of fertilizer application by hobby farm size

Parcel Size of Small-Scale Farm (acres)	Nitrogen Fertilizer Application (lb/acre/yr)	Nitrogen Fertilizer Application (kg/hectare/year)
$0 \leq 2.5$	14	15.7
$2.51 \leq 5.0$	21	23.5
$5.01 < 10.0$	28	31.4

The loading rate was then applied to the corresponding Small-Scale Farm size using the effective area. The results are shown in Table 30.

Table 30. Total nitrogen loading for hobby farms

Parcel Size of Small-Scale Farm	Small-Scale Farm Effective Area (acres)	Application (lbs)	TN Low at 20% (tons)	TN Medium at 50% (tons)	High at 80% (tons)
0 ≤ 2.5 Acres	570.2	14	0.80	2.00	3.19
2.51 Acres ≤ 5.0 Acres	838.4	21	1.76	4.40	7.04
5.01 Acres ≤ 10.0 Acres	687.7	28	1.93	4.81	7.70
Total (ton N/year)			4.48	11.21	17.94
Total (kg N/year)			4,068	10,171	16,273

4. ATMOSPHERIC DEPOSITION

WSDA author: Kelly McLain

Background

Atmospheric deposition is the process by which aerosol particles collect or deposit themselves on the earth's surfaces. It can be divided into two general sub-processes: dry and wet deposition. Nitrogen emissions in the Pacific Northwest may come from transportation, agriculture, power plants, industrial, and natural sources. In coastal areas, transport of nitrogen due to emissions in Southeast Asia may also be a source. In urban areas, emissions will mainly be in the form of oxidized sulfur compounds (NO_x) while in agricultural areas emissions from fertilized cropland and CAFOs will be largely in reduced forms (ammonia and ammonium). In general, emissions of both oxidized and reduced nitrogen have been increasing in recent decades (Fenn 2003). Emissions may travel distances ranging from meters to thousands of kilometers before subsequent wet (through precipitation) or dry redeposition takes place (Viers et al. 2012). Monitoring of deposition is conducted by the National Atmospheric Deposition Program, which conducts both monitoring of and modeling of N species emissions concentrations and deposition throughout the United States. Monitoring is conducted mainly at fairly remote sites; there are 5 wet deposition monitoring stations in Western Washington and 1 in Eastern Washington (in Whitman County) (NADP 2017). In conjunction with this wet deposition modeling, EPA uses emissions and ambient concentration data to model dry deposition based on emissions and one dry deposition station in Mt. Rainier National Park (now discontinued) (EPA 2015, EPA 2016).

NRAS reviewed similar studies to assess what, if any, atmospheric deposition information was available from other agricultural areas on the west coast. A significant nitrogen loading study by the University of California at Davis (Viers et al. 2012) includes atmospheric deposition data for California's Central Valley. EPA modeling in the Tulare Lake Basin and Salinas Valley was reviewed for that study to identify atmospheric deposition levels of 9 and 5 lb N/ac-yr, respectively. These numbers greatly exceed atmospheric deposition estimates for this study area. There are a few reasons why the levels seen in the Tulare Lake Basin and the Salinas Valley are not comparable to those estimated in Yakima. The first major difference between the regions is proximity to major urban areas; a significant source of deposition in California's Central Valley is the San Francisco Bay area transportation corridor. The Yakima Valley does not have a transportation or population hub of similar magnitude and proximity. In addition, the scale of animal agriculture in the Central Valley is an order of magnitude greater than that found in Yakima County (approximately 640 dairies compared to about 50 in the GWMA). Finally, the numbers in the Tulare Lake Basin and Salinas Valley are likely higher due to the effect of the Sierra Nevada – winds travelling from heavily populated areas meet the Sierra Nevada and deposit atmospheric pollutants in the adjacent valleys (Viers et al. 2012). Again, this is not a scenario seen in the Yakima Valley where winds travel mostly away from the mountains towards the Columbia River Basin. It is not surprising that the atmospheric nitrogen deposition estimates would be much higher in the UC Davis study than in the Lower Yakima Valley GWMA.

Methods, limitations, and assumptions

Limitations

The lower Yakima Valley has low annual rainfall (6.8 inches) and moderate winter snowfall (12.4 inches per year), from mean yearly records kept from 1894 – 2012 at Sunnyside, WA (Western Regional Climate Center 2017). As mentioned above, Washington State has 5 wet deposition monitoring stations in the National Atmospheric Deposition Program but only 1 located on the eastern side of the Cascade Mountains (NADP 2017). One limitation of this study is the very small amount of deposition data collected in the study area. The location of the eastern Washington NADP station (in Whitman County, NADP 2017) is similar in precipitation but not in geography or land use practice (Whitman County produces dryland crops such as wheat, barley, and dry peas) (WSDA 2016). There is also a limited amount of development and only small transportation corridors located in Whitman County, as compared to our study area in the lower Yakima Valley, surrounded by mountains, reasonably sized cities and towns, and bisected by a major interstate. In addition, the Yakima Valley is largely planted in irrigated cropland and a large number of concentrated animal feeding operations (none of which are found in Whitman County)¹⁵. Use of the wet deposition data from the Whitman County station would likely underestimate the influence of atmospheric deposition on the geographic footprint of the lower Yakima Groundwater Management Area. This limitation makes it more difficult to use Washington measurements in the analysis.

Another limitation of this estimate is categorization of ecosystems and development types that may result in deposited atmospheric nitrogen available for transport to groundwater. It is expected that in most urban areas (with a high percentage of impervious surface), any atmospheric deposition would likely be retained in the natural ecosystem through turfgrass sequestration or make its way to surface water via stormwater runoff. Natural areas are often nitrogen limited and atmospheric deposition in those regions may be used in the production of increased biomass and not available for leaching (Viers et al. 2012). It is assumed that atmospheric deposition does not contribute significantly to groundwater loading in these systems. However, this study does not include a refined analysis to exclude these areas.

Methods

The mechanism for nitrogen loading through atmospheric deposition to cropland is mobilization to groundwater through irrigation; atmospheric deposition to cropland is included as an input in the mass balance conducted in Section 2. IRRIGATED AGRICULTURE. As a result, this section of the report excludes the acreage from the irrigated agriculture section. In addition, the known areas of pens and lagoons are excluded (both of these estimates already account for atmospheric nitrogen deposition).

In order to establish low, medium, and high estimated available nitrogen due to atmospheric deposition, WSDA relied on 2 main sources; a state atmospheric scientist with the Washington State

¹⁵ WSDA NRAS agricultural land use mapping program, 2015 data.

Department of Ecology (Dr. Ranil Dhammapala¹⁶) and the data available for wet and dry deposition from the NADP-managed Mt. Rainier station.

The lowest number used is the combination of the most recently available annual wet and dry deposition data from the NADP Mt. Rainier station. Deposition reported includes dry nitric acid, dry ammonium, dry nitrate, wet ammonium, and wet nitrate (EPA 2016). This is believed to be a good surrogate for low deposition due to the considerable transportation corridor along I-5 in western Washington mimicking farm-related emissions and deposition seen in eastern Washington.

The average estimate provided by Dr. Dhammapala takes into account modeled deposition in the lower Yakima Valley over a 5-day period during December, when stagnant air and regular inversions result in poor regional air quality. For the highest rate estimate, WSDA again relied on feedback from Dr. Dhammapala to include a multiplier of 3 times the average rate to generate an expected upper limit for atmospheric deposition.

An underlying assumption included in this analysis is that deposition within the design surface area of each lagoon is conveyed to the lagoon liquid and accounted for as lagoon nitrogen concentration in the lagoon seepage calculation.

The total area used in the final annual calculations excludes 210 acres of lagoons, 2,096 acres of dairy and non-dairy livestock pens, and 85,775 acres of irrigated agricultural land. Atmospheric deposition on these areas was incorporated into calculations elsewhere in this report. The total remaining acreage used in the calculation below is 87,082 acres (ton N/yr calculation) or 35,241 hectares (kg N/yr calculation).

Results

The low, medium, and high atmospheric deposition rates are listed in the table below (Table 31).

Table 31. Low, medium, and high atmospheric deposition rates

	Deposition rate (kg N/ha)	Deposition rate (lb N/ac)
Low	1.69	1.53
Medium	2.30	2.05
High	6.89	6.15

The low rate of 1.53 lb/acre is the result of the most recently reported year (2012) of wet and dry atmospheric nitrogen deposition at the Mt. Rainier station (EPA 2016).

The medium rate, as mentioned above, is the result of a 5-day modeled average from December 2015. The final estimate of 2.05 lb/acre was provided by state atmospheric scientist Dr. Ranil Dhammapala.

The high rate multiplies the medium rate by a safety factor of 3, accounting for transient atmospheric conditions retaining local emissions in the valley when air quality is already poor. This

¹⁶ Medium and high deposition values were recommended by Dr. Dhammapala during a meeting on November 3, 2016.

high rate of 6.15 lb/acre is also in the range of values used in the UC Davis study of the Salinas Valley and Tulare Lake Basin (Viers et al. 2012).

Conclusions and recommendations

The total estimated deposition across the entire GWMA (excluding irrigated agricultural lands, animal pens and manure lagoons) is shown in Table 32.

Table 32. Estimated atmospheric nitrogen deposition in the GWMA

	Total Deposition (kg N/yr)	Total Deposition (tons N/yr)
Low	60,000	57
Medium	81,000	76
High	243,000	227

These estimates likely represent a significant overestimate of loading potential from atmospheric deposition. The number used as the rate is the amount of nitrogen deposited on the landscape, but the amount of nitrogen that subsequently is available for transport to groundwater is very different. Deposited nitrogen may be used by the ecosystem or be transported with precipitation to surface water before it leaches to groundwater. There are likely environments in the GWMA where very little or none of the deposited nitrogen reaches groundwater. A more detailed literature review and GIS analysis of regions likely and unlikely to result in leaching of deposited nitrogen to groundwater would result in a large improvement of the accuracy of this estimate. This would not have to involve additional modeling or monitoring work. However, the deposition numbers used are also estimates based on best professional judgment and evaluation of limited data. In the future, the GWAC may benefit from additional model runs and collection of local wet and dry deposition information to refine this estimate of the potential impacts of atmospheric deposition on the system.

Conclusions and recommendations

Conclusions

These estimates of nitrogen available for transport can be used at different scales to evaluate which sources play a role in different regions of the GWMA and how the contribution from different sources changes with scale and the area examined. For example, examining a smaller urban area will give a very different result than a large area dominated by irrigated agriculture. Management practices needed to reduce available nitrogen in a region where dairies are the dominant source will be different from management practices needed in a region where other sources dominate.

The ranges calculated (between low and high evaluation points) were very large for irrigated agriculture, lagoons, and pens (an entire order of magnitude). For RCIM sources, the ranges were much smaller. For this reason, agricultural activities (both irrigated agriculture and activities at CAFOs) should be the first candidate for additional research to narrow the range of estimated available nitrogen.

In all scenarios (low, medium, and high), evaluated over the entire GWMA acreage, the largest nitrogen contributors are irrigated agriculture, CAFO lagoons, and then CAFO pens. These activities account for 80, 94, and 96% of the available nitrogen in low, medium, and high scenarios, respectively (Figure 11). However, the large contribution to available nitrogen from irrigated agriculture is largely due to the high acreage of irrigated agriculture, with about 99,000 acres of irrigated land in the GWMA (of which more than 85,000 acres was part of the mass balance). The nitrogen from different land uses was also evaluated on a per-acre basis (Table 33). In this analysis, the top contributor to estimated available nitrogen at all evaluation levels was CAFO lagoons. With per-acre nitrogen losses 1-2 orders of magnitude above any other contributor, in an area with large numbers of lagoons, based on these calculations, the lagoons will supply the most nitrogen. Additional top contributors on a per-acre basis varied in the low, medium, and high scenarios. In the low rate scenario, the top 3 were CAFO lagoons, ROSS, and LOSS. In the medium and high rate scenarios, the top 3 were CAFO lagoons, CAFO pens, and ROSS. This variability in per-acre available nitrogen estimates suggests that evaluating small geographic areas individually based on the activities present will be very important to identify management needs in different regions.

Table 33. Estimated nitrogen available per acre from all sources at low, medium, and high range

Source		Area (acres)	Scenario A (low) (lb/acre-year)	Scenario B (medium) (lb/acre-year)	Scenario C (high) (lb/acre-year)
Irrigated Agriculture		85,775	0-58	0-148	0-284
CAFO	Pens	2,096	67	480	892
	Lagoons	210	1,354	7,448	13,542
RCIM	ROSS	398	223	403	662
	LOSS	3	195	209	225
	COSS	30	163	173	183
	Residential fertilizer	4,381	4.7	11.7	18.6
	Small scale farms	2,096	4.3	10.7	17.1
Atmospheric deposition		87,082	1.53	2.05	6.15

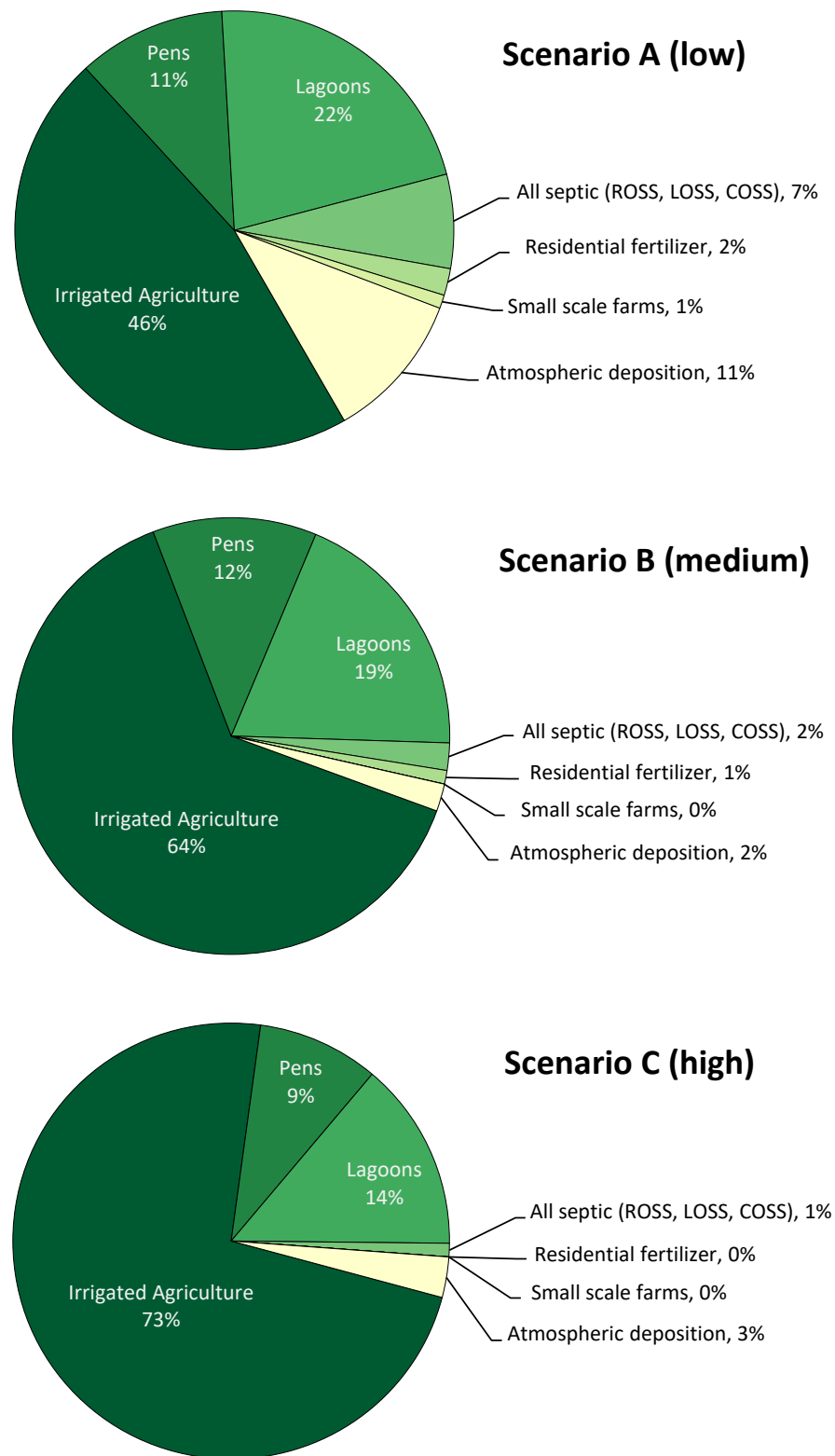


Figure 11. Low, medium, and high estimates from all sources, over the entire GWMA, with percentage of total for each category

Recommendations

WSDA has identified top priorities for researchers to improve the estimates made in this study. These items were chosen because they relate to land uses with large acreages, large estimates of available nitrogen, or they would provide calibration for modeled estimates.

- Update all calculations as and when new information becomes available (for example, if information on lagoon liner condition ratings or seepage rates becomes available, that information should be incorporated into these estimates).
- Compare irrigated agriculture mass balance predictions to the deep soil sampling results to calibrate the model.
- Conduct a statistically-based study of lagoon seepage rates in the GWMA to improve seepage estimates.
- Conduct a statistically-based study of soil nitrogen concentrations beneath pens to provide local data for pen nitrogen loss estimates.
- Conduct a statistically-based study of lagoon nitrogen concentrations to confirm lagoon nitrogen concentrations used in this study.

In addition to these recommendations, there are other steps that Yakima County or the GWAC could take to improve these estimates. These additional options are lower priority because WSDA believes they are less likely to result in changes to the estimates.

- A sensitivity analysis over all inputs to identify which inputs have the largest effect on the estimates; those inputs should be the top priority for additional study.
- Categorize impoundments by primary use, and use-specific parameters could be included in the estimate (for example, main or flush lagoons vs secondary lagoons).
- Research construction dates of existing lagoons, pair with liner condition ratings and historic NRCS recommendations, and generate effective permeabilities for each lagoon.
- Conduct a statistically-based study of soil nitrogen concentrations beneath lagoons to estimate nitrogen loss rates and storage in the soil.
- Identify impoundments are used as settling basins or ponds and review construction techniques to determine whether additional analysis for settling basins is needed.
- Conduct a statistically-based study of soil beneath composting areas to provide data for compost area nitrogen loss estimates.
- Review literature on the fate of deposited nitrogen for different ecosystems and land uses; pair with GIS analysis to determine the fate of deposited nitrogen for different land uses.

During this project WSDA has also identified some critical information gaps affecting growers.

- Most Washington State University Extension fertilizer guides currently available date to the 1970's. Updating these would provide crop growers with valuable information to use in decision making.
- Synthesis of existing data and new research on several topics would also help: soil organic matter mineralization, organic fertilizer composition and breakdown rates, and the interactions and effects when fertilizers of different types (for example, manure and commercial fertilizer) are applied during the same growing season.

These study results can be used in several different ways to aid the GWAC as they choose how to allocate limited resources.

- Review contributions from all sources simultaneously, spatially throughout the GWMA, to identify areas where available nitrogen is high or where contributions from several sources overlap.
- Review nitrogen availability data in conjunction with other data layers (depth to groundwater, soil type, documented groundwater nitrogen concentrations, deep soil sampling results, proximity to drinking water supply wells, or proximity to vulnerable or susceptible aquifer areas) to identify locations where elevated risk of potential nitrogen loading and resultant impacts to groundwater can be prevented.

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Appendix A: Data sources, uses, and potential concerns

Section	Data	Source	Use	Concerns
CAFO: Pens and compost areas	Pen locations and dimensions	2014 dairy registration locations USDA National Agricultural Imagery Program 2013, 2015 imagery	Pen calculation	Potential for human error. Changes in operation since data collection.
CAFO: Pens and compost areas	Pen location QA	WSDA NRAS QA procedure (Beale and Baker 2009)	Pen calculation	Entire data set not ground truthed.
CAFO: Pens and compost areas	Dairy CAFO pens	NAIP 2013, 2015 imagery WSDA DNMP WSDA Animal Services	Pen calculation	Potential for human error. Changes in operation since data collection.
CAFO: Pens and compost areas	Non-Dairy CAFO pens	NAIP 2013, 2015 imagery WSDA DNMP WSDA Animal Services	Pen calculation	Potential for human error. Changes in operation since data collection.
CAFO: Pens and compost areas	Compost locations	NAIP 2013, 2015 imagery 2014 dairy registration locations	Pen calculation	Potential for human error. Changes in operation since data collection. Potential misidentification of silage storage as compost area.
CAFO: Pens and compost areas	High rate for pens	Viers et al. 2012	Pen calculation	Data is not specific to Yakima Valley. Research conducted in California's San Joaquin Valley and in Kansas where meteorological conditions are very different from Yakima.
CAFO: Pens and compost areas	Low rate for pens	Viers et al. 2012	Pen calculation	Data is not specific to Yakima Valley. Research conducted in California's Tulare Lake Basin where meteorological conditions are similar to Yakima.

Section	Data	Source	Use	Concerns
CAFO: Lagoons	All lagoon locations	WSDA DNMP staff NAIP 2013, 2015 Google Earth	Lagoon calculation	Potential for human error. Potential misidentification of irrigation pond or settling pond as lagoon and vice versa.
CAFO: Lagoons	Lagoon location QA	WSDA NRAS QA procedure (Beale and Baker 2009)	Lagoon calculation	Entire data set not ground truthed.
CAFO: Lagoons	Lagoon capacity	DNMP lagoon assessment project	Lagoon calculation	Provides an average snapshot in time. Lagoon capacity varies throughout year.
CAFO: Lagoons	Length and width of lagoons	Nutrient management plans DNMP staff onsite data collection using ArcGIS Collector	Lagoon calculation	Potential for human error.
CAFO: Lagoons	Individual lagoon design depth	DNMP lagoon assessment Average from DNMP lagoon assessment	Lagoon calculation	All lagoons do not have recorded design depth.
CAFO: Lagoons	Lagoon total nitrogen concentration	EPA 2013a Self-reported data to SYCD	Lagoon calculation	Potential bias in both sources. EPA data set: small sample size, not statistically selected. SYCD data set: voluntarily self-reported, not statistically selected.
CAFO: Lagoons	Lagoon liner permeability and thickness	USDA NRCS 2009, USDA NRCS 2016a, USDA NRCS 2016b	Lagoon calculation	Unknown what percentage of lagoons were constructed to NRCS standards. Permeability and liner thickness chosen may not accurately represent range of lagoon construction.
Irrigated Agriculture	Acreage of crops in GWMA	WSDA crop mapping	Irrigated agriculture mass balance	Potential for human error.
Irrigated Agriculture	Fertilizer application data	Telephone survey	Irrigated agriculture mass balance	Potential bias from self-reported data, only a subset of each commodity represented in data.
Irrigated Agriculture	Atmospheric Deposition	Dr Ranil Dhammapala EPA 2016	Irrigated agriculture mass balance	Few deposition monitoring stations: may not accurately reflect deposition in GWMA

Section	Data	Source	Use	Concerns
Irrigated Agriculture	Irrigation water nitrogen concentration	Lower Yakima River nitrogen levels at USGS Yakima River station at Kiona (USGS 2012) Washington State Irrigation Guide precipitation data	Irrigated agriculture mass balance	Located downstream of irrigation districts serving the GWMA. Does not account for potential increase in nitrogen concentration if water is used by successive growers.
Irrigated Agriculture	Crop residue left in fields and incorporated	Irrigated Agriculture Work Group "Estimated Nitrogen Usage for Agricultural Production in the GWMA"	Irrigated agriculture mass balance	Potential bias from IAWG.
Irrigated Agriculture	Crop uptake	Irrigated Agriculture Work Group "Estimated Nitrogen Usage for Agricultural Production in the GWMA"	Irrigated agriculture mass balance	Potential bias from IAWG.
Irrigated Agriculture	Nitrogen loss to atmosphere	Potter et al. 2009	Irrigated agriculture mass balance	
Irrigated Agriculture	Soil organic matter conversion to nitrate-nitrogen	Dr Haiying Tao, Department of Crop & Soil Sciences, Washington State University SYCS deep soil sampling 2015 results	Irrigated agriculture mass balance	Changing assumptions based on new information; not yet established science.
RCIM	Number of households and number of people per household	Census 2010	Residential on-site sewage system calculation	Information is outdated.
RCIM	Soil type, soil classification, infiltration rate	USDA NRCS 2014	Residential on-site sewage system calculation	
RCIM	Total nitrogen per person per day	EPA 2002a	Residential on-site sewage system calculation	

Section	Data	Source	Use	Concerns
RCIM	Denitrification in septic	EPA 2002a	Residential on-site sewage system calculation	
RCIM	Total nitrogen content of septage	EPA 1994	Residential on-site sewage system calculation	
RCIM	Average size of septic tank	WAC 246-272A-0232 (On-site...2005)	Residential on-site sewage system calculation	Actual sizes of septic tanks are unknown, the assumption that each tank meets or is equal to the minimum requirement may not be valid.
RCIM	Septic tank pumping frequency	GWMA Survey "Well Assessment Survey" EPA 2002b	Residential on-site sewage system calculation	Survey of GWMA residents is voluntary and not necessarily geographically dispersed.
RCIM	Number of migrant workers	USDA NASS 2014 Prorated total Yakima County number by crop acres within GWMA ESD 2015	Residential on-site sewage system calculation	Proration of migrant workers by crop acres may not be valid, some crops require migrant workers and others do not.
RCIM	Design capacity, location, and times of use for LOSS	Washington Department of Health GIS Department	Large on-site septic system calculation	
RCIM	Average loading generated by toilet flushing	EPA 1992	Large on-site septic system calculation	Value may be outdated considering new technology.
RCIM	Design flow for LOSS	WAC 246-272B 06450(4) (b) (Large...2011)	Large on-site septic system calculation	No actual measurements of flow from LOSS system.
RCIM	Locations of COSS	WSDA DNMP number of CAFOs in GWMA	Commercial on-site septic systems calculation	Assumes all COSS are on CAFOs and that every CAFO has a COSS.

Section	Data	Source	Use	Concerns
RCIM	Number of employees using COSS	Reed 2004	Commercial on-site septic systems calculation	Assumes COSS at CAFOs in Yakima Valley will be the same as those in California.
RCIM	Area of maintained lawn areas	ArcMap Spatial Analysis by Yakima County	Residential lawn fertilizer calculation	Tool may misidentify some areas as lawn and miss other areas.
RCIM	Lawn fertilization frequency and rate	Scott's Turf Builder	Residential lawn fertilizer calculation	Assumes proportion of residents who fertilize Assumes that residents who fertilize follow fertilizer guidelines.
RCIM	Number of hobby farms	ArcGIS model developed by Yakima County	Small-scale commercial and hobby farms calculation	Potential for model error.
RCIM	Fertilizer application for hobby farms	RCIM Work Group	Small-scale commercial and hobby farms calculation	Potential bias in data from RCIM workgroup.
Atmospheric Deposition	Atmospheric Deposition	Dr Ranil Dhammapala EPA 2016	Atmospheric deposition estimates over GWMA	Few deposition monitoring stations: may not accurately reflect deposition in GWMA

Appendix B: Lagoon nitrogen concentration statistical analysis

Descriptive statistics were calculated for the two datasets for comparison purposes; a summary of these statistics is displayed in Table 34. With the exception of the maximum, standard deviation, and sample size all values in the EPA data set were higher than those in the SYCD data.

Table 34. Comparison of EPA and SYCD lagoon nitrogen concentration (mg N/L)

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

Figure 12 displays the data from both sources on one boxplot. Two measurements in the SYCD data set are classified as outliers because they exceed 1.5 times the interquartile range (the difference between the 1st and 3rd quartile). These measurements are displayed as small circles in the figure.

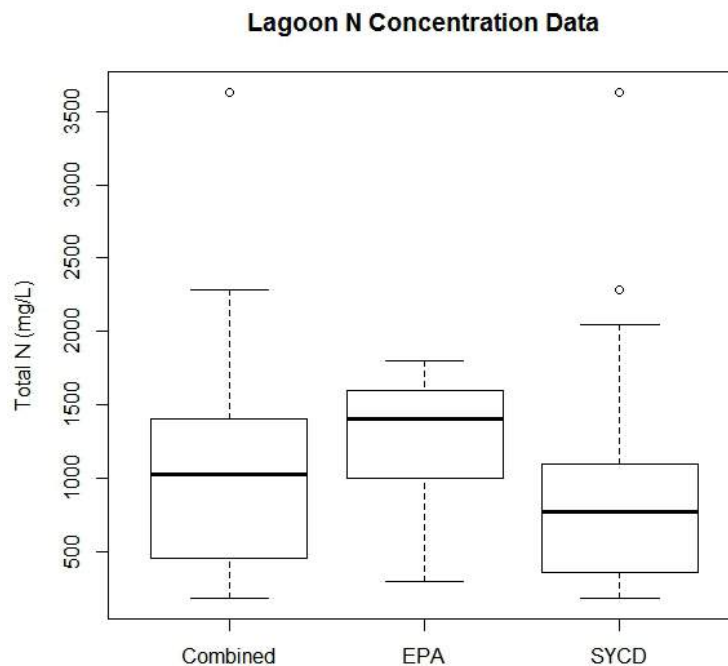


Figure 12. Boxplots of EPA and SYCD lagoon nitrogen concentration data

Appendix C: Lagoon surface area reduction methodology

Manure storage lagoons are constructed with sloping interior and exterior sides. As a result, a change in the liquid level within the lagoon changes the liquid surface area. Since liquid surface area was used as an input in the Darcy's law calculations in the CAFO section, it was necessary to calculate the needed adjustment to surface area based on the average lagoon capacity that was used to adjust the lagoon design depths. When DNMP conducted the lagoon assessment, the site information recorded was surface area, based on delineation of the lagoon perimeter, and side slope for lagoons where the liquid level was low enough to allow determination of side slope. The following diagram (Figure 13) shows a profile (side) view of a typical manure storage lagoon. In this diagram (which is not drawn to scale) the vertical dimension has been increased to show the liquid level and side slopes, which were used to adjust the surface area. The excavation depth H is used with the liquid depth D to determine what reduction in surface dimensions (length, width, and surface area) is necessary based on the side slope X . The interior side slope (often written as a proportion, $X:1$) determines the amount of lateral shift (X) for every 1-unit change in height. This determines the total reduction in a horizontal dimension; the difference between the excavation depth H and the liquid level D ($H-D$) is multiplied by the horizontal translation in side slope for every 1-unit reduction in height, which would be multiplied by two to find the total reduction in one horizontal dimension (length or width):

$$(H - D)X$$



Figure 13. Profile view of typical manure storage lagoon construction. Not drawn to scale; the vertical scale on this diagram is exaggerated to show the side slopes and liquid level clearly.

This surface area adjustment depends on the typical liquid depth, the interior side slope, and also on the lagoon shape in plan view (from the top). Reducing the depth of a round lagoon from the full design depth to 43% of the full design depth would reduce the full surface area by a different proportion than the same reduction for a rectangular lagoon, for example. In order to estimate this surface area reduction it was necessary to generally characterize the range of lagoon shapes represented. The GIS data was informally reviewed; the vast majority of dairy lagoons had plan outlines ranging from a square to a rectangle with length equal to twice the width ($L = 2W$). Other shapes represented were largely regular rectangles with proportions of length greater than twice the width (from $L = 3W$ to $L = 5W$). Less than 5 lagoons were triangular; these other shapes (long rectangles and triangles) were an estimated less than 10% of the lagoons in the study. Because of this relative uniformity in shape, surface area reductions were calculated for only two shapes: square and $L = 2W$ rectangle. These calculations provided enough information about the trend that the surface area reduction would follow to make a conservative estimate. In order to do these

sample calculations it was necessary to determine an example depth, surface area, and side slope to work with. The values used were derived from the field measurements taken during the DNMP's lagoon assessment process. Note that numbers are reported in these examples to 4 decimal places and rounded at the end, corresponding to the method used for the actual calculations in which all digits were retained during the calculation.

Average surface area at full capacity: 70659.7289 ft² (n = 90)

Average depth at full capacity: 11.3029 ft (n = 105)

Average side slope: 3:1 (n = 99)

Average depth at reduced capacity:

$$0.4326 \times 11.3029 \text{ ft} = 4.8896 \text{ ft}$$

A typical square lagoon with these average values is used for a sample calculation. The following diagram (Figure 14) shows the parameters needed for the calculation: surface area at full capacity is used to calculate side length. Side length at full capacity is then used to calculate side length at reduced capacity, which is used to calculate surface area at reduced capacity. The percent reduction is based on the surface area at full capacity and the surface area at reduced capacity.

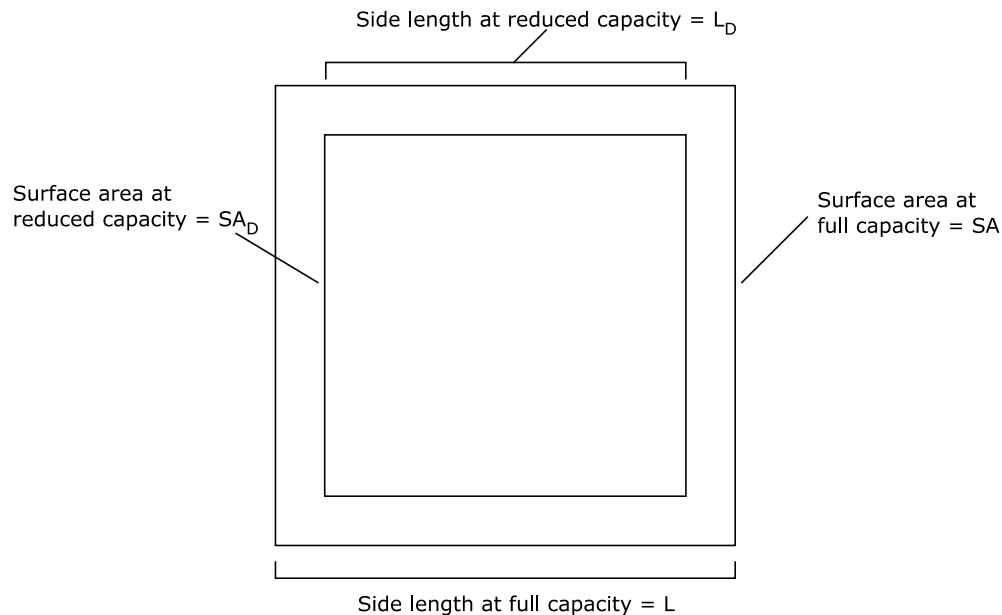


Figure 14. A typical square manure storage lagoon, with side length and surface area shown at both full and reduced capacities

$SA = 70,659.7289 \text{ ft}^2$, surface area at full capacity

SA_D = Surface area at reduced capacity, unknown

$$L = \sqrt{SA} = 265.8190 \text{ ft}$$

$$L_D = L - 2(H - D) = 265.8190 \text{ ft} - 2((11.3029 \text{ ft} - 4.8896 \text{ ft})3) = 227.3395 \text{ ft}$$

$$SA_D = L_D^2 = 51,683.2623 \text{ ft}^2$$

$$\frac{SA_D}{SA} = 0.7314; 73\% \text{ reduction}$$

A typical rectangular lagoon ($L = 2W$) with the same average values for surface area at full capacity, depth at full capacity, reduced depth, and side slope was used for the same calculation (Figure 15).

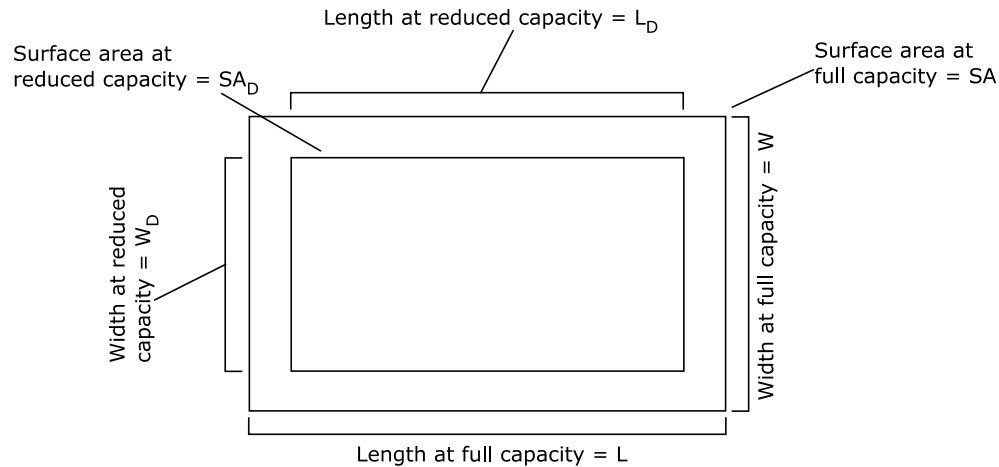


Figure 15. A typical rectangular manure storage lagoon, showing length, width, and surface area at full and reduced capacities

$$SA = 70,660 \text{ ft}^2, \text{ surface area at full capacity}$$

$$SA_D = \text{Surface area at reduced capacity, unknown}$$

$$W = \sqrt{\frac{SA}{2}} = 187.9624 \text{ ft}$$

$$L = 2 \times W = 375.9248 \text{ ft}$$

$$W_D = W - 2(H - D)X = 187.9624 \text{ ft} - 2((11.3028 \text{ ft} - 4.8896 \text{ ft})3) = 149.4830 \text{ ft}$$

$$L_D = L - 2(H - D)X = 375.9248 \text{ ft} - 2((11.3028 \text{ ft} - 4.8896 \text{ ft})3) = 337.4453 \text{ ft}$$

$$SA_D = W_D \times L_D = 50,442.3290 \text{ ft}^2$$

$$\frac{SA_D}{SA} = 0.7139; 71\% \text{ reduction}$$

Based on the preceding calculations, the surface area reduction due to the depth reduction used to adjust the depths for the Darcy's law calculation is 73% for a square lagoon and 71% for a rectangular lagoon. Additional longer, thinner rectangular lagoons would continue the same trend, with a larger surface area reduction due to the depth reduction. As a result, the 73% reduction was chosen to adjust the surface areas for Darcy's law in order to use the most conservative value available.

Appendix D: Darcy's law example calculation

Darcy's law

$$Q = k * \frac{(H + d)}{d} * A$$

Where:

Q = the calculated volumetric flow rate (L³/T)

k = coefficient of permeability (hydraulic conductivity, either 1x10⁻⁷ or 1x10⁻⁶ cm/s) (L³/L²/T)

d = thickness of soil liner (estimated at 1 foot) (L)

H = vertical distance between top of liner and top of liquid storage (L)

A = lagoon area (L²)

L = length

T = time

$$N \text{ Loading} = Q * C$$

Q = volumetric flow rate calculated using Darcy's law (L³/T)

C = Total N concentration, 1053 mg N/L

Example Calculation

Inputs:

K = 1x10⁻⁷ cm/s = 1x10⁻⁹ m/s (low range hydraulic conductivity)

D = 1 ft = 0.3048 m

H = 11.3028 ft = 3.4451 m * 0.4326 = 1.4903 m

A = 70659.7289 ft² = 6467.5036 * 0.7314 = 4801.5322 m²

C = 1052.6965 mg N/L = 10.526965x10⁻⁴ kg N/L

Darcy's law:

$$Q = 1 \times 10^{-9} \text{ m/s} * \frac{(1.4903 \text{ m} + .3048 \text{ m})}{.3048 \text{ m}} * 4801.5322 \text{ m}^2$$

$$Q = 2.8279 \times 10^{-5} \text{ m}^3/\text{s}$$

$$Q = 2.8279 \times 10^{-5} \text{ m}^3/\text{s} * \frac{86400 \text{ s}}{\text{day}} * \frac{365 \text{ day}}{\text{year}} = \mathbf{891.8085 \text{ m}^3/\text{year}}$$

Potential N Loss:

$$N \text{ Loss} = 891.8085 \text{ m}^3/\text{year} * 10.526965 \times 10^{-4} \text{ kg N/L} * \frac{1000 \text{ L}}{\text{m}^3}$$

$$N \text{ Loss} = 938.8037 \text{ kg N/year} = \mathbf{939 \text{ kg N/year}}$$

$$N \text{ Loss} = 938.8037 \text{ kg N/year} * 1 \text{ ton}/907.1848 \text{ kg} = 1.0348 \text{ tons N/year} = \mathbf{1 \text{ ton N/year}}$$

Appendix E: Sensitivity analysis on Darcy's law

In order to identify which inputs to the Darcy's law calculation would have the greatest influence on the calculation's result, WSDA conducted a sensitivity analysis. Each input parameters was evaluated (keeping all other parameters constant) at a range of values Figure 16). Average parameters were used for this analysis, and then the outcome flow was evaluated for variation in each parameter individually (while the other parameters were held constant). Each parameter was evaluated for a range from 75% of the average to 125% of the average, with step sizes of 5%.

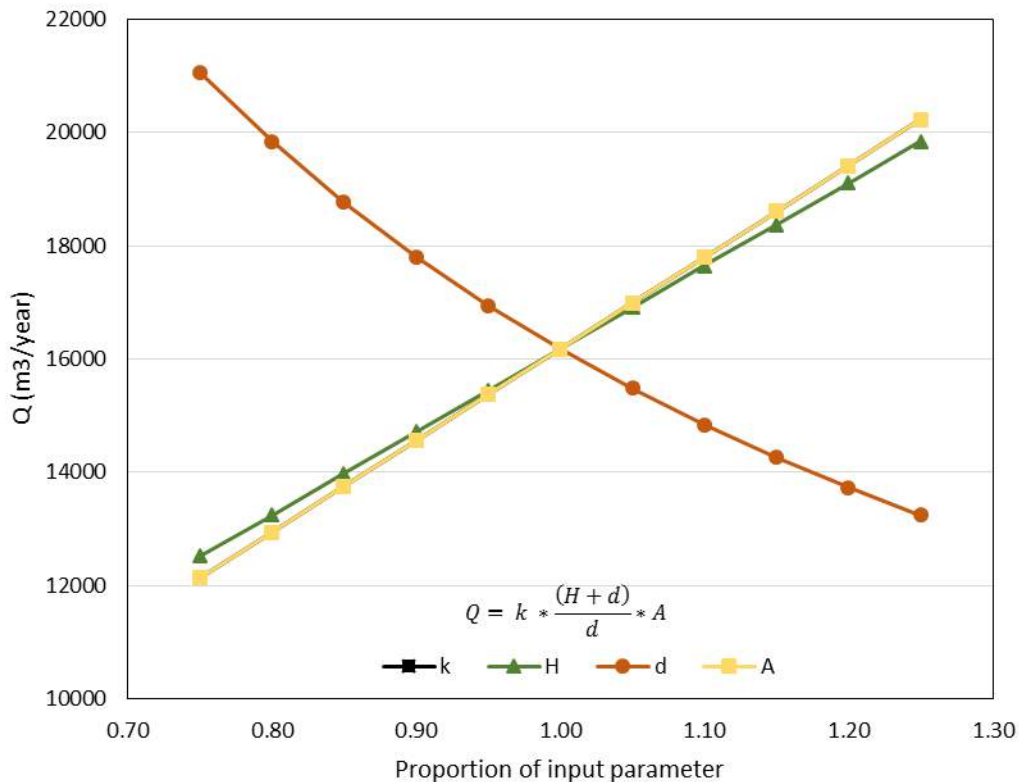


Figure 16. Results of sensitivity analysis on Darcy's law

As a result, NRAS concluded that the flow resulting from Darcy's law, calculated for an individual lagoon, is equally sensitive to all inputs. Permeability (k), surface area (A), and depth (H) are directly proportional to flow. k is invisible because it is hidden by one of the other parameters. Liner thickness (d) is inversely proportional to flow.

Appendix F: Irrigation water use

Source: Jim Davenport, Stuart Turner								
	Water Duty (in/acre)	Water Duty (in/acre)	Water Duty (in/acre)	Water Duty (in/acre)	Water Duty (in/acre)	Water Duty (ac-ft/ac)	Water use (liters/ac)	Irrig water lb N/ac (based on 0.809 mg N/L, USGS 2012)
Location	Yakima	Sunnyside	Prosser	Average	Stu's #'s*	Average		
Total Precip (in)	7.98	6.70	7.74	7.47				
Effective Precip (in)	3.04	3.00	3.40	3.15				
Crop Type								
Silage Corn	28.20	29.31	28.13	28.55		2.38	2934316.238	5.23
Field Corn (Grain)	28.20	29.31	28.13	28.55		2.38	2934316.238	5.23
Triticale				28.55		2.38	2934658.872	5.23
Apple	42.42	44.37	42.42	43.07	30.00	2.50	3083704.594	5.50
Grape, Juice	26.14	27.35	26.04	26.51		2.21	2724966.959	4.86
Alfalfa Hay	35.31	37.01	35.30	35.87		2.99	3687425.426	6.58
Pasture	37.29	39.07	37.30	37.89		3.16	3894376.268	6.95
Cherry	42.94	44.94	42.92	43.60	30.00	2.50	3083704.594	5.50
Grape, Wine	26.14	27.35	26.04	26.51		2.21	2724966.959	4.86
Hops	29.52	30.76	29.39	29.89		2.49	3072397.677	5.48
Pear	39.25	41.09	39.21	39.85		3.32	4096187.602	7.31
Wheat	22.67	24.35	22.85	23.29		1.94	2393982.666	4.27
Mint	34.35	35.93	34.32	34.87		2.91	3583950.006	6.39
Asparagus**				0.00		0.00	0	0.00
Nectarine/Peach***	39.81	41.70	39.76	40.42		3.37	4155120.623	7.41

Washington State Irrigation Guide, Appendix A, Climatic Stations for Consumptive Use, WA210-VI-October 1985

*Stu Turner best professional judgement numbers are used for water duty for apples and cherries.

**No data

***Washington State Irrigation Guide, Appendix A, Climatic Stations for Consumptive Use, WA210-VI-October 1985 (added by WSDA)

Appendix G: Nitrogen uptake estimates

Source: Jim Trull, SVID, Scott Stephens

ESTIMATE OF NITROGEN USAGE FOR AGRICULTURAL PRODUCTION IN THE GWMA

Crop	Typical Yield ¹ /Acre	Yield (Scott) ⁴	Nitrogen Removed in Harvested Portion of the Crop - (lbs/acre)	Removal (Scott) ⁴	Reference ³	Nitrogen Uptake in Plant in Growing Cycle (lb./acre)	Uptake (Scott) ⁴	Estimate of Nitrogen Applied ² (lbs/acre)	Range		Scott's opinion ⁴	Yield parameters ⁴
									Production	Application		
Silage Corn	30 tons	30	250	270	A		250-290	250	25-40	12-592	22-40	Tons at 68% moisture
Grain Corn	4-8 tons	6-6.5	186	170-190	A	214	290-325	250	2.5-8.0	90-375	5.5-8	Tons Grain weight
Triticale	8 tons	7.5-8	455	190-210	B		200-225	0-100	5.0-15	0-575	6-10	Tons at 50% moisture
Apples	20 tons	20	120	40-60	A		80-120	50-100			15-40	
Grapes, Juice	10 tons	10	125	20-40	A		80-100	80			8-16	
Alfalfa Hay	8 tons	8	448	400	A	449	480				7-11	Tons at 15% moisture
Pasture	6 tons	6	300	270	A		270+				5-7	Tons at 15% moisture
Cherries	5 tons	5-6	95	25-40	A		60-100		4-8	30-50	4-8	
Grapes, Wine	6 tons	6	100	15-30	A		50-65	83	2.5-5.0	0	4-8	
Hops	1 ton	1.25	180	150-250	A		200-300		0.3-1.5	150-175	1-1.8	
Pears	20 tons	25	85	40-60	A		80-160		20-27.5	150	18-35	
Wheat	120 bu	125	175	187	A	226	275		65-120	90-213	115-140	

Crop	Typical Yield ¹ /Acre	Scott's opinion	Nitrogen Removed in Harvested Portion of the Crop - (lbs/acre)	Removal (Scott) See References below	Reference ³	Nitrogen Uptake in Plant in Growing Cycle (lb./acre)	Uptake (Scott) See references below	Estimate of Nitrogen Applied ² (lbs/acre)	Range		Scott's opinion	Yield parameters
									Production	Application		
Mint	160 lb	160	160	280	D		280-320		68-70	0-275	140-180	
Asparagus	3000 lb	3500	95	20	A		50				?	
Nectarine/Peach	15 tons	15	95	50	A		95				?	

¹. SYCD and IAWG

². Various sources

³. References: A-Western Fertilizer Handbook; B - NRCS Crop Nutrient Tool; C-SYCD; D- WSU Fertilizer Guides

⁴. Reference from the following resources:

International Plant Nutrition Institute (ipni.net)

USDA Crop Nutrient Tool

Potash Corp (<http://potashcorp-ekonomics.com/>)

(wfsag.com) Potash and Phosphate Institute-Agrilience

Appendix H: Mass balance example calculation, apples

$$N \text{ accumulation or loss} = \text{Inputs} \pm \text{Transformations} - \text{Outputs}$$

Inputs:

Commercial, manure, and compost nitrogen applications

Commercial nitrogen	Medium application rate: 59.78 lb N/acre % using: 86.3%
Manure nitrogen	Medium application rate: 0 lb N/acre % using: 0%
Compost nitrogen	Medium application rate: 46.6 lb N/acre % using: 13.7%

$$\text{Commercial } N * \% \text{ using} + \text{Manure } N * \% \text{ using} + \text{Compost } N * \% \text{ using} =$$

$$59.78 \frac{\text{lb } N}{\text{acre}} * 86.3\% + 0 \frac{\text{lb } N}{\text{acre}} * 0\% + 46.6 \frac{\text{lb } N}{\text{acre}} * 13.7\% = 57.974340 \frac{\text{lb } N}{\text{acre}}$$

Atmospheric nitrogen deposition

Atmospheric nitrogen deposition, medium rate:

$$2.05 \frac{\text{lb } N}{\text{acre}}$$

Irrigation water nitrogen

Water duty for apples: 30 ac-in/acre

Water nitrogen concentration: 0.809 mg N/L

$$30 \frac{\text{ac} \cdot \text{in}}{\text{acre}} * \frac{1 \text{ ac} \cdot \text{foot}}{12 \text{ ac} \cdot \text{in}} * \frac{1233.481838 \text{ m}^3}{1 \text{ ac} \cdot \text{foot}} = \frac{3083.704595 \text{ m}^3}{\text{acre}}$$

$$\frac{0.809 \text{ mg } N}{L} * \frac{3083.704595 \text{ m}^3}{\text{acre}} * \frac{1000 L}{\text{m}^3} * \frac{1 \text{ g}}{1000 \text{ mg}} * \frac{1 \text{ kg}}{1000 \text{ g}} * \frac{1 \text{ lb}}{0.453592 \text{ kg}} = \frac{5.499914 \text{ lb } N}{\text{acre}}$$

Calculated residual nitrogen

Estimated nitrogen uptake by crop, medium rate: 100 lb N/acre

Estimated nitrogen removed through harvest, medium rate: 50 lb N/acre

$$\text{Residual nitrogen} = N \text{ uptake by crop} - N \text{ removal by harvest}$$

$$100 \frac{\text{lb } N}{\text{acre}} - 50 \frac{\text{lb } N}{\text{acre}} = 50 \frac{\text{lb } N}{\text{acre}}$$

Transformation:*Soil organic matter conversion to nitrate*

Soil organic matter content: 2.17%

Soil organic matter conversion rate to nitrate, medium rate: 30 lb N/% organic matter

$$2.17\% \text{ organic matter} * 30 \frac{\text{lb N}}{\% \text{ organic matter}} = 65.1 \frac{\text{lb N}}{\text{acre}}$$

Outputs:*Crop nitrogen uptake*

Estimated crop nitrogen uptake, medium rate:

$$100 \frac{\text{lb N}}{\text{acre}}$$

Loss to atmosphere

Estimated nitrogen lost to atmosphere:

$$17 \frac{\text{lb N}}{\text{acre}}$$

Complete calculation:

*N applications + atmospheric N deposition + irrigation water N + calculated residual N
+ soil organic matter conversion – crop N uptake – N loss to atmosphere =*

$$57.974340 \frac{\text{lb N}}{\text{acre}} + 2.05 \frac{\text{lb N}}{\text{acre}} + 5.499914 \frac{\text{lb N}}{\text{acre}} + 50 \frac{\text{lb N}}{\text{acre}} + 65.1 \frac{\text{lb N}}{\text{acre}} - 100 \frac{\text{lb N}}{\text{acre}} - 17 \frac{\text{lb N}}{\text{acre}} = 63.6 \frac{\text{lb N}}{\text{acre}}$$

FACT SHEET FOR THE DRAFT CONCENTRATED ANIMAL FEEDING OPERATION GENERAL PERMITS

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM AND
STATE WASTE DISCHARGE GENERAL PERMIT

DECEMBER 2022



ADA ACCESSIBILITY

To request ADA Accommodation, contact Water Quality Reception at 360-407-6600 or visit [Ecology's ADA Accessibility webpage](https://ecology.wa.gov/accessibility)¹. For Relay Services or TTY call 711 or 877-833-6341.

For document translation services, call Water Quality Reception at 360-407-6600. Por publicaciones en español, por favor llame Water Quality Reception al 360-407-6600.

PURPOSE OF THE FACT SHEET

This fact sheet is a companion document to the National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Concentrated Animal Feeding Operations (CAFO general permit). It explains the nature of the proposed discharges, summarizes the history of the permit, documents the Washington State Department of Ecology's (Ecology) decisions for limiting the pollutants in the wastewater discharges, provides the regulatory and technical bases for those decisions, and fulfills the requirements of Washington Administrative Code (WAC) Section 173-226-110.

PERMIT SUMMARY

The permit authorizes discharges associated with manure, litter, process wastewater, and other organic by-product from CAFO production areas and land application fields. The permit limits the discharge of pollutants to surface waters under the authority of the Federal Water Pollution Control Act (U.S.C.S. 1251) and limits the discharge of pollutants to surface and groundwater under the authority of Chapter 90.48 RCW. Ecology anticipates that Permittees' diligent implementation of the requirements of this permit will result in discharges that do not cause or contribute to violations of state water quality standards.

¹ <https://ecology.wa.gov/accessibility>

SUMMARY OF PROPOSED CHANGES

Aside from clarifying and typographical changes, the draft CAFO General Permits proposes the following changes from the current permit (effective January 2017 through March 2022).

Draft Permit Sections(s)	Previous Permit Language	Draft Permit Language
<i>S1.A Facilities Required to Seek Coverage under This General Permit</i>	Details on CAFOs required to obtain permit coverage was located in S1 Permit Coverage and S.2.A Who Must Apply for Coverage	Permit language in S1 and S2.A from the previous permit were combined into this new section in the draft permits.
<i>S1.B Activities Covered Under This Permit</i>	Duplicated requirement in general condition 1.	Removed repeated language
<i>S1.C Geographic Area Covered</i>	N/A	The draft permits add two new definitions to simplify the text elsewhere in the draft permit referring to annual precipitation. The new terms are: - Wetter Climates - Drier Climates
<i>S2.A. How to Apply for Coverage</i>	To apply for a permit, a CAFO mailed an application form to Ecology.	To apply for a permit, a CAFO operator mails or electronically submits an application form and a Manure Pollution Prevention Plan. They must revise the application or Plan if requested by Ecology. The public will have the opportunity to review the plan prior to issuing permit coverage.
<i>S2.B When Permit Coverage is Effective</i>	Section title was Permit Coverage Timeline	The draft permits changed the section title and moved the definition of when a CAFO operator becomes a permittee from the previous section <i>How to Apply for Coverage</i> to this section.
<i>S2.C How to Transfer Permit Coverage</i>	N/A	Permit coverage can be transferred only if the volume or characteristics of the wastewater or management practices are substantially

		unchanged. Otherwise, Ecology will require a new permit application.
<i>S2.D How to Terminate Permit Coverage</i>	Cleaning and re-purposing requirements were located under S2.D.1.d. Waste storage pond decommissioning requirements were located in S2.D.1.d.ii Ecology may deny the request for permit coverage termination if the permittee does not meet the eligibility requirements.	Ecology propose a new section S2.D.2. <i>Facility Cleaning Requirements</i> They are referenced in S2.D.1.d. The waste storage pond decommissioning requirements are When a permittee does not provide sufficient information, Ecology may deny the request for permit termination. Permittees must submit the required reports in order for Ecology to make a determination.
S3.A Total Maximum Daily Loads (TMDL) - Combined – Only	Conditional discharges must not exceed an establish load allocation for CAFOs discharging to waterbodies which have a TMDL.	Conditional discharges must not exceed an established waste load allocation for CAFOs discharging to waterbodies which have an EPA-approved TMDL..
S3.B Impaired Waterbodies- Combined – Only	Conditional discharges must not contain the pollutant for which a waterbody is impaired.	Conditional discharges to an EPA-approved 303(d)-listed waterbody must not contain the pollutant for which the waterbody is listed.
S3.D Land Application Fields - Combined – Only	Previous permit included the definition of agricultural stormwater in the text.	Ecology proposes to shorten the text to “unless the discharge meets the definition of agricultural stormwater”. Agricultural stormwater is defined in Appendix A.
<i>S4.A Pollution Prevention Plan</i>	Permittees must submit a site-specific Manure Pollution Prevention Plan within 6 months of permit coverage. Updates to the Plan must be completed within certain timeframes. The permittee is not required to submit the revised Plan to Ecology.	The Manure Pollution Prevention Plan must be submitted with application, prior to permit coverage. The draft permits add two new definitions to simplify the text elsewhere in the draft permit referring to annual precipitation. The new terms are: - Wetter Climates

		- Wetter Climates If a waste storage facility has a leak detection system, the Plan must describe how the Permittee will test for leaks. Updates to the Plan must be completed within certain timeframes and must be submitted to Ecology for review. If changes are substantial, the Permittee must publically notice the updates. Revised the section layout for ease of reading and referencing.
S4.B Production Area Runoff Controls	Pollution prevention practices in the production area must comply with S3.C	Added text from the requirement at S3.C to emphasize that the scope of this condition is not limited to track-out on roadways.
S4.C Storage of Manure, Litter, Process Wastewater, Other Organic By-Products and Feed	N/A	Revised the section layout for ease of reading. The sections are now: - Liquid Waste Storage Structures - Solid Waste Storage Facilities - Maintenance - Closure Procedures
S4.C.1 Liquid Waste Storage Structures	New or refurbished storage structures were required to achieve permeability threshold and distance from water table.	All liquid storage structures must be below a specific discharge rate. The draft permit changes the way to measure the distance between the bottom of the lagoon and water table. Measurements start from where the liquid manure meets the liner and end at the water table.
S4.C.2 Solid Materials Storage Structures	Runoff must be collected from structures that store solid materials. Permittees must document that nutrients in runoff are utilized by vegetative filter strips.	Permittees must design structures for storing solid materials to minimize the discharge of pollutants. Site storage on impervious or low permeability soils. Direct runoff to liquid storage or a vegetative treatment area. Consider covering area.

S4.C.3 Maintain Waste Storage Structures	N/A	Added the requirement that storage structures are inspected and maintained per S5.A
S4.F <i>Prevent Direct Animal Contact with Water</i>	N/A	Livestock must be excluded from the field discharge management areas established in S4.N.
S4.H <i>Livestock Mortality Management</i>	Mortalities must follow specific mortality handling techniques of burial, composting, or natural decomposition.	Ecology simplified the text in the permit condition to refer to requirements for each of the techniques previously outlined. Under the composting section, Ecology removed the requirement to comply with the out-of-date Ecology regulatory guidance.
S4.I <i>Manure, Litter, Process Wastewater and Other Organic By-Product Sampling and Nutrient Analysis</i>	The permit required annual sampling and analysis of nutrients sources to begin after TSUM200.	We removed the reference to TSUM200 from this section to allow sampling and analysis of nutrient sources before TSUM200. Land application may not occur before TSUM200. Samples must be representative of nutrients applied.
S4.I Soil Sampling and Nutrient Analysis	N/A	Ecology made changes to the formatting and order of requirements to make it easier to read and reference.
S4.J.1 Yearly Field-Specific Nutrient Budgets	N/A	Reorganized the list of required elements in a nutrient budget and clarified that the budget must balance nitrogen.
S4.J.3 Application Restrictions	Prohibits manure application to currently saturated soils.	Ecology is proposing to extend the prohibition to when forecast precipitation will saturate soils.
S4.J.4 Double Cropping, Winter Cover Crops, Perennial Crops	N/A	Clarify the requirement to evaluate soil nitrogen changes.
S4.J.5 Emergency Winter Land Application	N/A	Added the requirement to collect samples should a discharge occur. Clarified and reorganized the steps a permittee must take when making emergency applications.

S4.K Adaptive Management	Permittees have the option of using groundwater monitoring to demonstrate manure applications did not impact groundwater.	Ecology added the requirement to conduct deep soil monitoring to assess whether groundwater impact is occurring. Ecology moved the requirement to conduct groundwater monitoring from the table to permit text at S4.K.3. Other changes in this section improved readability. Ecology added a risk level table for categorizing fields. Ecology converted the adaptive management table to two tables to accommodate climate-specific management actions.
S4.I Irrigation Water Management	The permittee must prevent irrigation water from exceeding the water holding capacity in the top two feet of soil.	The permittee must prevent irrigation water from exceeding the water holding capacity in the crop's root zone.
S4.M Field Discharge Prevention – State-Only permit	The permittee must prevent all discharges to surface waters and conduits to surface waters.	Added specificity into the State Waste Discharge Permit's field discharge prevention practices. Control stormwater, treat stormwater, and prevent contamination of stormwater. Require compliance with Ecology BMPs.
S4.M Field Discharge Prevention – Combined permit	Land application fields must have manure setbacks of 100 feet. Alternatively, the permittee can use a 35-foot vegetative buffer or berm. The permittee may propose another practice that is equivalent to the 100-foot setback.	Ecology rearranged this section to present the field discharge practices as a list of options. The manure setback, vegetated buffer, and berm were included. We added a new practice-- a riparian management zone. The permittee may still propose an alternative practice.
S4.P Emergency Procedures	N/A	Ecology added requirement that emergency procedures include how to sample discharges.
S5 Monitoring	N/A	Added paragraph about permit conditions varying based on climate.

S5.B Manure and Wastewater Monitoring	Samples must be analyzed for ammonia/ammonium, nitrate/nitrite, organic N, and P ₂ O ₅ .	Added requirement to monitor leaks, if a leak detection system is in place. Change two manure analysis parameters: - Organic N is now Total Kjeldahl Nitrogen - P₂O₅ is now TP Reorganized the section and added requirements that also appear in special condition S4.H for clarity.
S5.C Soil Monitoring	Spring soil samples must be analyzed for ammonia/ammonium, nitrate/nitrite. Fall soil samples must be analyzed for ammonia/ammonium, nitrate/nitrite, P ₂ O ₅ and organic matter.	Add spring soil analysis parameter: - Total Kjeldahl Nitrogen Change one fall soil analysis parameters: - P₂O₅ is now Phosphorus with method determined by pH
S5.D Groundwater Monitoring	If the permittee conducts groundwater monitoring, they must develop and submit a plan to Ecology for approval. The plan must follow guidelines in <i>Implementation Guidance for Groundwater Quality Standards</i> .	If groundwater monitoring is required based on a determination of reasonable potential to impact groundwater quality, the draft permit condition outlines the procedures to design and install groundwater monitoring wells. These procedures are consistent with <i>Implementation Guidance for Groundwater Quality Standards</i> .
S5.E Surface Water Monitoring	N/A	New special condition with required procedures and parameters to sample in the event of a surface water discharge.
S6.B Land Application Records	N/A	Clarified the requirement to maintain records of the amount of nutrients applied to land and specified units for each item.
S6.D Monitoring Records	N/A	New special condition that lists the records related to S5.B, C, D and E that must be retained onsite.

		This is not a new requirement, but makes record retention requirements more clear.
S7.A Electronic Reporting Requirements	N/A	New special condition requiring electronic report submittals.
S7.B Submittal of MPPP	Plan must be submitted within 6 months of coverage.	Plan must be submitted with the application for permit coverage, plus the MPPP must be submitted when the facility makes changes
S7.C Storage Assessment	Conduct an assessment of waste storage ponds according to NRCS Technical Note 23. If waste storage pond results in a category 3 or 4, develop a plan to bring it into category 1.	The assessment procedure depends on the type of waste storage structure. Liquid waste stored in ponds with earthen liners must be assessed for compliance with S4.B by an engineer or through the NRCS Technical Note 23. Deficiencies found in the assessment must be addressed. Upright tanks and ponds with leak detection systems must follow visual monitoring procedures in S5.A or a leak detection plan. Solids material storage facilities must be evaluated for compliance with S4.B. The permittee must test the permeability of the soil pad. If the soils do not meet the permeability threshold, deficiencies must be addressed. Soil sampling beneath the soil pad may be used to determine the potential to impact groundwater.
S7.E Reporting Permit Violations (previously Non Compliance Notification)	N/A	Added regional contact information for ERTS reporting. Added requirements for electronic reporting and water sample collection and analysis if a discharge to surface waters occurs.
Appendix A: Definitions	N/A	Renamed lagoons as waste storage ponds. Added three definitions: - Drier climates - Wetter climates

		- Qualified expert
Appendix B: Annual Report	N/A	Added requirement to report soil collection date and changed naming conventions of animal types.

Table of Contents

ADA ACCESSIBILITY.....	2
PURPOSE OF THE FACT SHEET.....	2
PERMIT SUMMARY	2
SUMMARY OF PROPOSED CHANGES	3
INTRODUCTION.....	6
PUBLIC PARTICIPATION	6
PUBLIC COMMENT PERIOD	6
PUBLIC HEARINGS AND WORKSHOPS	7
ISSUING THE FINAL PERMITS	7
BACKGROUND.....	8
DESCRIPTION OF ANIMAL AGRICULTURE INDUSTRY	8
WASTEWATER CHARACTERIZATION.....	8
REGULATORY AUTHORITY AND MAJOR CASE LAW	13
LEGAL AND TECHNICAL GROUNDS FOR PERMIT CONDITIONS.....	16
SEPA COMPLIANCE	24
DISCLOSURE OF BUSINESS INFORMATION	26
ECONOMIC IMPACT ANALYSIS.....	27
SPECIAL CONDITIONS.....	27
S1 PERMIT COVERAGE.....	27
S2 PERMIT ADMINISTRATION	35
S3 DISCHARGE LIMITS	40
S4 MANURE POLLUTION PREVENTION.....	43
S5. MONITORING	70
S6 RECORD KEEPING.....	77
S7 REPORTS.....	80
S8 APPENDICES	86
GENERAL CONDITIONS.....	83
G1 DISCHARGE VIOLATIONS	83

G2 PROPER OPERATION AND MAINTENANCE.....	83
G3 RIGHT OF ENTRY	83
G4 PERMIT COVERAGE REVOKED	83
G5 GENERAL PERMIT MODIFICATION AND REVOCATION.....	83
G6 REPORTING A CAUSE FOR MODIFICATION.....	84
G7 TOXIC POLLUTANTS	84
G8 OTHER REQUIREMENTS OF 40 CFR	84
G9 COMPLIANCE WITH OTHER LAWS AND STATUTES.....	84
G10 ADDITIONAL MONITORING	84
G11 PAYMENT OF FEES	84
G12 REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER A GENERAL PERMIT	85
G13 PENALTIES FOR VIOLATING PERMIT CONDITIONS.....	85
G14 SIGANTORY REQUIREMENTS.....	85
G15 APPEALS	85
G16 SEVERABILITY	85
G17 DUTY TO REAPPLY	85
G18 MONITORING BEYOND PERMIT REQUIREMENTS	85
BIBLIOGRAPHY	87
APPENDICES.....	88
APPENDIX A: GLOSSARY OF TERMS.....	88
APPENDIX B: ACRONYMS AND UNITS OF MEASURE	93
APPENDIX C: RESPONSE TO COMMENTS	95

List of Tables and Figures

Table 1 Field Risk Level.....	61
Figure 1 Composite Sample	89
Figure 2 Crest of a waste storage structure	89
Figure 3 Freeboard.....	90
Figure 4 Top of the bank	92

INTRODUCTION

This fact sheet is a companion document to the draft revised National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permits for Concentrated Animal Feeding Operations (CAFO general permits). It provides the legal and technical basis for permit reissuance required in Washington Administrative Code (WAC) 173-226-110.

The current permits, which expired on March 2, 2022, limits the discharge of manure, litter, process wastewater, and other organic by-product from CAFO production areas and land application fields to surface and groundwaters in Washington. This fact sheet explains the nature of authorized discharges, Ecology's decisions on limiting the pollutants in the discharges, and the regulatory and technical bases for those decisions.

The Washington State Department of Ecology (Ecology) is proposing to reissue the CAFO General Permits with changes. The proposed changes to the permit are documented in the Special Conditions section of this fact sheet.

This fact sheet does not contain any independently enforceable requirements. The General Permit contains all of the enforceable requirements applicable to CAFOs. In case of any conflict between the fact sheet and the General Permit, the terms of the General Permit govern.

The text of this fact sheet contains words and phrases in bold and italics. These words and phrases are the first usage in the fact sheet and are defined in Appendix B of this fact sheet.

PUBLIC PARTICIPATION

The procedures for the formulation of a final determination of permit issuance include:

PUBLIC COMMENT PERIOD

Ecology invites public comment on the proposed draft permit and fact sheet until 11:59 p.m. on Wednesday, August 17, 2022. Ecology welcomes all comments that address the permit requirements in the formal draft CAFO General Permits.

In order for Ecology to adequately address comments, please include the following information with each comment:

1. The specific permit language used in the requirement subject to your comment. Include the page number(s) and, where indicated, section reference (i.e., S8.E.7.a).
2. A brief, concise comment including the basis for the comment, and in particular the administrative, legal, technical, or other basis for the concern.
3. Suggested permit language or a conceptual alternative to address your concern.

Submit oral comments by attending and testifying at the public hearings. Send written comments to Ecology by either:

1. [eComments](#)² (preferred)
2. Mail

Washington State Department of Ecology
Water Quality Program
Attn: Chelsea Morris
PO Box 47696
Olympia, WA 98504-7696

PUBLIC HEARINGS AND WORKSHOPS

Ecology will host two public workshops and hearings on the proposed changes in the draft permits. The workshops provide Ecology an opportunity to explain the proposed changes and to answer questions. Each workshop will be immediately followed by a public hearing. The public hearings will provide an opportunity for the public to give formal comments on the draft permits or fact sheet.

Tuesday, July 26, 2022 – 10:00 AM

[Register for the Webinar](#)^{3*}

Call-in Only: 253-215-8782

Meeting ID: 863 0949 8365

Thursday, July 28, 2022 – 6:00 PM

[Register for the Webinar](#)^{4*}

Call-in Only: 253-215-8782

Meeting ID: 865 3217 2503

*The workshops and hearings offered via webinar allow individuals to view the presentation and provide testimony via computer or mobile device.

ISSUING THE FINAL PERMITS

Ecology will make a final permit issuance decision after it receives and considers all public comments. Ecology expects make an issuance decision on the final general permits by the end of 2022. Final permits will be effective one month after the issuance date.

² <https://wq.ecology.commentinput.com/comment/index?id=5gTtQ>

³ <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Concentrated-animal-feeding-operation>

⁴ <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Concentrated-animal-feeding-operation>

BACKGROUND

A general permit is designed to provide coverage for a group of related facilities or operations of a specific industry type or group of industries. Ecology issues general permits when the discharge characteristics are similar and a standard set of permit requirements can effectively provide environmental protection and comply with water quality standards for discharges to surface water or ground water. The CAFO General Permits are issued to operations that confine livestock for long periods of time in pens or barns and discharge pollutants to surface or groundwater. The permits require medium and large-scale livestock operations that discharge pollutants to implement specific management practices to protect water quality.

DESCRIPTION OF ANIMAL AGRICULTURE INDUSTRY

Commercial and/or industrial operations that produce animal and animal-based products may confine and feed substantial numbers of livestock and poultry in a small area. Typical animals raised in confinement include milk cows, beef, veal, pigs or hogs, chickens, turkeys, ducks, sheep, goats, and horses, but other animals may also be confined (e.g. mink). Animals are confined to barns, sheds, pens, cages, or other type of confinement depending on the type of animal. Confinement areas do not sustain vegetation, nor will they be available for cropping or forage. At times, the confined animals may be pastured or given access to outside spaces. Feed is supplied to the animals and waste materials are removed during confinement. The waste material includes animal feces and urine, feed waste, wash water, bedding material, contaminated rainwater, waste materials, and other processing waste waters generated by these facilities.

The waste material is collected and may be treated and stored before it is either land applied or transferred to a separate non-related entity for land application. The purpose of land application is to treat certain pollutants found in the waste material and to beneficially use the material to provide crop nutrients, improve soil quality, and supplement or replace the use of chemical fertilizers.

WASTEWATER CHARACTERIZATION

Manure and other waste material generated on CAFOs can pose substantial risks to the environment and public health if improperly managed. Manure and other waste materials can enter surface and ground waters during rain events, spills, infrastructure and equipment failures, or by the improper application of manure to fields. Potential water pollutants include nutrients such as nitrogen and phosphorus from feed or manure, pathogens from manure, turbidity from various operational practices, temperature from process water or lack of riparian vegetation, and chemical compounds ranging from metals (e.g. zinc, copper) and salts (e.g. sodium, chlorides, potassium) to organic chemicals in animal feed, cleaning agents, vaccines and anti-microbials, growth hormones, pesticides, and petroleum products.

Manure, which may be comingled with other waste material, is used by many CAFOs as fertilizer and soil amendments for growing crops. The use of manure as fertilizer may be in place of, or in addition to, commercial chemical fertilizers. Various techniques are used to **land apply** the material such as surface application through irrigation reels, sprinkler sets, or slurry trucks, and subsurface applications with disks, knives, or chisels.

Manure

Manure is a product generated by CAFO and as excreted, is primarily liquid. Portions of the manure stream that are less than 90% liquid may be handled as a solid material. Manures that are more than 90% liquid may be separated into liquid and solid fractions. Solid manure is stored in covered or open bunkers, on concrete and soil pads, or in place within poultry houses. Depending on the animal type, the solid manure is stored and composted until it is ready for use as animal bedding or a soil amendment. Liquid manure is stored in concrete or metal tanks, **waste storage ponds**, or pits until it is ready to for use as a fertilizer or soil amendment.

Treatment System Additives and Digestate

Some CAFOs utilize biological and chemical treatment systems to reduce pathogens and nutrients found in manure, capture biogas for energy production, manage odors, or reduce the net effect of greenhouse gas emissions. Depending on the design of the treatment system, additives may be used to increase treatment. The material remaining after treatment is often called digestate and may be land applied in the same manner as manure.

Even after treatment, digestate may contain high concentrations of nutrients and organic chemicals that pose a risk to water quality in the event of infrastructure and storage failures, or improper land application.

Process Wastewater and Chemical Compounds

A CAFO may generate other waste streams in addition to manure. Process wastewater may come from cleaning animals and infrastructure in the barns, pens, and milking parlor. Process wastewater also includes any water which comes into contact with any raw materials including manure, litter, feed, or bedding. Some CAFOs may also have on-site facilities to make animal-based products that generate wastewater from the production process. Process wastewaters are typically mixed with manure and/or litter and stored for later use as fertilizer.

Feed and feed additives are rich in nutrients thus, spilled feed or runoff mixed with feed has the potential to negatively impact water quality if not managed. Common feed types include alfalfa, corn silage, grasses, sorghum, and brewery wastes. CAFOs store animal feed that is turned into silage typically in covered bunkers, silos, or silage bags.

Many different types of cleaners are used by CAFOs to protect animal and human health. These cleaners may contain salts, metals, and organic chemicals that risk water quality. Cleaners often

used by CAFOs include germicidal detergents, foot dips, chlorinated liquid cleaners, acid cleaners.

CAFOs will also use vaccines, medications including antibiotics and antimicrobials, and hormones to maintain the health of livestock animals. Incidental release may occur where animals are fed or confined.

Bacteria and Other Pathogens

High *E.coli* and fecal coliform levels, which are an indicator for other bacteria and pathogens, come from many sources in a watershed including agriculture, septic systems, and wild animals and pets. During rain events, the fecal coliform are picked up by run-off and transported to water bodies and other water conveyances (e.g. stormwater drains) that eventually end up in lakes, rivers or marine waters. The presence of fecal coliform bacteria indicate that illness-causing viruses and bacteria may also be present, which can affect the public health, economy, and environmental quality of a community.

Manure contains many different types of bacteria, viruses and parasites (some of which are pathogenic to humans) in addition to the fecal coliform. They are naturally present in the intestines and excreta from animals. Determining if pathogens are present is challenging due to the wide variety that may be present. Fecal coliform are always present in animal wastes, and ease of testing make fecal coliform an indicator for determining the presence of pathogens from animals. Pathogens that may be present in manure, litter, and process wastewater (others may exist that are not included): *Campylobacter*, *Cryptosporidium*, *Escherichia coli* (*E. coli*), *E. coli* O157:H7, *Giardia*, *Leptospira*, *Listeria*, and *Salmonella*.

Fecal coliform are used to monitor the health of shellfish beds by the Washington State Department of Health Shellfish Program. High levels of fecal coliform in shellfish indicate the presence of other pathogens that are harmful to humans if eaten. This is especially important to the commercial shellfish industry, whose growers cannot sell harvested shellfish from beds with high fecal coliform levels. Large amounts of pathogens coming from a watershed, as indicated by the presence of high fecal coliform counts, can cause significant economic damage to shellfish growers.

Nitrogen & Phosphorus

Nitrogen and phosphorus are two of a few nutrients essential to life. Without them, plants would not grow. Yet, excessive amounts of these nutrients in surface and groundwaters lead to conditions that harm aquatic ecosystems, lower recreational opportunities, and pose a risk to human health. Both nitrogen and phosphorus exist in several forms that change as they pass from animal manure to soil to plants. Of importance in the manure-soil-plant system is organic nitrogen, ammonium (NH_4^+), nitrate (NO_3^-), nitrite (NO_2^-), organic phosphorus, and orthophosphates (H_2PO_4^- and HPO_4^{2-}).

Organic forms of nitrogen and phosphorus are not readily available to plants. In the manure-soil-plant system, organic matter must first be broken down by microorganisms (e.g. bacteria, fungi) before nitrogen and phosphorus can be taken up by a crop. The biological processes, sometimes collectively referred to as mineralization, depend on environmental factors such as moisture, temperature, and other nutrients available to the soil microorganisms.

Most of the time, plants use the inorganic forms of nitrogen and phosphorus-- ammonium, nitrate, and orthophosphates. These inorganic forms are soluble and can be driven out of the soil's root zone or a manure pile when rain or irrigation saturates the material.

When nitrate is driven out of the rooting zone it becomes less accessible to plants, fungi, and bacteria and it may reach groundwater drinking supplies. Groundwater is considered contaminated when nitrate concentrations are greater than 10 mg/L-- EPA's drinking water standard for nitrate (40 CFR 141). Nitrates pose health risks to vulnerable populations such as infants under six months old and pregnant adults. Infants who drink water with high nitrates may develop the serious health condition methemoglobinemia or blue baby syndrome. For information on nitrates in groundwater see [Washington Nitrate Prioritization Project](#)⁵. For health information, see Washington Department of Health's fact sheet on [Nitrate in Drinking Water](#)⁶.

When too much nitrogen or phosphorus enters surface waters (e.g. streams, rivers, lakes, and coastal waters), the nutrients act like fertilizer to trigger algal and aquatic plant growth. Excessive algae and aquatic plants can disrupt boating and swimming recreation, increase harmful algae blooms, and degrade habitat for other aquatic life. Toxic blue-green algae (cyanobacteria) can cause serious illness when people and animals are exposed. To find out more about Ecology's efforts, visit [our Freshwater Algae Control webpage](#)⁷.

When algae and aquatic plants die, their decomposition decreases the dissolved oxygen in a surface water. When lots of algae and plants die in the water, dissolved oxygen levels can drop dramatically, killing fish and other aquatic organisms. Lower oxygen in surface waters will change aquatic food webs. For more on the impact of nutrients on surface waters see Ecology's Visit Ecology's webpage on [reducing nutrients in Puget Sound](#)⁸.

There are at least two nitrogen gas forms related to manure collection, storage, and crop fertilization with environmental impacts. Manure and litter is rich in ammonium and when exposed to air, that ammonium converts or volatilizes, to ammonia gas, a respiratory irritant. The speed of conversion depends on atmospheric and environmental conditions such as air temperature, wind, and humidity.

⁵ <https://apps.ecology.wa.gov/publications/SummaryPages/1610011.html>

⁶ <https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/331-214.pdf>

⁷ <https://ecology.wa.gov/Water-Shorelines/Water-quality/Freshwater/Freshwater-algae-control>

⁸ <https://ecology.wa.gov/Water-Shorelines/Puget-Sound/Helping-Puget-Sound/Reducing-Puget-Sound-nutrients>

Denitrifying bacteria in soil and manure piles convert nitrate to nitrous oxide gas. Like similar microbial processes that convert organic nitrogen to inorganic forms, the rate of nitrous oxide production depends on environmental factors such as soil temperature, wetness, and the amount of nitrate available. Nitrous oxide is a long-lasting greenhouse gas with a much greater heat-trapping ability than carbon dioxide. For an in depth explanation of nitrous oxide production in agricultural soil management, see Chapter 5 of EPA's most recent [Greenhouse Gas Inventory Report](#)⁹.

Contaminants of Emerging Concern

Historically, water quality regulation has focused on toxics and the priority pollutants Biological Oxygen Demand (BOD), temperature, pathogens, and nutrients. Contaminants of Emerging Concern (CECs) are contaminants, both natural and synthetic, that may cause ecological or human health impacts but may not be currently regulated. Examples of CECs on CAFOS include pharmaceuticals, antimicrobials, disinfection by-products, and microplastics.

Most livestock and poultry receive pharmaceuticals and antimicrobials to treat and prevent diseases and outbreaks. Pharmaceutical compounds may bioaccumulate in the aquatic environment and cause an array of impacts to aquatic life and human health such as reduced growth, increased mortality, reproduction abnormalities, or endocrine disruption. The impact is dependent on the compound and dose ingested by the target species. The use and overuse of antimicrobials can lead to antibiotic resistance, a concern for animal and humans health. Antimicrobials and antibiotic resistance bacteria and genes may be present in manure and manure-contaminated water.

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are manufactured chemicals that are water soluble, highly mobile, and never disappear from the environment. At contaminated sites, food raised for human consumption could have elevated PFAS. Research studies documented in [Ecology's Chemical Action Plan for PFAS](#)¹⁰ have demonstrated that when perfluoroalkyl acids are present in soil, drinking water, irrigation water, or animal feed, they can transfer to livestock and food crops. Ecology is working with the Washington State Department of Health to identify sources and recommend actions to reduce the use, release, and exposure to PFAS in Washington. [US EPA is also taking action to address PFAS](#)¹¹, including proposing draft aquatic life criteria for PFOA/PFOS in surface waters. For more information on PFAS, see [Ecology's Chemical Action Plan for PFAS](#)¹².

⁹ <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>

¹⁰ <https://ecology.wa.gov/Waste-Toxics/Reducing-toxic-chemicals/Addressing-priority-toxic-chemicals/PFAS>

¹¹ <https://www.epa.gov/pfas/epa-actions-address-pfas>

¹² <https://ecology.wa.gov/Waste-Toxics/Reducing-toxic-chemicals/Addressing-priority-toxic-chemicals/PFAS>

REGULATORY AUTHORITY AND MAJOR CASE LAW

This review is not intended to be exhaustive. It provides a broad overview of the laws and rules under which Ecology has authority to regulate discharges to *waters of the state*.

The Federal Clean Water Act (CWA) 33 U.S.C. §1251 et seq.

The federal CWA, as amended, establishes water quality goals for navigable surface waters of the United States. One of the mechanisms for achieving the goals of the Clean Water Act is the NPDES system of permits, which the United States Environmental Protection Agency (EPA) administers. The EPA has delegated responsibility and authority to administer the NPDES permit program to the State of Washington. In addition to this delegation under the CWA, the state legislature in Revised Code of Washington 90.48 defines Ecology's authority and obligations in administering the NPDES permit program. RCW 90.48.260. Ecology directly implements the Code of Federal Regulations (CFRs) when developing state NPDES permits. Ecology does not have the authority to issue NPDES permits to CAFOs that are federal or tribal facilities (with the exception of some limited areas on Puyallup tribal land).

Chapter 90.48 RCW - The State Water Pollution Control Act

Chapter 90.48 RCW declares that maintaining the highest possible standards to insure purity of all waters of the state is the policy of the State. Healthy water quality must be maintained for public health, public enjoyment, protection of terrestrial and aquatic life, and the industrial development of the state. All known, available, and reasonable methods must be used by industries and others to prevent and control pollution.

In addition, it is unlawful for any person to discharge pollutants to waters of the state (RCW 90.48.080). The only time a discharge is lawful is when a permit to discharge is obtained from Ecology prior to the discharge occurring (RCW 90.48.160).

Chapter 173-226 WAC - Waste Discharge General Permit Program

The purpose of chapter 173-226 WAC is to establish a state general permit program for the discharge of pollutants to waters of the state under the authority granted to Ecology in RCW 90.48. Permits issued under chapter 173-226 WAC may be state waste discharge general permits or combined NPDES and state waste discharge general permits.

Chapter 173-200 WAC - Water Quality Standards for Groundwaters and Chapter 173-201A - WAC Water Quality Standards for Surface Waters

The **water quality standards** for the state of Washington determine **beneficial uses** of waters of the state. Any permits issued must include **effluent limitations** so that allowed discharges meet the water quality standards, including antidegradation.

Concerned Area Residents for the Environment v. Southview Farm, 35 F.3d 114 (2nd Cir. 1994)

Concerned Area Residents for The Environment brought a citizen suit under the CWA against Southview Farm for the discharge of manure without a permit from a CAFO to surface water on five occasions. The Court held:

1. Manure spreading vehicles are **point sources**.
2. A facility is a CAFO, and a point source, if it confines animals for 45 days or more in any 12-month period, and crops, vegetation forage growth, or post-harvest residues are not sustained over the normal growing season on any portion of the area where the animals are confined. Growing crops or forage on another portion of a facility that does not contain confined animals does not change the facilities status from being a CAFO.
3. **Agricultural stormwater** exemption only applies to the discharge of pollutants caused by precipitation, not discharges that occur during precipitation due to other activities.

CARE v. Henry Bosma Dairy, 305 F.3d 943 (9th Cir. 2002)

The Community Association for Restoration of the Environment (CARE) brought a CWA citizen suit against the Henry Bosma Dairy for discharges in violation of its NPDES permit. The Court held that fields where manure is stored and ditches that store or transfer manure, and manure spreading vehicles are part of the CAFO, and therefore part of the point source that makes up a CAFO.

Waterkeeper Alliance, Inc v. EPA, 399F.3d 486 (2nd Cir. 2005)

EPA revised and updated the CAFO regulations in 2001 and issued the final rule in 2003. Several aspects of the 2003 CAFO rule were challenged by the Waterkeeper Alliance. The court vacated three portions of the 2003 CAFO rule. Permitting authorities may no longer:

1. Issue permits without reviewing the terms of the nutrient management plans (NMP),

2. Issue permits that do not include the terms of the NMP as permit terms and provide for public participation (public comment) on the NMP,
3. Require CAFOs to apply for an NPDES permit based on the potential to discharge or otherwise demonstrate that they have no potential to discharge.

National Pork Producers Council, v. EPA: 635 F.3d 738 (5th Cir. 2011)

The NPPC appealed provisions of the 2008 federal CAFO rule (which applies only to surface water). The court held that EPA cannot impose a duty for a CAFO to apply for a permit unless the CAFO is actually discharging (or has discharged), vacating any duty to apply for a CAFO that only “proposes to discharge.” That portion of the 2008 CAFO rule was vacated. CAFOs are only required to apply for a permit if a discharge occurs.

Wash. State Dairy Fed'n v. Dep't of Ecology, 18 Wn. App. 2d 259, 490 P.3d 290 (2021)

Environmental groups and industry groups sought review of the State Pollution Control Hearings Board decision to mostly approved the conditions in the Concentrated Animal Feeding Operation National Pollution Discharge and Elimination System and State Waste Discharge General Permits (permits) issued by Washington State Department of Ecology in 2017. The Court held that:

1. The permits met all known, available, and reasonable methods of prevention, control, and treatment for animal pens and corrals, but not manure lagoons or composting areas.
2. Soil sampling and visual inspections alone were insufficient to ensure compliance in all cases.
3. The Manure Pollution Prevention Plan did not provide the public with the opportunity for review and comment as required by federal regulation.
4. Ecology did not consider the effects of climate change before issuing the permits.
5. The cumulative air temperature standard T-SUM 200 satisfied AKART for Eastern Washington.

LEGAL AND TECHNICAL GROUNDS FOR PERMIT CONDITIONS

The CWA defines “effluent limitation” as any restriction on the quantity, rate, and concentration of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean, including schedules of compliance (33 USC § 1362(11)). Effluent limitations are among the permit conditions and limitations prescribed in NPDES permits issued under Section 402(a) of the CWA (33 USC §1342(a)). Delegated states such as Washington, must meet, at a minimum, the requirements for effluent limits set by EPA; however, they have the option of adopting more stringent requirements.

Effluent limitations in NPDES permits may be expressed as numeric or non-numeric standards. Under EPA’s regulations, non-numeric effluent limits are authorized in lieu of numeric limits, where “[n]umeric effluent limitations are infeasible” 40 CFR 122.44(k)(3). As far back as 1977, courts have recognized that there are circumstances when numeric effluent limitations are infeasible and have held that EPA may issue permits with conditions (e.g., Best Management Practices or “BMPs”) designed to reduce the level of effluent discharges to acceptable levels (Natural Res. Def. Council, Inc. v. Costle, 568 F.2d 1369 (D.C. Cir.1977)).¹³

Through the Agency’s NPDES permit regulations, EPA interpreted the CWA to allow BMPs to take the place of numeric effluent limitations under certain circumstances. 40 C.F.R. §122.44(k), entitled “Establishing limitations, standards, and other permit conditions (applicable to State NPDES programs),” provides that permits may include BMPs to control or abate the discharge of pollutants when: (1) “[a]uthorized under section 402(p) of the CWA for the control of stormwater discharges”; or (2) “[n]umeric effluent limitations are infeasible.” 40 C.F.R. § 122.44(k).

The U.S. Court of Appeals for the Sixth Circuit has held that the CWA does not require the EPA to set numeric limits where such limits are infeasible in *Citizens Coal Council v. United States Environmental Protection Agency*, 447 F.3d 879, 895-96 (6th Cir. 2006). The *Citizens Coal* court cited to *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 502 (2d Cir. 2005), stating “sitespecific BMPs are effluent limitations under the CWA.” “In sum, the EPA’s inclusion of numeric and non-numeric limitations in the guideline for the coal remining subcategory was a reasonable exercise of its authority under the CWA.”

Technology-Based and Water Quality-Based Effluent Limitations

¹³ Where EPA has not issued effluent guidelines for an industry, EPA and State permitting authorities establish effluent limitations for NPDES permits on a case-by-case basis based on their best professional judgment. See 33 U.S.C. § 1342(a)(1); 40 C.F.R. § 125.3(c)(2).

Federal and state regulations require that discharges from existing facilities, at a minimum, meet technology-based effluent limitations reflecting, among other things, the technological capability of Permittees to control pollutants in their discharges that are economically achievable. Specifically, state laws (RCW 90.48.010, 90.52.040 and 90.54.020) require the use of “all known, available and reasonable methods of prevention, control and treatment” (AKART).

Technology-based effluent limitations are in many cases established by EPA in regulations known as effluent limitations guidelines. EPA establishes these regulations for specific industry categories or subcategories after conducting an in-depth analysis of that industry. The ELGs for CAFOs are at 40 CFR 412.

Water quality-based effluent limitations are required by CWA Section 301(b)(1)(C) and in Washington State, are based on compliance with state Surface Water Quality Standards (WAC 173-201A), Groundwater Quality Standards (WAC 173-200), Sediment Quality Standards (WAC 173-204), or the Federal water quality criteria applicable to Washington (40 CFR 131.45).

Between the two types of limits, technology or water quality-based, the most stringent must be chosen for each of the pollutants of concern, and implemented through NPDES permits. (CWA sections 301(a) and (b)).

This permit uses technology-based effluent limitations. Numeric effluent limitations are not feasible for discharges from CAFOs, so Ecology has chosen to use narrative effluent limits. Discharges to surface waters are generally prohibited. When they occur, discharges may be intermittent in flow rate, volume, and levels of pollution. Discharges to groundwater are also dependent on facility design and management, cropping methods, and the local environmental conditions including site specific hydrogeology. Water quality standards for surface water, groundwater, and drinking water serve as limits. Discharges may not cause or contribute to an excursion above these limits.

Meeting Technology-based Effluent Limitations

Federal regulations at 40 CFR 123.36 require state permitting authorities to develop technical standards for nutrient management by CAFOs in their state. The technical standards must be consistent with CAFO effluent limitations guidelines at 40 CFR 412. The technical standards developed by the state must, at minimum, be consistent with the requirements for land application of waste at 40 CFR 412.4(c)(2). To protect water quality, Ecology has included standards for more than just land application of waste in the permit.

State laws (RCW 90.48, 90.52 and 90.54) require the use of ***all known, available, and reasonable methods of prevention, control, and treatment (AKART)*** by commercial and industrial operations to prevent and control the pollution of the waters of the state of Washington. AKART is a technology-based approach to limiting pollutants in discharges the same as BPT, BCT, and BAT. Ecology determined that implementing the technical standards included as permit requirements meet AKART and 40 CFR 123.36. The technical standards

developed by Ecology are included in the permit special conditions and are discussed in the specific condition, or conditions, where implemented.

These requirements are the technical standards that Ecology developed to comply with 40 CFR 123.36 (see the fact sheet sections above).

As part of the application, facilities seeking coverage under the CAFO general permits must prepare a Manure Pollution Prevention Plan (MPPP) that meets the requirements for a Nutrient Management Plan (NMP) found in the EPA CAFO rule. The EPA CAFO rule requires nine minimum practices in the NMP (40 CFR 122.42(e)) and additional requirements, such as depth gauge for liquid waste storage facilities and record keeping (40 CFR 412).

1. Ensure adequate storage of manure, litter, and process wastewater, including procedures to ensure proper operation and maintenance of the storage facilities.
2. Ensure proper management of mortalities (i.e., dead animals) to ensure that they are not disposed of in a liquid manure, storm water, or process wastewater storage or treatment system that is not specifically designed to treat animal mortalities.
3. Ensure that clean water is diverted, as appropriate, from the production area.
4. Prevent direct contact of confined animals with waters of the United States.
5. Ensure that chemicals and other contaminants handled on-site are not disposed of in any manure, litter, process wastewater, or storm water storage or treatment system unless specifically designed to treat such chemicals and other contaminants.
6. Identify appropriate site specific conservation practices to be implemented, including as appropriate buffers or equivalent practices, to control runoff of pollutants to waters of the United States.
7. Identify protocols for appropriate testing of manure, litter, process wastewater, and soil.
8. Establish protocols to land apply manure, litter or process wastewater in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter or process wastewater.
9. Identify specific records that will be maintained to document the implementation and management of the minimum elements described in paragraphs (e)(1)(i) through (e)(1)(viii) of this section.

Ecology was prescriptive in writing the technology-based narrative effluent limitations in this permit to make it clear what Ecology requires in a facility's MPPP. As part of that simplification, in the land application permit condition, Ecology chose the narrative approach to develop a plan. 40 CFR 122.42(e)(5)(i) and (ii) define two approaches to developing a NMP, linear and narrative. In the linear approach, effluent limitations are the rates of application of waste expressed as lbs/N or lbs/P. The narrative approach sets effluent limitations as the process by which a facility calculates its waste application rates in lbs/N or lbs/P.

The draft permit requires that the maximum amount of nutrients that can be applied to a crop be no more than the difference between the nitrogen inputs and outputs as recorded in a field nutrient budget worksheet. This maximum amount of needed nutrients is a technology-based effluent limitation. The Permittee may not exceed this amount for the year.

Meeting Surface Water Quality Standards

In order to protect existing water quality and preserve the designated beneficial uses of Washington's surface waters, WAC 173-201A-510 states that waste discharge permits shall be conditioned such that the discharges authorized will meet the water quality standards. The Washington State Surface Water Quality Standards (Chapter 173-201A WAC) is a state regulation designed to protect the beneficial uses of the surface waters of the state. Surface water quality-based effluent limitations may be based on an individual waste load allocation (WLA) or on a WLA developed during a basin-wide total maximum daily loading study (TMDL).

Numeric water quality criteria at WAC 173-201A specify the levels of pollutants allowed in receiving water to protect drinking water uses, human health, aquatic life, and recreation in and on the water. The standards may be more restrictive if a waterbody has been identified as being polluted (303(d) listed) or if it has had a Total Maximum Daily Load (TMDL) completed for the watershed. EPA has published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State (40 CFR 131.36). These criteria protect people from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters.

Narrative water quality criteria at WAC 173-201A-260 limit toxic, radioactive, or other deleterious material concentrations below those that have the potential to adversely affect designated water uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

Ecology considered the numerical and narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of prevention, control, and treatment (AKART) as described above in the technology-based limits section. Permittees are required to apply AKART, including the preparation and implementation of an adequate Manure Pollution Prevention Plan, and the installation and maintenance of BMPs in accordance with the Plan and the terms and conditions of this permit. Ecology has determined that Permittees in full compliance with the CAFO General Permits meet the state AKART requirements in Chapter 90.48 RCW. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

Meeting Sediment Management Standards

The sediment management standards (**WAC 173-204**) protect aquatic biota and human health. Under these standards, Ecology may require a Permittee to evaluate the potential for the discharge to cause a violation of sediment standards (WAC 173-204-400).

Meeting Groundwater Quality Standards

Similar to the Surface Water Quality Standards discussed above, the Groundwater Quality Standards (WAC 173-200) protect existing and future beneficial uses of groundwater. Permits issued by Ecology must not allow violations of those standards and that all pollutants proposed for entry into groundwater are provided with AKART treatment prior to entry.

Source control and treatment BMPs can eliminate or minimize the contamination of groundwater from CAFO wastewater. However, if Ecology determines that BMPs are ineffective in protecting groundwater quality, Ecology may require the Permittee to implement additional measures to protect groundwater quality or to apply for an individual permit. The permits contain requirements for deep soil monitoring or groundwater monitoring in response to site-specific conditions. The technology and water quality based effluent limitations in the permit ensure that discharges do not cause or contribute to violation of the groundwater quality standards.

Antidegradation

Federal regulations (40 CFR 131.12), the Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A-300, 310, 320, 330) and Water Quality Standards for Groundwaters of the State of Washington (WAC 173-200) establish a water quality antidegradation policy. This section applies only to the combined permit as the state permit does not authorize surface water discharges.

This program establishes three tiers of protection for surface water quality. These three tiers function to 1) protect existing and designated in-stream uses, 2) limit the conditions under which water of a quality higher than the state standards can be degraded, and 3) provide a means to set the very best waters of the state aside from future sources of degradation entirely. WAC 173-201A-320 contains the Tier 2 antidegradation provisions for the state's surface water quality standards.

Washington's Antidegradation Policy also establishes protection for groundwater quality, but it does not require a Tier 2 analysis as the Surface Water Quality Standards do. For groundwater, existing and future beneficial uses must be maintained and protected against degradation that would prevent or interfere with the use of groundwater for a beneficial use. Degradation of groundwater is not allowed in national or state parks, wildlife refuges, or waters of exceptional recreational or ecological existence. If the groundwater is of better quality than the criteria assigned to the waters, the better quality waters must be protected against degradation to the existing background quality. The exception to the better quality water protection is if there is

an overriding public benefit, and any pollutants allowed into better quality waters is provided with AKART.

A Tier 2 analysis is required when new or expanded actions are expected to cause a measurable change in the quality of a receiving water that is of a higher quality than the criterion designated for that waterbody in the water quality standards (WAC 173-201A-320(1)). WAC 173-201A-320(3) defines a measureable change as specific reductions in water quality, and defines “new or expanded actions” as “human actions that occur or are regulated for the first time, or human actions expanded such that they result in an increase in pollution, after July 1, 2003.” This definition includes facilities that first began to discharge waste, or increased the discharge of waste, after July 1, 2003. The definition also applies to those facilities that discharged waste prior to July 1, 2003, but were regulated by Ecology for the first time after July 1, 2003. All **applicants** for coverage under the CAFO permit have “the potential to cause a measurable change in the physical, chemical, or biological quality of a waterbody” and meet the definition of a “new or expanded action.” Therefore, Ecology has prepared this Antidegradation Plan during the development process to comply with the Tier 2 antidegradation rule (WAC 173-201A-320).

WAC 173-201A-320(6) states that “the antidegradation requirements of this section can be considered met for general permits and programs that have a formal process to select, develop, adopt, and refine control practices for protecting water quality and meeting the intent of this WAC section. This adaptive process must:

1. Ensure that information is developed and used expeditiously to revise permit or program requirements.
2. Review and refine management and control programs in cycles not to exceed five years or the period of permit reissuance.
3. Include a plan that describes how information will be obtained and used to ensure full compliance with this chapter. The plan must be developed and documented in advance of permit or program approval under this section.

Antidegradation Analysis and Plan

Ecology prepared the Tier 2 antidegradation plan even though implementation of the permit requirements lead CAFOs to eliminate discharges during their normal operations. Not discharging is the best way to prevent degradation of water quality. The water quality standards at WAC 173-201A-320(6) describe how Ecology should conduct an antidegradation Tier II analysis when it issues NPDES general permits. In preparing the draft permits, Ecology met the requirements of each section:

1. Use the information collected, from implementation of the permit, to revise the permit or program requirements.

- Ecology revised the proposed permit based on written and verbal feedback from permittees, parties affected by the permit, internal staff, and government agencies about what was working well and what was not. Ecology also maintained notes about comments received over the life of the permit and used these for reference when developing the proposed permit. Ecology will further revise the draft permit based on a formal public comment period (6 weeks) and testimony received at two planned public hearings.
 - Ecology reviewed technical literature and consulted staff experts in pollution control and monitoring.
2. Review and refine management and control programs in cycles not to exceed five years or the period of permit reissuance.
- Ecology was on track to meet the five-year reissuance cycle for the CAFO permit. In June 2021, when the Washington Court of Appeals issued their decision on the appeal of the current permit, Ecology revised the reissuance schedule. Between July 2021 and today, Ecology worked to align the permits with the Court's decision. The current permits issued in 2017 expired in March 2022. Ecology plans to reissue them by the end of 2022. Permit reissuance includes a public involvement process as described in Appendix C.
 - Ecology will spend about two and a half years soliciting input from users and affected parties, rewriting and revising permit conditions, and reviewing relevant data before going out for public comment on the permit and accompanying documents and finalizing the proposed new version of the permit.
3. Include a plan that describes how Ecology will obtain and use information to ensure full compliance with water quality standards. Ecology must develop and document the plan in advance of permit or program approval.
- The information in this factsheet and in the antidegradation section of this factsheet constitute Ecology's antidegradation plan for the CAFO General Permit.
 - Ecology prohibits the further impairment of 303(d)-listed waterbodies in this proposed permit. The conditionally authorized discharges must not contain the pollutant or pollutants for which the waterbody is listed as impaired. Where a waterbody has an approved Total Maximum Daily Load (TMDL), the discharges conditionally authorized by this permit must not exceed wasteload established in the TMDL. Where no wasteload was allocated for the permitted facility, any authorized discharged must not contain the pollutant or pollutants for which the waterbody is listed as impaired.

Meeting Beneficial Use Definition

Federal and State solid waste regulations, in the Resource Conservation and Recovery Act (RCRA 42 U.S.C. §§ 6901-6992k) and the state Solid Waste Management statute (RCW 70A.205), concern discarded materials. Agricultural wastes, including manure, are not discarded materials when returned to the soil as fertilizer.

The manure land applied by a CAFO in compliance with the CAFO General Permits does not meet the definition of a discarded material or solid waste under RCRA. This is because land applied manure is a nutrient source (fertilizer) for crop growth, and is therefore put to beneficial use and not discarded. Permit conditions that limit the use of manure to its beneficial use include, but are not limited to:

- Developing a field-specific nutrient budget every year (condition S4.J.1)
- Applying only the amount of nutrients estimated in the budget (condition S4.J.3.a)
- Restricting applications during high risk of transport periods (condition S4.J.3.d)

If a permitted CAFO treats the manure as discarded material (e.g., applies manure that exceeds normal agronomic rates), then the operation is in violation of the terms of the CAFO General Permits. If land application becomes disposal, then a solid waste handling permit is required. However, that permit would not allow for an application of manure beyond the agronomic need of the crop.

As directed by RCW 70A.205.025, Ecology adopts standards for solid waste facilities, while local jurisdictional health departments (county, regional, or local health departments or districts) have primary oversight of solid waste facilities and issue permits and enforce the standards. As allowed by RCW 70A.205.275, the local health departments may defer to another permit like the State Waste Discharge permit if it provides a comparable level of protection as a solid waste handling permit.

SEPA COMPLIANCE

Ecology's Duty to Comply

State law exempts the issuance, reissuance, or modification of any wastewater discharge permit from the State Environmental Policy Act (SEPA) process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383 and WAC 197-11-855). This proposed reissued general permit does not (a) Add to the covered area, which is the entire State of Washington; (b) Add to the type of facilities that must be covered; (c) Allow the discharge of additional pollutants; and (d) Contain conditions less stringent than the applicable federal and state rules and regulations.

This is a reissuance of existing general permits. The draft permits are at least as stringent as the version of the permits which expired in March 2022. However, Ecology did not file the initial SEPA documents from the first issuance of the general permit in 2000. As part of this reissuance, Ecology prepared a SEPA checklist for the authorized discharges associated with manure, litter, process wastewater, and other organic by-product from CAFO production areas and land application fields. We determined that the proposed draft permits will not have a probable significant adverse impact on the environment. The checklist and determination of non-significance can be found at the [Statewide SEPA Register](#)¹⁴.

Permittee's Duty to Comply

New operations must demonstrate compliance with the State Environmental Policy Act (SEPA, Chapter 43.21C RCW) before Ecology can authorize permit coverage. A modification of permit coverage for physical alterations, modifications, or additions to the CAFO operations also requires certification of SEPA compliance, if it results in an increase in volume of wastes or change in character of effluent is requested over that previously authorized. WAC 173-226-200(3)f(II).

Reduce and Prepare for Climate Impacts

Ecology is preparing for the future by understanding and reducing the effects of climate change. Through several efforts we will reduce greenhouse gas emissions and prevent and remediate negative impacts.

In 2021, the Washington Legislature passed the [Climate Commitment Act](#)¹⁵ (or CCA) which establishes a comprehensive program to reduce carbon pollution and achieve the greenhouse gas limits set in state law. The Climate Commitment Act (CCA) caps and reduces greenhouse gas emissions from the state's largest emitting sources and industries. CAFOs are not required to

¹⁴ <https://apps.ecology.wa.gov/separ/Main/SEPA/Search.aspx>

¹⁵ <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65>

report emissions - the legislative omitted manure management from reporting under the CCA. Facilities that are required to report their emissions will receive caps. They can trade emissions with others or conduct/fund offset actions outside of the program that result in GHG reductions. This may be the most common place where CAFOs participate in the CCA. In addition to the cap and invest program, the CCA expands [air quality monitoring](#)¹⁶ in overburdened communities. Ecology is currently in the process of developing criteria for identifying overburdened communities. We will be publishing a draft for public comment summer 2022.

Ecology publishes an inventory of Washington's greenhouse gases every two years, measuring the state's progress in reducing greenhouse gases compared to a 1990 baseline. This inventory helps us design policies to reduce greenhouse gas emissions and track progress toward meeting the state's reduction limits. The most recent inventory was published in Jan 2021 for the emissions period 1990-2018 (publication 20-02-020). In this most recent report, agricultural activities such as manure management, fertilizer use, and livestock digestion processes (enteric fermentation) result in methane and nitrous oxide emissions. In 2018, these agricultural emissions accounted for about 6.7 percent of Washington's total greenhouse gas emissions. In this emissions report, manure management refers to the collection and storage of manure. It does not include applying the manure to land as fertilizer.

Agriculture, in general, has an opportunity to play a significant role in reducing the climate warming gas nitrous oxide. According to EPA's most recent GHG inventory report published in April 2022, the agricultural sector as a whole contributes 9.9% to the US GHG emissions. Of that 9.9%, most (74.2%) is nitrous oxide. This potent greenhouse gas comes from fertilizer application and increased nitrogen availability in the soil. One key goal of the CAFO general permits is to ensure manure is applied to soils where plants will utilize the nutrients and the build up of nitrogen is prevented. Prohibiting nutrient applications when the field is saturated means less nitrogen is available to denitrifying soil bacteria at times when they're most likely to produce nitrous oxide. For an in depth explanation of nitrous oxide production in agricultural soil management, see Chapter 5 of EPA's most recent [Greenhouse Gas Inventory Report](#)¹⁷.

Methane is emitted when waste is stored in anaerobic conditions. Many facilities choose to compost rather than stockpile solid manures. Composting introduces oxygen and therefore reduces the amount of methane produced. In addition to the environmental benefits, composted manure is a better fertilizer source for crops than uncomposted solid manure. Methane is also a by-product of enteric fermentation and makes up the largest fraction of methane emissions in agriculture. Ecology supports the use of approaches to reduce enteric fermentation, but it is outside the scope of this permit - instead we focus on manure management.

¹⁶ <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Air-quality-monitoring-network>

¹⁷ <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>

DISCLOSURE OF BUSINESS INFORMATION

By law, information that is required to be submitted to Ecology by a permit is available to the public. This is necessary because it allows the public to determine if a facility is in compliance with its permit. Certain exceptions apply.

RCWs 42.56.610 and 90.64.190 require that certain information for dairies, feedlots, AFOs, and CAFOs not subject to or applying for permit be kept only be released in ranges. Once a facility obtains permit coverage under the state permit or combined permit, this exemption from release of records no longer applies to that facility. For a facility under the combined permit, all records and information must be released. For a facility under the state permit, in response to a public disclosure request, the information specified in RCW's 42.56.610 and 90.64.190 is to be released in the ranges identified in WAC 16-06-210. The information these requirement affect includes:

- Number of animals.
- Volume of livestock nutrients (manure) generated.
- Number of acres used for land application (of manure).
- Amount of livestock nutrients transferred to other persons.
- Crop yields.

Other information is exempt from disclosure under RCW 42.56.380. This information is generally business-related such as import/export, veterinary, sales, or other financial information. Unless related to facility effluent, neither the state permit nor combined permit ask for this type of information.

Confidential Business Information

Confidential business information may be requested for certain types of information under RCW 43.21A.160. Confidentiality does not extend to discharges or to information which would be detrimental to the public interest if withheld.

The information gathered as part of the state permit and combined permit is necessary to determine compliance with permit conditions. It is also related to the management of the effluent (manure, litter, process wastewater) generated by a facility covered by permit. Withholding such information would be detrimental to the public interest. Because of this, the information required to be submitted to Ecology by either the permit or the permit application is not confidential business information.

ECONOMIC IMPACT ANALYSIS

Ecology's State Waste Discharge General Permit Program rule (WAC 173-226-120) requires an economic impact analysis (EIA) of any draft wastewater general permit intended to directly cover small businesses. The analysis is required to serve the following purposes:

- A brief description of the compliance requirements of the draft general permit.
- The estimated costs for complying with the permit, based on existing data for facilities to be covered under the general permit.
- A comparison, to the greatest extent possible, of the cost of compliance for small businesses with the cost of compliance for the largest ten percent of the facilities to be covered under the general permit.
- A discussion of what mitigation the permit provides to reduce the effect on small businesses (if a disproportionate impact is expected), without compromising the mandated intent of the permit.

RCW 19.85.020(4) defines a small business as any business entity, including a sole proprietorship, corporation, partnership, or other legal entity, that is owned and operated independently from all other businesses, and that has fifty or fewer employees.

The 2017 EIA determined the general permit had a disproportionate impact on small business. To mitigate the burden on the smallest businesses (small CAFOs), Ecology included a lower threshold for CAFOs that require a permit. Only when Ecology determine a small CAFO is a significant contributor of pollutants will the small business be required to get a permit.

The 2022 EIA again determined the general permit has a disproportionate impact on small business, but there were no opportunities for mitigation. The conditions in the permit are intended to help CAFOs meet legal requirements that protect the state's surface and ground waters from unpermitted discharges and contamination (chapter 90.48 RCW, chapter 173-201A WAC, chapter 173-200 WAC).

SPECIAL CONDITIONS

S1 PERMIT COVERAGE

The draft CAFO permits are statewide permits that provide coverage for discharges associated with operations that confine and feed animals within the State of Washington. A facility is a CAFO, and a point source, if it confines animals for 45 days or more in any 12-month period, and crops, vegetation forage growth, or post-harvest residues are not sustained over the normal growing season on any portion of the area where the animals are confined. Growing crops or forage on another portion of a facility that does not contain confined animals does not change the facilities status from being a CAFO.

Ecology has chosen to use herd size to distinguish which facilities are required to obtain a permit. Medium and Large CAFOs that discharge to waters of the state are required to obtain a permit. Small facilities that discharge pollutants to waters of the state are assessed using factors from Federal CAFO regulations (40 CFR 122.23(c)(2)) that determine if the facility is a significant contributor of pollutants (SCOP) to surface water or groundwater. If Ecology's determination concludes that the facility is a SCOP, Ecology notifies them of the need to obtain coverage via technical assistance letter. Table 2 in the permit lists the size threshold for small CAFOs by animal type. Details on who must apply for permit coverage is in the next section, S2 Permit Administration.

A. Facilities Required to Seek Coverage under This General Permit

This condition specifies who is required to apply for permit coverage and when. Facilities defined as a medium or large CAFO that discharge to surface or groundwaters are required to apply for permit coverage. Medium and large CAFOs are defined by animal herd size in Table 2 in the permits. Ecology conducts a significant contributor of pollutants analysis before requiring small CAFOs to apply for permit coverage, on a case by case basis. Facility operators or owners in charge of CAFO operations are the person(s) required to apply for permit coverage.

Section 402 of the CWA (33 USC § 1251) requires that a NPDES permit be issued for the discharge of pollutants surface waters. Discharges to surface waters, even if the facility is otherwise constructed and operated as specified in 40 CFR § 412, require the owner or operator of the facility to apply for coverage under the combined CAFO permit.

RCW 90.48.160 requires a commercial or industrial operation of any type which results in the disposal of solid or liquid waste material into the waters of the state (surface or ground), to procure a permit prior to discharge. For purposes of this code, CAFO production areas, waste storage facilities, and land application fields are commercial and industrial operations.

The following sections present special discharge cases that Ecology has found need greater discussion and clarification.

Surface Water Discharges from Land Application Fields

Discharges to surface water from land application fields requires the owner or operator of a facility to apply for coverage under the combined permit. The federal CWA exempts certain precipitation-related discharges from needing an NPDES permit; however, state law at RCW 90.48 does not include the same exemptions, requiring a permit for any commercial or industrial operation discharging solid or liquid waste to waters of the state. In implementing the permits, Ecology and WSDA found most discharges from land application fields were the result of poor management decisions and caused an exceedance of water quality criteria. Ecology cautions operators that the federal exemption that applies only under specific conditions to facilities covered by the federal permit is a limited exemption and CAFOs are still prohibited from discharging to surface waters under RCW 90.48.080.

The federal CWA exempts agricultural stormwater from the definition of a point source discharge of pollution. In federal CAFO rules, agricultural stormwater is defined as : “Where manure, litter or process wastewater has been applied in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter or process wastewater, as specified in 40 CFR 122.42(e)(1)(vi-ix), a precipitation related discharge or manure, litter, or process wastewater from land areas under the control of a CAFO is an agricultural stormwater discharge” (40 CFR § 122.23(e)).

If all the following are true, then a precipitation related surface water discharge from a land application field is agricultural stormwater and does not violate a NPDES permit (combined permit):

1. The discharge was generated by precipitation,
2. The discharge was not from the production area,
3. The discharge was not caused by human activities (e.g. land application, irrigation) even if the activity took place during precipitation, and
4. The CAFO was operating in accordance with their site-specific nutrient management plan and maintains records demonstrating compliance.

State waste discharge permit rules excludes irrigation return flows, but not agricultural stormwater, in the definition of point source (WAC 173-226-030). Further, State law regarding nutrient management on dairies (90.64.010 RCW) considers a dairy in violation unless a dairy producer “has complied with all of the elements of a dairy nutrient management plan that: Prevents the discharge of pollutants to waters of the state, is commensurate with the dairy producer's current herd size, and is approved and certified under RCW 90.64.026.” Not all violations of 90.64 RCW will be discharges to waters of the state, but if a dairy’s violation includes a discharge, the operators or owner will be required to apply for permit coverage. Further, discharges of waste materials from the production area, whether caused by

environmental conditions or human activities, require the owner or operator of the facility to apply for coverage under the combined permit.

In the case of agricultural stormwater on unpermitted CAFOs, State law is more stringent than the Federal rule. Thus, all stormwater discharges of waste material from an unpermitted CAFO in Washington are a violation of RCW 90.48. A discharge that meets the definition of agricultural stormwater, however, does not automatically trigger a requirement to apply for combined permit coverage.

Groundwater Discharges from Waste Storage Structures

Liquid waste storage on CAFOs has the potential to impact groundwater if the containment structure is not properly designed or maintained. In developing the previous permit, Ecology established three cases where waste storage structures are not considered discharges to groundwater requiring a permit. An owner or operator of a CAFO is not required to apply for coverage under these permits if the waste storage structure is:

- a. Not discharging to groundwater, or
- b. Constructed with a double-layer synthetic liner with a leak detection and capture system between the liner layers, or
- c. An above-ground structure constructed of concrete or steel.

Ecology identified these three cases because waste storage ponds or manure lagoons all have a seepage rate based upon the structure's permeability. The amount and quality of the liquid waste escaping the storage pond is dependent on the engineering properties of the materials used to construct the storage pond, as well as the continual operation and maintenance of the structure.

Several waste storage structures, such as those with two layer synthetic liners, leak detection and a capture system between the layers, synthetic liner over clay (GCL), steel or concrete lining will have a very low seepage rate. Given the low risk, Ecology's Water Quality Program has determined that a waste storage pond with a two layer synthetic liner with leak detection and capture between the layers is not required to obtain a permit for groundwater discharge. The other liner types listed (concrete or steel) are low risk structures that when in good condition are not expected to seep or discharge pollutants to groundwater.

In developing the previous permit, Ecology identified a number of risk factors that if present, would lead Ecology to believe based on a predominance of the evidence that a waste storage pond is discharging to groundwater. If the risk factors are present based on the facility owner or operators assessment (or their technical service provider), they have a discharge to groundwater and must apply for coverage under the state permit.

There are two sets of risk factors to consider when determining if, based on a predominance of the evidence if a waste storage pond is discharging to groundwater. These risk categories are the seepage from the pond itself, i.e. the quantity of seepage, and the time of travel to

groundwater. Preferential flow paths (such as cracks in clay pond liners due to repeated dry/wet cycles) are acknowledged here, but because they can vary greatly are not quantified.

Seepage from a waste storage pond, assuming no preferential flow paths, is calculated using Darcy's Law and will vary according to the materials used to construct the waste storage pond as well as the operation and maintenance of the pond. Assuming steady state conditions, the amount of seepage will vary based on head (depth of liquid, which varies), soils, compaction, and permeability. Conditions that allow greater seepage will increase the risk of discharge.

The time of travel (TOT) from the bottom of the waste storage pond to groundwater is dependent on many environmental factors. Put simply the TOT is the time it takes for a drop of water to move from the point just under the pond to the point it reaches the first groundwater below the pond. Again, this assumes steady state conditions. The TOT is dependent on the environmental conditions when the waste storage pond was built. Some conditions such as highly porous soils and seasonally high groundwater will generate a higher risk for discharge to groundwater than high clay soils and a very deep distance to groundwater.

If the risk factors indicate there is a discharge to groundwater based on a preponderance of evidence, the facility operator has the option of demonstrating there is no discharge to groundwater through a study designed to determine if there is a discharge from the waste storage pond. The study must be designed and verified by a licensed hydrogeologist with experience performing this type of work (RCW 18.220 and WAC 308-15). If the study determines there is a discharge to groundwater, the owner or operator of the facility must apply for coverage under the state permit.

Additional factors that Ecology may consider when determining based on a preponderance of the evidence if there is a discharge from a CAFO's waste storage pond to groundwater include, but are not limited to:

1. Results from an assessment of the waste storage pond conducted by licensed engineer, such as NRCS Engineering Technical Note 23 – Assessment Procedure for Existing Waste Storage Ponds.
2. Type of construction, e.g. above ground storage tank, in ground pit, earthen embankments.
3. Permeability of the structure walls, base, and liner (e.g. synthetic or clay) if present.
4. The depth of liquid in the waste storage pond when full and seasonal variations.
5. How long the waste storage pond is full, empty, or in-between.
6. Any additional sealing of the structure or liner pores provided by manure.
7. Operations and maintenance of structure that may have altered the physical characteristics of the structure or liner (e.g. maintenance removes sealing of liner pores by manure).
8. Age of the structure.

9. Permeability of the soils and presences of tile drainage below the structure.
10. Depth to groundwater.
11. Preferential flow paths (e.g. cracks, scoured areas, liner punctures).

Groundwater Discharges from Land Application Fields

Land application fields where manure, litter, and process wastewater are applied as crop nutrients can discharge pollutants to groundwater and be a source of groundwater pollution. When sources of nutrients are excessively applied to the field beyond the amounts for optimal crop growth, the land application activity is considered a discharge of waste to ground. Excess nitrate in the soil profile may travel beyond the crop's root zone and result in a discharge to groundwater. Discharge of waste to ground and discharges to groundwater require permitting in Washington.

Application of nutrients in excess of crop nutrient requirements creates a substantial potential to pollute groundwater. CAFOs that pollute groundwater through over application of manure, litter, process wastewater or other organic by-products and do not have a requirement to obtain a solid waste handling permit are required to apply for state-only permit.

Some operations may be required to obtain a solid waste handling permit from the solid waste permitting authority (local health departments). However, as allowed by RCW 70.95.310, a local health departments may defer to another permit if it addresses the same sources of discharge to ground that a solid waste handling permit would. The other permit needs to have at least the same level of protection provided by a solid waste handling permit. Should an owner or operator of a facility be in a situation where excess nutrients were applied to land application fields and a solid waste handling permit is required, an option is for the local health department to defer to the state only permit. This would cover the facility for both solid waste handling purposes as well as discharges to groundwater under chapter 90.48 RCW.

Case by Case Permitting of Small CAFOs

Small CAFOs, as defined in Table 2 in the permit, with discharges to surface or groundwater may require permitting on a case by case basis. In order require a small facility to obtain a CAFO permit (state or combined), Ecology must assess whether the small facility is a significant contributor of pollutants to surface or groundwater and designate it a small CAFO, and notify the operator of the need to submit an application via technical assistance letter. The significant contributor analysis usually involves an inspection, sampling, and collection of facts regarding the amount of manure, litter, or process wastewater reaching surface water or groundwater, depth to groundwater, facility location relative to surface waters, how manure, litter, or process wastewater are conveyed to surface water, landscape factors affecting frequency and likelihood of discharge, and other relevant factors. These significant contributor factors come from EPA's regulations at 40 CFR § 122.23(c).

Proposed Revisions

Ecology is proposing to move the text in permit condition from S2.A to S1.A and modifying Table 2. Ecology found that interested parties were confused by having the requirements to obtain a permit split between two sections – previously S1 and S2.A. Ecology moved the text from S2.A and created a new section in S1. Additionally, Ecology clarified the requirements embedded in Table 2 in the previous permit by removing them from the table and placing it in the body of the permit text. These changes do not change the requirements for facilities that must obtain permit coverage.

B. Activities Covered Under This Permit

S1.A authorizes the discharge of pollutants from two defined areas on a CAFO—the production area and the land application fields—under very limited circumstances. Activities on other areas of the facility (e.g. pastures with sustained vegetated growth) are required to comply with state water pollution control law prohibiting the discharge of pollution to water (RCW 90.48.080). Ecology chose not to include these areas under the CAFO general permits as they do not meet the definition of areas that are part of a CAFO. Special Condition S3 describes in detail the conditionally authorized discharges from each area on the facility and in certain watersheds.

Section 402 of the CWA (33 USC § 1342) requires that a NPDES permit be issued for the discharge of pollutants to waters of the United States. Chapter 90.48 RCW also requires a state waste discharge permit for any form of commercial or industrial operation discharging solid or liquid waste material to waters of the state (surface or groundwater). As the delegated CWA authority in Washington, Ecology issues combined permits which authorize discharges to surface and groundwater under both state and federal authority.

Authorized Discharges in the State-only Permit

The state-only permit authorizes discharges to groundwater only. Groundwater means all underground waters within the jurisdiction of the state of Washington (RCW 90.48.020, WAC 173-200-020 and WAC 173-226-030). Surface water discharges authorized in the Combined permit, for example, discharges resulting from extreme storm events, are not authorized in the State-only permit. See S3 Discharge Limits for details.

Authorized Discharges in the Combined Permit

The Combined permit authorizes certain discharges to surface and groundwaters. Surface waters include lakes, rivers, ponds, streams, inland waters, wetlands, brackish waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington (RCW 90.48.020, WAC 173-201A-020 and WAC 173-226-030). Groundwaters are all underground waters within the jurisdiction of the state of Washington (RCW 90.48.020, WAC 173-200-020 and WAC 173-226-030). See S3 Discharge Limits for details.

Proposed Revisions

Ecology is proposing to remove the statement “All conditionally authorized discharges and activities must be consistent with the terms and conditions of this permit” because it is contained in general condition 1.

C. Geographic Area Covered

The permits provide coverage for discharges of waste material (manure, litter, process wastewater) from CAFOs within the State of Washington where Ecology has permitting authority (chapter 90.48 RCW).

Ecology does not have permitting authority for discharges from federal operators or tribal lands except for a portion of Puyallup Tribal land under the Puyallup Tribe of Indians Land Claims Settlement Act of 1989, 25 USC § 1773.

Some conditions in the permit apply differently in certain parts of the State. Special Condition S4 requires different soil sampling and adaptive management actions based on the climate where the facility operates.

Proposed Revision

Ecology is proposing to add a clarification to this special condition to indicate that some requirements in this permit differ based on the location of the CAFO. The previous CAFO permits covered regionally different requirements in S4. The draft CAFO permits do not alter that framework, but highlight the regional difference in pollution prevention requirements at the top of the permit document. Ecology believes this will make it clearer that there are conditions in the permit that vary by climate.

S2 PERMIT ADMINISTRATION

Special Condition S2 concerns the administrative tasks in applying for permit coverage, issuing coverage, modifying coverage, transferring coverage, and terminating coverage based on 40 CFR 122, Chapter 173-226 WAC, and relevant case law.

A. How to Apply for Permit Coverage

Unpermitted CAFOs seeking coverage under the CAFO general permits must submit a **permit application (Notice of Intent or NOI)** and a Manure Pollution Prevention Plan (MPPP) to Ecology at least 60 days before any discharge to waters of the state occur (RCW 90.48.170).

A copy of the permit application form is available from [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)¹⁸. The information required in the form comes from 40 CFR 122.21(i). Unpermitted CAFOs are required in 40 CFR 122.21(i) to submit site-specific nutrient management plans as part of the application for coverage. The nutrient management plans must at a minimum satisfy the requirements in 40 CFR 122.42(e) and 40 CFR 412, as applicable.

An official who has signature authority for the entity applying for permit coverage must sign all documents (WAC 173-226-200).

Special Procedures for Applications for the State-only Permit

Existing facilities: Applications for facilities built and operating before the issuance date of the CAFO permits are not required to public notice their permit application.

New facilities: Applicants who build a new facility and begin operation after the issuance date of the CAFO permits must publish a public notice of their application for permit coverage. Ecology must receive the complete application for permit coverage on or before the first publication date of the public notice the permit applicant posts in a newspaper of general circulation within the county in which the discharge is proposed (WAC 173-226-130(5)).

The public has the opportunity to comment on the permit application, MPPP, and the proposed coverage during the 30 days after publication of the second public notice (public comment period). Ecology will consider comments during this period. If Ecology receives no substantive comments, it may issue permit coverage on the 38th day (at the earliest) following receipt of a complete application. The public has the right to appeal coverage decisions (WAC 173-226-190).

¹⁸ <https://ecology.wa.gov/cafo>

Special Procedures for Applications to the Combined Permit

All combined permit applicants, whether they are new or existing facilities, must public notice their permit application (Ecology must receive the complete application for permit coverage on or before the second publication date of the public notice the permit applicant posts in a newspaper of general circulation (WAC 173-226-130). Ecology considers a newspaper of general circulation to be a major newspaper publication for a region.

The public has the opportunity to comment on the permit application and the proposed coverage during the 30 days after publication of the second public notice (public comment period). Ecology will consider comments about the applicability or nonapplicability of the permit to the proposed activity received during this period. If Ecology receives no substantive comments, it may issue permit coverage on the 38th day (at the earliest) following receipt of a complete application. The public has the right to appeal coverage decisions (WAC 173-226-190).

Proposed Revision

In response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021), Ecology changed the process for applying for coverage under the CAFO general permits. Applications for coverage must include both the notice of intent form, discussed above and a site-specific MPPP. The documents must be submitted to Ecology for review and a preliminary determination of the application's completeness. When Ecology notifies the applicant that their application is complete, the applicant will publish public notice, if required by WAC 173-226-130(5).

Ecology is also proposing to require electronic NOIs unless a Permittee obtains a waiver. The requirement for electronic submittal makes progress with Ecology's obligation to comply with EPA's NPDES Electronic Reporting Rule (40 CFR Parts 122, 123, 127, 403, 501 and 503). RCW 43.17.095 also requires Ecology to offer electronic reporting options.

This proposed electronic NOI is expected to save time and resources for permittees and Ecology (e.g., eliminating paperwork, data entry workload, database errors) while improving compliance and protection of water quality. It will also enhance transparency and public accountability.

The electronic reporting waiver provisions are intended to allow a paper option for small business that may not have the ability to use the Water Quality Web Portal system (e.g. they do not have broadband internet or a business computer). The permit contains mailing instructions for permittees who receive a waiver.

Electronic NOIs are submitted through [Ecology's Water Quality Permitting Portal](#)¹⁹.

¹⁹ <https://secureaccess.wa.gov/ecy/wqwebportal>

B. Permit Coverage Timeline

Ecology is not proposing changes to S2.C.

The section describes how Ecology is implementing WAC 173-226-200 in the permit so that the applicant for permit coverage can know what to expect when applying for permit coverage.

C. How to Transfer Permit Coverage

State waste discharge rules (WAC 173-226-210) provide for transfers of permit coverage from one party to another:

WAC 173-226-210

Transfer of permit coverage.

Coverage under a general permit is automatically transferred to a new discharger if:

(1) A written, signed agreement between the old and new discharger containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to the director; and

(2) The director does not notify the old and new discharger of the director's intent to revoke coverage under the general permit. If this notice is not given, the transfer is effective on the date specified in the agreement mentioned in subsection (1) of this section.

This would generally only occur when another party buys a permitted CAFO facility. To complete the permit coverage transfer, both the current permittee and new permittee must sign a *Transfer of Coverage Form* provided by Ecology. The transfer of coverage is complete once the form is signed by both parties. The new party then becomes the Permittee and accepts all permit responsibility and liability, including permit fees.

The Transfer of Coverage Form is available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)²⁰. This form is not available through Ecology's Water Quality Permitting Portal.

Proposed Revisions

Ecology is proposing to clarify in the draft permits that transfer of permit coverage procedure may only be used when the waste management system does not change significantly. This ensures that permittees are in compliance with the Manure Pollution Prevention Plan modification requirements in special condition S4.A.

D. How to Terminate Permit Coverage

²⁰ <https://ecology.wa.gov/cafo>

As long as a permitted CAFO operation is discharging waste materials to waters of the state, the operation is required to have a permit (RCW 90.48.160). Permit coverage may be terminated only if the permittee demonstrates that the CAFO no longer has a discharge. The permits outline four conditions for permit termination. The conditions are based on WAC 173-226-240 and [Oregon's CAFO permit](#)²¹. At least one condition needs to be met to be considered eligible for permit coverage termination. All conditions require there to be no discharge from the CAFO. Requiring that there is no longer a discharge ensures that facilities that discharge remain covered under permit (WAC 173-226-230; 40 CFR § 122.64(b)).

When a permittee requests termination of their permit coverage, Ecology will request WSDA to perform a permit cancellation inspection. WSDA will complete a permit cancellation inspection for permitted CAFOs within 30 days of a request by Ecology and provide a recommendation for appropriate action Ecology will act on WSDA recommendations. This process is outlined in our 2011 "[Memorandum of Understanding between the Washington State Department of Agriculture and the Washington State Department of Ecology](#)"²².

Proposed Revisions

Ecology is proposing to include a procedure for when a Permittee requests termination of their permit coverage, but the information necessary for Ecology to make a termination decision is missing. This proposed revision will also allow Ecology more time to schedule an inspection, review records for compliance, and ensure that the facility has no discharge to waters of the state is therefore eligible for termination of permit coverage.

E. How to Renew Permit Coverage

General permits are typically revised every five (5) years. In order to continue their coverage under the revised general permit and comply with "Duty to Reapply" requirements in state and federal code, Permittees must submit a renewal application to Ecology at least one hundred eighty (180) days before the current version of the general permit expires (40 CFR §122.21(d), 40 CFR §122.41(b), and WAC 183-220-180(2)). Ecology typically notifies permittees of reapplication deadlines well in advance of the deadline, but permittees should not rely on this courtesy reminder. Coverage under an expired general permit for Permittees who fail to submit a timely and sufficient application will expire on the expiration date of the general permit. Ecology will consider any Permittee that does not reapply for coverage as a **new applicant**.

Proposed Revisions

General Condition G17 Duty to Reapply is a requirement in all NPDES and SWD permits. Ecology added this section to clarify that CAFO permittees renewing their coverage are only required to

²¹ <https://www.oregon.gov/oda/programs/naturalresources/pages/cafo.aspx>

²² <https://ecology.wa.gov/DOE/files/6f/6f30de07-feb0-463a-958e-cf48df3a43bf.pdf>

submit an NOI. If the Permittee is making changes to their MPPP, they must follow procedures for revised MPPPs in special condition S4.A.4 Update of the MPPP.

S3 DISCHARGE LIMITS

Discharge limits are amounts of discharge whether volume, concentration, or frequency that must not be exceeded. Several permit conditions are designed to prevent Permittees from exceeding discharge limits and thus, violating water quality standards. The CAFO permits use technology-based requirements for preventing and controlling discharges. In the state and combined permits, technology-based requirements include the implementation of AKART and BMPs. Implementation of AKART prior to discharge is required by:

- RCW 90.48.010
- RCW 90.54.020(3)(b)
- RCW 90.54.040
- RCW 90.54.520
- WAC 173-221A-020
- WAC 173-226-070(1)

Water quality based effluent limits require the authorized discharges from a CAFO must not cause or contribute to an exceedance of – i.e. the discharge may not cause a measured water quality parameter to increase to a level above that set in the water quality standards. See also the sections listed below for more discussion on the various water quality standards:

- Chapter 173-201A WAC Water quality standards for surface waters of the state of Washington
- Chapter 173-200 WAC Water quality standards for groundwaters of the state of Washington

The discharges authorized by a permit are also permit limits. Discharges that are not authorized by the permit are considered a permit violation. The Permittee must ensure that any discharges are limited to only those allowed by permit.

A. Limits Based on Total Maximum Daily Loads

Ecology publishes Total Maximum Daily Load (TMDL) reports for some impaired waterbodies. These loading reports may establish wasteload allocations that are used to derive effluent limits on on point source discharges in the TMDL area (e.g., watershed, basin, sub-basin, etc.). When an applicable TMDL establishes a waste load allocation for a permitted CAFO (or CAFOs), all discharges must be consistent with the allocation. To achieve this, permittees may need to consider additional BMPs or technologies appropriate for the pollutants of concern. Examples include implementing additional best management practices or exporting manure outside of the watershed or to an anaerobic digester.

Where a facility discharges to a waterbody with an approved TMDL, Ecology will notify Permittees in writing of any additional limits or controls necessary to meet any waste load

allocation. This notification will come when Ecology grants permit coverage. For purposes of this requirement, an applicable TMDL means final TMDLs that are approved by US EPA on or before the date of permit coverage. TMDLs approved after the issuance date of this permit, or a specific facility's permit coverage, become applicable to the Permittee only if Ecology imposes the TMDL through an administrative order.

For waterbodies with an EPA-approved Final TMDL, refer to [Ecology's list of TMDLs](#)²³.

Proposed Revisions

Ecology made minor changes to clarify that pollutant loads for permitted CAFOs established in a TMDL are wasteload allocations. Wasteload allocations quantify how much of the pollutant(s) can be discharged from point sources, along with other sources, and have the water body still meet water quality standards. The previous permit incorrectly referred to "load allocations", the terminology for nonpoint pollution. The draft permit also includes an updated web address for TMDLs.

B. Limits based on Impaired Waterbodies

Ecology periodically reviews water quality data to determine if water bodies fail to meet surface water quality standards. Section 303(d) of the CWA requires that waters not meeting surface water quality standards undergo an evaluation of the cause and amount of the pollution in the waterbody, and need for a TMDL or other water clean-up plan to reduce point source pollution with wasteload allocations, or nonpoint pollution sources with load allocations.

Where a permitted facility discharges to an impaired waterbody without a TMDL, Ecology notifies Permittees in writing of additional limits or controls necessary to meet water quality standards. This notification comes when Ecology grants permit coverage. In the case of the CAFO general permits where the authorized discharges are episodic and limited, no discharges to impaired waters would be authorized. The permittee must not cause or contribute to any impairment for which the waterbody is currently impaired.

For a list of impaired waterbodies in Washington State, refer to [Ecology's impaired waterbody database](#)²⁴.

Proposed Revisions

Ecology proposes minor changes to clarify that impaired waterbodies are Category 5 waterbodies on the most recent EPA-approved CWA Section 303(d) list at the time of permit issuance of permit coverage of a specific facility. The draft permit also includes an updated web address for impaired waterbodies.

²³ <https://ecology.wa.gov/TMDLs>

²⁴ <https://ecology.wa.gov/303d>

C. Limits for the Production Area

Ecology is not proposing changes to S3.C.

Surface water discharges are not authorized under the state permit. This permit conditionally authorizes discharges only to groundwater, under the authority of Chapter 90.48.160 RCW.

For the combined permit, the federal CAFO rules in 40 CFR § 412 specify the conditions under which a surface water discharge may occur from a CAFOs production area. If a production area is designed, constructed operated, and maintained to contain all process-generated (generated by facility operation) wastewaters plus the runoff from a 25-year, 24-hour rainfall event at the location of the CAFO, any process wastewater pollutants in the overflow may be discharged to surface water provided that the discharge will not violate water quality standards. The combined permit also conditionally authorizes discharges to groundwater, under the authority of Chapter 90.48.160 RCW.

D. Limits for Land Application Fields

Ecology is not proposing changes to S3.D.

Surface water discharges are not allowed under the state permit, therefore discharges under the state permit are limited to only groundwater, provided the Permittee is in compliance with the permit.

The combined permit conditionally authorizes discharges from land application fields when they meet the definition of agricultural stormwater. Section 502 of the federal CWA exempts agricultural stormwater from the definition of a point source of pollution. Under the combined permit, if all the following are true, then a precipitation related surface water discharge from a land application field is agricultural stormwater and does not violate the combined permit:

1. The discharge was generated by precipitation,
2. The discharge was not from the production area,
3. The discharge was not caused by human activities (e.g. land application, irrigation) even if the activity took place during precipitation, and
4. The CAFO was operating in accordance with their site-specific nutrient management plan and maintains records demonstrating compliance.

Dry weather discharges are never considered agricultural stormwater. See the previous section in this fact sheet for a longer discussion on [agricultural stormwater](#).

S4 MANURE POLLUTION PREVENTION

40 CFR 122.23(h) requires that as part of the permit application process, the permit applicant develop and submit a nutrient management plan (NMP) to the permitting authority (i.e. Ecology in Washington State). The NMP contains a set of actions and activities developed by the permit applicant to address the nine elements in 40 CFR 122.42(e)(1). Ecology must review the actions and activities and determine if they are adequate for protecting water quality. If adequate, the actions and activities developed by the permit applicant undergo public review and comment, and then become permit effluent limits.

Because a CAFO could be covered under either the state or combined permit, and could move from being covered by one permit to the other, most of the conditions for manure pollution prevention are the same in both permits. This is to prevent confusion and the need for a CAFO to change its practices depending on the permit coverage type.

A. Pollution Prevention Plan

Federal rules at 40 CFR § 122.23(h) and § 122.42(e)(1) require that, as part of the permit application process, the applicant must develop and submit a NMP which contains (after review, public comment, and approval) the facility effluent limitations. Ecology has been prescriptive with the nine minimum elements from 40 CFR § 122.42(e)(1) in the text of the state and combined general permits. To complete the requirements of 40 CFR § 122.23(h) and § 122.42(e)(1), the applicant must describe and document how they will meet the requirements. The MPPP is a document developed by the Permittee that documents how the Permittee is meeting the performance objectives in permit conditions S4.A-Q at their facility. Ecology's intention in being more prescriptive with the minimum technical and operating standards is to providing a more clear compliance pathway.

The MPPP does not replace the Dairy Nutrient Management Plan required for dairies by chapter 90.64 RCW. It also does not replace the Comprehensive Nutrient Management Plan required by NRCS to participate in cost-share programs. The permits' MPPP covers a portion of the requirement in a Dairy Nutrient Management Plan or Comprehensive Nutrient Management Plan.

Updates to the MPPP

The Permittee is required to revise its MPPP within thirty days of becoming aware of a change in the design of the facility's manure management infrastructure. If the changes will take a significant amount of time to complete, for example construction of a new storage facility, the revised MPPP must include the timeline for project completion.

CAFOs may increase their herd sizes, provided they revise their MPPP and submit it to Ecology for review and approval. WSDA uses a 10% increase in dairy animal numbers and field acres when it suggests a facility update its Dairy Nutrient Management Plan for the larger size. The

permits incorporates the same “10% increase threshold” as the basis to trigger the requirement to update and submit a revised MPPP to Ecology. A Permittee may plan for a greater increase so that it does not have to modify its MPPP as often based upon animal number changes.

When Ecology receives a revised MPPP, we will review the changes to determine if they are substantial. Substantial changes will require that the public be notified of the revised MPPP and given the opportunity to review and comment on the revisions. Federal rules in 40 CFR 122.63 and 40 CFR 122.42(e)(6) define procedures for modifying CAFO permit coverages. 40 CFR 122.63 lists the type of minor changes that do not need to be publically noticed. In 40 CFR 122.42(e)(6), the substantial changes include, but are not limited to:

1. Adding new land application fields. There is an exception for land application areas that are covered by the terms of a nutrient management plan incorporated into an existing NPDES permit.
2. Any changes to the field-specific maximum annual rates for land application, and to the maximum amounts of nitrogen and phosphorus derived from all sources for each crop.
3. Addition of any crop or other uses not included in the terms of the CAFO's nutrient management plan and corresponding field-specific rates of application
4. Changes to site-specific components of the CAFO's nutrient management plan, where such changes are likely to increase the risk of nitrogen and phosphorus transport to waters of the U.S.

Some minor modifications do not require public noticing under 40 CFR 122.63. CAFOs must submit the Nutrient Management Plan changes to Ecology. If Ecology determines they are nonsubstantial changes to the MPPP, public notice and comment is not required before the permit is revised. In that case, the revised MPPP will be made publically available via Ecology's [Permitting and Reporting Information System](#)²⁵. Ecology will notify the permittee of the revised terms.

Proposed Revisions

Special condition S4.A Pollution Prevention Plan was previously labeled as S4.Q Pollution Prevention Plan. Ecology moved this permit condition to the beginning of the section to highlight the procedural requirements when developing and implementing the Manure Pollution Prevention Plan.

In response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021), Ecology proposes changes to the procedures for submitting and updating the MPPP.

In the draft permit, the MPPP must be submitted with the permit application and the public must be allowed to review and comment on the application and MPPP. For consistency in the permitting procedures, the change in the submittal deadline was applied to both the Combined

²⁵ <https://apps.ecology.wa.gov/paris/PermitLookup.aspx>

and State-only permits. Special condition S2.B How to Apply for Permit Coverage also reflects this change.

In the draft permit, revised MPPPs must be submitted to Ecology within 30 days of a change in design. Substantial changes must be publicly noticed per 40 CFR 122.42(e)(6).

B. Production Area Run-off Controls

Under this permit condition, the CAFO operator must ensure that discharges of pollutants to surface water caused by stormwater or run-off are

Manure and soils from the production area or land application field that are tracked onto public roadways, is a source of polluted run-off. When it rains, these materials may be carried by run-off into surface waters. The state and combined permits are requiring that the Permittee control the materials tracked off-site (off of the production area or land application field) using specific BMPs (technology-based narrative effluent limit). Ecology has determined that this approach will be effective based on similar requirements in the Construction Stormwater General Permit. All construction sites must have “hardened” ingress and egress pads stabilized and surfaced with quarry spall, crushed rock, or other equivalent materials over filter cloth where equipment and vehicles leave the facility. For permit implementation and management guidance on track out BMPs, refer to BMP C105: Stabilized Construction Access in [Ecology’s Stormwater Management Manuals](#)²⁶.

Vegetated treatment areas must be constructed and maintained to treat the volume of runoff and mass of pollutants from the contributing area. The vegetated treatment area must not cause a violation of groundwater standards and may not discharge to surface waters. If a surface water discharge occurs, the permittee must collect and analyze representative sample(s) according to requirements in S5.E.Surface Water Discharges Prohibited in State-only Permit

Surface Water Discharges Prohibited in State-Only Permit

The state permit does not authorize discharges from the production area to surface waters. The conditions requiring control of facility run-off are meant to prevent surface water discharges from occurring. If a discharge from the production area occurs, it is a permit violation and Ecology may require the permittee to apply for the Combined Permit.

Surface Water Discharges Limited in Combined Permit

The combined permit authorizes discharges from the production area to surface water in limited cases per special condition S3; i.e., surface water discharges are prohibited unless the operator meets the exception requirements. For a discharge to qualify for the exception, the

²⁶ <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals>

facility must be designed, constructed, operated, and maintained to capture all liquids and contaminated run-off plus the direct precipitation from a 24-hour, 25-year storm event. 40 CFR § 412,413. See the discussion in permit condition S3 Discharge Limits. Implementing these permit conditions prevent surface water discharges except during exceptional storm events.

Proposed Revisions

Ecology modified special condition S4.B to clarify that all discharges from the production area must be prevented, not just track out. In the Combined Permit, we included the requirement in 40 CFR §412,413 that all waste facilities be built and operated to contain all manure, litter, and process wastewater including the contaminated runoff and direct precipitation from a 24-hour, 25-year storm. This requirement was previously included in only special conditions S3.C and S4.B. We do not interpret this as imposing additional requirements on those complying with the previous permit.

Additionally, Ecology moved the requirements for filter strips to special condition S4.B. They were previously included under requirements for solid manure, litter, feed storage, and composting facilities. Filter strips may be used to treat and infiltrate contaminated runoff on any part of the production area, not only storage facilities, although this is most common set-up. Filter strips were renamed to 'vegetated treatment areas' to match the name given to these structures by NRCS in Conservation Practice Standard 635. The vegetated treatment areas requirements were updated to require that the design of the treatment BMP ensure hydraulic and nutrient balance.

The vegetated treatment area requirements are included in both the combined and state-only permit, based on AKART (Chapter 90.48 RCW). Ecology used NRCS Conservation Practice Standard 635 and treatment BMPs guidance in Ecology's Stormwater Management Manuals (2019) to develop the performance standard for vegetated treatment areas.

C. Storage of Manure, Litter, Process Wastewater, Other Organic By-Product, and Feed

This section of the permit is intended to ensure that discharges from the storage of manure, litter, process wastewater, animal feed, and other organic by-products do not result in a violation of applicable water quality standards. This permit condition covers requirements for storage volume, structure design and construction, what to do when closing a liquid waste storage pond, and maintenance. These requirements are used in both the state and combined permits to prevent surface water discharges and to limit discharges to the circumstances allowed by the combined permit. Monitoring and reporting requirements are referenced here, but are described in detail in other special conditions.

In general, the owner or operator of the facility is required to store materials in areas designed for either liquid or solid waste, collect contaminated water for later land application as crop nutrients. When possible, materials should be covered and clean water directed away from the

facility so that it does not come into contact with contaminants. This will reduce the storage volume needs of the facility. The owner or operator must describe in their MPPP how the pollution prevention measures are accomplished onsite.

In accordance with 40 CFR § 122.42(e)(1)(i), the draft general permits include the requirement for adequate storage of manure, litter, and process wastewater. Storage is adequate if it accounts for operational volume and emergency needs. The operational volume is the amount of manure, litter, process wastewater, and other organic materials accumulated during the storage period plus the normal runoff and seepage from the facility's drainage area. The storage period will be site-specific, depending on location and crop management plan. If an applicant's manure pollution prevention plan does not demonstrate adequate storage for the facility seeking permit coverage, Ecology will require changes or additional manure storage to be in compliance with special condition S4.B.

The draft general permits has specific requirements and considerations for liquid and storage structures. They are explained in the following two sections. Maintenance and the closure liquid waste storage ponds are discussed in the final two sections of this special condition.

Liquid Waste Storage Structures

The current industry standard for agricultural waste storage facility construction is NRCS Conservation Practice Standard 313. Agricultural engineers use NRCS' Agricultural Waste Management Field Handbook to design new and refurbish waste storage facilities to the Practice Standard.

Federal regulations require that waste storage pond be maintained in good working order, as they were built (40 CFR § 122.41(e)). A good inspection and maintenance program will protect a structure against deterioration and prolong its life. In Washington, any liquid storage facility that impounds 10 acre-feet or more (measured from natural grade to the crest of the impoundment) above ground level and not overseen by another dam safety program (e.g. federal dam safety) is required to comply with chapter 173-175 WAC (Dam Safety). 10 acre-feet is approximately 32.5 million gallons. Most waste storage ponds are likely to be smaller than this, but due to similarities in construction, many of the maintenance procedures required of large liquid impoundments also apply to smaller ponds as well.

The two feet of vertical separation between the bottom of the waste storage pond and the water table is the standard minimum distance Ecology uses for all waste storage ponds. This is the minimum distance necessary to provide filtering and attenuation of pathogens into groundwater.

Maintenance will prolong the life of a structure and help prevent catastrophic failure. Permittees should consider the actions necessary to deal with a catastrophic failure of a waste storage pond to prevent, or minimize to the extent possible, environmental harm.

An “**upset**” is not a defense against failure to maintain a waste storage (or other containment) structure. 40 CRF § 122.41(n) clearly lays out the requirements that must be met for a failure to be considered an upset.

Solid Material Storage Facilities

The draft permit conditions listed here address solids storage and composting areas where solid manure, bedding, and other organic by-products are dried, stacked, and sometimes composted for further use. It does not address disposal or composting of animal mortalities. Refer to special condition S4.G Livestock Mortality Management. Solid material in this permit refers to stackable material that does not flow and is generally greater than 25 percent solids.

The purpose of storing solid waste piles on compacted or impervious surfaces is to control the seepage from leaching into the ground. Water is a by-product of the decomposition process and may seep from the pile over time, but zero discharge is possible by containing all leachate from the facility (in tanks or ponds) or preventing production of leachate (by composting under a roof or in an enclosed building). NRCS recognizes that the need for seepage control may vary based on stored material’s seepage potential, whether the storage facility is roofed, and the climate where the facility is located (NRCS PS 313).

Permittees may refer to several best management practices for preventing discharges from composting areas. S403 BMPs for Commercial Composting in Ecology’s Stormwater Management Manual include procedures for eliminating discharges. NRCS Conservation Practice Standards 317 and 313 recommend installing a concrete slab or compacted soil pad facilitates the collection of that seepage which then must be transferred to facilities designed for liquid storage. Likewise, runoff from the pile must be collected and transferred to liquid storage. Depending on the geographic location of the facility, the volume of contaminated runoff can be reduced by covering the pile. In recent evaluations of different solid storage practices, covering the pile reduced the mass of nutrients lost via runoff and seepage (Discovery Farms Washington Dry Manure Storage Report, 2021).

Field stockpiling of solid material is a temporary storage practice used prior to land application. These temporary piles must be located away from surface waters such that runoff from the pile does not enter surface waters.

The effectiveness of the restrictive layer or soil pad under both animal pens and solid manure piles depends on maintenance of the surface. The draft permit requires that the soil pad compaction be maintained so there is continued control of seepage and runoff based on AKART requirements in Chapter 90.48 RCW. Weekly visual inspections are required in Special Condition S5.A. The inspection results are documented in accordance with Special Condition S6.A.

Maintain Storage Structures

This set of permit conditions also includes general maintenance requirements. In order to ensure that waste materials are properly managed, infrastructure must be maintained in proper working order. Due to the variation in facility infrastructure, the facility owner or operator must identify facility-specific infrastructure maintenance. The procedures, plans, and schedules are to be described in their MPPP.

Waste Storage Pond Closure Procedures

Ecology has received questions about how waste storage pond should be closed (decommissioned) in order to comply with regulations. The language included in the draft permits clarifies the conditions to permanently or temporarily close a pond for water quality protection. The conditions are intended to reduce the risk of discharge to groundwater of nutrients contained in and below the structure. This is because certain nutrients can build up in the waste storage pond soils. For example, ammonia/ammonium is known to be at high levels in the pond liner and depending on the time the pond has been in operation, a certain amount of soil depth below the waste storage pond (Environmental Water Resources Institute, 2005). Then when the waste storage pond is decommissioned, oxygen becomes more available which causes mineralization of ammonia to nitrate which is then mobile with any water percolating down through the soil profile.

The permit's proposed closure requirements are based partially on EPA's Idaho CAFO permit requirements, Oregon CAFO permit requirements, and NRCS Practice Standard 360 (Closure of Waste Impoundments) to meet technology based requirements of AKART (Chapter 90.48 RCW) and minimize the risk of discharge to surface or groundwaters.

Federal CAFO rules require that all open surface liquid waste storage structures must have a depth gauge which clearly indicates the minimum capacity to contain all the run-off and direct precipitation of a 25-year 24-hour storm when the waste storage is full. The depth gauge should cover the entire depth of the structure so that level of liquid waste may be observed to help detect leaks (which is different from seepage) in the waste storage pond. The level of liquid in the pond must be observed and recorded each week during pond inspection. See permit condition S5 for inspection and record keeping requirements.

Proposed Revisions

Ecology is proposing to change the standard to which a new waste storage pond must be designed and built. In typical waste storage pond design guidance, the liner standards are represented as either a combination of permeability and liner thickness or seepage rate, sometimes called specific discharge. NRCS engineers in Washington indicated a preference for the seepage rate measurement. We adopted the design standard used in NRCS' agricultural waste management design handbook (NRCS, 2009) and practice standards (NRCS, 2017). The

State of Idaho uses "specific discharge" as regulatory limit. Ecology's forthcoming guidance for municipal wastewater treatment facilities includes both approaches.

Ecology is also proposing to include additional specificity on the performance requirements for solid material storage and composting areas. These changes are made in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021). Authority to include these requirements is based upon WAC 173-226-070.

D. Other Above and Below Ground Infrastructure

Ecology is not proposing changes to S4.D.

Similar to storage structures for manure, litter, and process wastewater, other infrastructure such as buried pipes may be used by a facility for management of manure, litter, and process wastewater. These conditions are in place to ensure that owners and operators of a facility maintain this type of infrastructure to prevent and control discharges. Authority to include these requirements is based upon WAC 173-226-070.

E. Diversion of Clean Water

Water that comes into contact with animals, manure, litter, process wastewater or other sources of contaminants on-site (e.g. silage leachate) will contain pollutants (e.g. nutrients, fecal coliform, etc.). This type of contaminated water must be collected and prevented from discharging.

Clean water may be intercepted and diverted away from the manure, litter, process wastewater, feed stock and other sources of contamination. So long as the water does not come into contact with contaminants on-site, the clean water diverted away from the facility and discharged off-site. Diverting clean water away from the facility reduces the volume that the facility manure management systems must handle and minimizes the potential for violations of water quality standards.

These requirements are included in both the combined and state-only permit, based upon 40 CFR 122.42(e)(1)(iii) and AKART (Chapter 90.48 RCW).

Surface Water Discharges Prohibited in State-only Permit

The state permit does not allow discharges to surface water. All water that comes into contact with contaminants must be directed to storage systems. If water that has come in contact with pollutants is allowed to run off the production area into surface waters, or conduits to surface water this is considered a discharge to surface waters and is a permit violation. A discharge to surface waters would trigger the requirement that the facility apply for the combined permit based on 40 CFR 122.21(a) and 40 CFR 122.23(d),

Surface Water Discharges Limited in Combined Permit

The combined permit only allows surface water discharges in specific instances, based on 40 CFR § 412; see permit condition S3 Discharge Limits. Unless those conditions are met, all water that comes into contact with CAFO contaminants must be directed to storage systems. If water that has come in contact with pollutants is allowed to run off the production area into surface waters, or conduits to surface or groundwater, this is considered a discharge and unless the specific conditions in permit condition S3 are met, the discharge is a permit violation.

F. Prevent Direct Animal Contact with Water

Ecology is not proposing changes to S4.F.

Animal access to surface waters causes direct discharges to the water from animal fecal matter (directly excreted or otherwise carried on the animal). Animal use of the water also can lead to degradation of the riparian areas and releases of sediment (turbidity) from animals stirring the bottom sediments and trampling the water body banks. Because heavy use of stream banks by animals for watering causes water quality pollution, animals must be fenced out of riparian areas.

These requirements are based upon 40 CFR § 122.42(e)(1)(iv) and RCW 90.48.080. However, because a discharge from direct animal contact with surface water is not a discharge allowed by either the state or combined permits, these requirements are included in both permits.

Ecology is developing [clean water guidance for all agricultural producers](#)²⁷ that describes our recommended BMPs to protect water quality. We recommend Permittees consult this guidance when considering options for complying with this permit condition.

Ecology clarified in the draft permits that animals must be prohibited from the field discharge management areas established in special condition S4.M. Animal access in the streamside areas that are meant to filter or treat runoff will impact their function in pollution prevention.

Ecology outlined how field staff evaluate streamside cover and document site conditions that we know contribute to water pollution in [Clean Water and Livestock Operations: Assessing Risks to Water Quality](#)²⁸ (Publication 15-10-020).

G. Chemical Handling

Ecology is not proposing changes to S4.G.

In the normal course of operation, CAFOs may use chemicals such as pesticides, veterinary medications, cleaning and disinfection agents, or fuels. In general, manure management systems are not designed to treat these chemicals, so inadvertent contamination of the manure

²⁷ <https://ecology.wa.gov/About-us/Accountability-transparency/Partnerships-committees/Voluntary-Clean-Water-Guidance-for-Agriculture-Adv>

²⁸ <https://apps.ecology.wa.gov/publications/SummaryPages/1510020.html>

management system must be prevented to protect surface and groundwater quality. This permit condition prohibits the CAFO operator from disposing of excess, unused, or unwanted chemicals in any manure management system, surface water or conduit to surface or groundwaters.

Additionally, because the chemicals can be pollutants, the permit conditions require that the owner of operator of a facility ensure that chemicals are appropriately handled and stored to prevent spills. Permittees must develop and implement emergency procedures in the event of a chemical spill. These requirements are based upon 40 CFR § 122.42(e)(1)(v) and WAC 173-226-070. For permit implementation and management guidance on chemical handling BMPs, refer to BMPs for Spill Prevention and Cleanup in [Ecology's Stormwater Management Manuals](#)²⁹.

Many agrochemicals are regulated under Federal Insecticide Fungicide and Rodenticide Act (FIFRA) and have detailed disposal requirements for excess, unused, or unwanted chemicals or used wash water. Where a chemical does not have a FIFRA label, a Safety Data Sheets (SDS) provides proper handling and disposal instructions. The permit requires CAFO operators to dispose of chemicals according to requirements on the FIFRA label or instructions in the SDS. Ecology considers these requirements, in part, AKART (WAC 173-226-070).

Because chemicals are used on all types of CAFO facilities regardless of if they only have a groundwater discharge or a surface water discharge, the chemical handling requirements are included in both the state and combined permits.

H. Livestock Mortality Management

As livestock carcasses decompose, they release leachate that is high in nutrients and pathogens. Proper handling of livestock mortalities is important for the protection of water quality and for biosecurity. Through different management practices, the environmental and biosecurity impacts of livestock mortalities can be reduced. For routine disposal, a number of options exist including composting, rendering, burial, and natural decomposition.

Federal CAFO rules require proper management of livestock mortalities. Mortalities may not be disposed of in liquid waste handling systems (unless the system is designed to handle mortalities), and they must be handled in a way that prevents discharge of pollutants. Addressing livestock mortalities to prevent discharges is based partially upon 40 CFR § 122.42(e)(1)(ii). A discharge from animal mortalities is not a discharge allowed by either the state or combined permits, therefore these requirements are included in both permits.

Washington State also has laws and rules that are more explicit in describing how mortalities must be handled. The permits require compliance with these requirements at RCW 70A.205, WAC 16-25 and WAC 173-350. Additionally, local ordinances may have requirements

²⁹ <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals>

beyond those in Federal and State regulations. Permittees must comply with applicable local codes too.

Ecology has only included requirements related to water quality in the permit. However, chapter 16-25 WAC contains requirements beyond those protecting water quality such as moving mortalities away from fence lines if allowed to decompose naturally.

Mortalities due to unknown causes must always be presumed to be from disease. RCW 16.36.092 requires that any livestock that died of disease or unknown causes will be disposed of as described in rule by the director of the Washington State Department of Agriculture. This is implemented in chapter 16-25 WAC which also covers routine disposal of mortalities.

If on-farm mortality composting is conducted, chapter 70.A.205 RCW and chapter 173-350 WAC must be complied with. Ecology developed technical guidance called “On-Farm Composting of Livestock Mortalities” (ECY Pub No. 05-07-034), however some of the regulatory guidance found in this document is no longer current. Until an update is completed, refer to RCW 70.95.306 for details specific to composting bovine and equine carcasses under routine conditions and when compost is distributed to a third party, as these statutory requirements have not changed. General regulatory information on agricultural composting can be found in WAC 173-350-220. Please contact the Department of Ecology’s Solid Waste Management program or your local health department if you have questions about complying with chapter 70.A.205 RCW and chapter 173-350 WAC.

The technical guidance remains valid. State solid waste regulations were last amended in 2018, prompting a need to update these guidelines.

In the event of livestock death from a reportable disease, the state veterinarian or local health department must determine appropriate carcass disposal methods.

Proposed Revisions

Ecology is proposing to remove the detail on the three common mortality management practices. We received feedback that because Permittees must follow all requirements of WAC 16-25, which are more in-depth than what was included in the previous permits, the permits’ detail on burial, composting, and natural decomposition was unhelpful. To streamline the permit condition and make clear that all parts of relevant regulations must be followed, Ecology removed the mortality management details and replaced it with a reference to WAC 16-25.

The regulations at 70.95 RCW were moved to 70.A.205 RCW. Ecology has changed the reference to avoid confusion. No changes were made to the state law that impact the composting of manure.

I. Manure, Litter, Process Wastewater, and Other Organic By-Products Sampling and Nutrient Analysis

Nutrient concentrations in manure vary widely between facilities and across seasons. Accurate nutrient concentration measurements from manure and wastewater are a foundation for making agronomic applications at a rate that ensures plant or soil uptake without leaching to groundwater and ensuring manure is not a discarded waste (see the previous section [Meeting Beneficial Use Definition](#)). For this reason, Ecology established a sampling frequency in the previous permit that requires collection of three samples spaced throughout the application season. The permittee then uses the results in preparing and following the field-specific nutrient budget (special condition S4.K.1) and estimating application rates (special condition S4.K.2).

Where possible, Ecology has required soil and manure sampling and analysis similar to the requirements of chapter 90.64 RCW and WAC 16-611.

Proposed Revisions

In the draft permit, the reference to TSUM200 was removed to allow sampling and analysis of nutrient sources before TSUM200. Land application still may not occur before TSUM200, based on AKART (Chapter 90.48 RCW). This change was made to accommodate a possible delay of a week in receiving the results from nutrient source sampling and analysis, which causes a conflict with special condition S4.K.3.

Ecology also specified that samples must be collected such that the results will be as representative as possible of the nutrient concentrations at the time of application. Together, these two changes serve to remove barriers to making safe, early applications. Nutrient applications in the early season are generally preferable to late season applications when plant uptake begins to decline. See land application restrictions in special condition S4.J.2 for more on when applications are prohibited.

Ecology made edits to improve the readability of the permit condition.

J. Soil Sampling and Nutrient Analysis

Soil sampling is an essential part of determining what nutrients are available for a crop and therefore what nutrients are needed to meet crop and yield goals. Soil sampling is monitoring tool used to implement AKART and ensure that excess nutrients do not leach or discharge to groundwater. Early season soil sampling is necessary to determine what nutrients are available or will become available to a crop over the growing season. Soil nutrient data is an important component of a field nutrient budget.

The late summer-early fall soil sampling is required as the “report card” or benchmark for how well the field nutrient budget and nutrient management practices performed during the growing season. These soil results triggers adaptive management action (permit condition S4.L) that the Permittee must take to improve their nutrient management. The post-harvest soil results are not used as enforceable limits and exceeding a threshold does not constitute a

permit violation. For more discussion of benchmarks and enforceable limits, see S4.L in this Fact Sheet.

Proposed Revisions

Ecology removed the requirement for soil sampling prior to TSUM200. It has been revised to a requirement to sample soil before land application, which may or may not coincide with reaching the TSUM200 threshold. The soil test results are to be used to develop field-specific nutrient budget and make decisions on appropriate land application rates. For permittees who are not applying shortly after TSUM200, the results from soil sampling in the previous permit did not provide consistently useful results. Soil nitrate results from later in the season may be more useful to informing nutrient management decisions and updating nutrient budgets. By providing flexibility to the permittee to determine the best time to collect soil samples that inform decision making, Ecology expects nutrient budgeting and post-harvest soil test results to improve. Improved source control of nutrients will ensure AKART and prevent water pollution.

Ecology made improvements to this permit condition by reorganizing the requirements into four sections and adding a fifth section to reference the methods section. The sampling depths by geographic differences were folded into a single section, the titles of the Spring and Fall soil sampling sections were changed, and the analytical method reference was moved into its own section. The reorganization improves readability.

K. Land Application

Land application of manure, litter, process wastewater, and other materials is essential to provide nutrients for crop growth as part of a land treatment system. However, it is important that land application take place in a manner that does not pose a high risk to surface and groundwater quality. Examples of land application practices that increase the risk of discharge from land application fields include, but are not limited to:

- applying in places and during times where field run-off may occur,
- applying at times of year where crops will take up minimal to no nutrients,
- applying right up to the edge of a waterbody (e.g. no buffers or setbacks),
- not following appropriate application rates or nutrient budgets, and
- applying during precipitation or when other environmental factors increase the likelihood of discharge.

In order to reduce the risk of discharge to surface water from field run-off and to groundwater from excessive over-application, Ecology has included requirements to prevent application during higher risk times and areas that can pose a higher risk of discharge.

Authority to restrict land application to prevent and control discharges as AKART comes from WACs 173-226-070(1) and (3) and 173-226-180(1) as well as RCW 90.48.010 and 90.48.520.

In addition to the authorities provided by state statutes and rules, 40 CFR 122.42(e)(1)(viii) requires the establishment of protocols for the appropriate land application of manure, litter, process wastewater, and other sources of nutrients. In addition 40 CFR 123.36 requires that Ecology develop technical standards for CAFOs for the land application of manure, litter, process wastewater, and other sources of nutrients. The requirements which the technical standards must address and how the permit addresses those requirements are listed below:

- a. A field specific assessment that addresses the form, source, amount, timing, and method of application of nutrients. Permit condition S4.B and the yearly field nutrient budget form address these requirements.
- b. Achieve realistic production goals while minimizing nitrogen and phosphorus movement to surface and groundwaters. The permit yearly field nutrient budget form address these requirements which are also listed as permit condition S4.J.1.
- c. Determination of application rates must include a field specific assessment for the potential for nitrogen and phosphorus transport from the field. The permit yearly field nutrient budget form address these requirements which are also listed as permit condition S4.J.1.
- d. Determination of application rates must address the form, source, timing, and method of application.

These requirements are addressed in permit condition S4.J and K where controls are placed on the time of year application may take place, and the weather conditions in which application may take place. Timing of actual applications is left to the Permittee as long as the application takes place within the constraints placed on application within the permit.

In the previous permit cycle, nitrogen was the focus of the field nutrient budgets and MPPP as it is currently the primary nutrient of concern (e.g. high nitrates in groundwater in Yakima and Whatcom Counties). Ecology expected to have permittee soil phosphorus data from the 2017 permit cycle which development of phosphorus limits could be based upon. However, time constraints and a small dataset prevented Ecology from developing phosphorus limits in this permit and, therefore, nitrogen remains the focus of field nutrient budgets and MPPPs, as the primary nutrient of concern in the draft CAFO permits.

Yearly Field-Specific Nutrient Budget

The basis for including the requirement to follow a yearly nutrient budget for land application for manure, litter, process wastewater and other sources of nutrients is the concept of a field nutrient balance. Other regulatory and technical assistance agencies are in agreement that nutrient budgets are necessary for appropriate land application (WSDA, CDs, NRCS). A field nutrient mass balance means that the nutrient inputs (e.g. nutrient mineralization, fertilizer) to a field roughly equal the nutrient outputs (e.g. crop harvest removed from field).

$$\text{Nutrient Balance} = \text{Inputs} - \text{Outputs}$$

When inputs and outputs are in balance, this prevents excessive nutrients (e.g. nitrate) being left in the field soil at the end of the growing season that can leach past the root zone, into the vadose zone, and finally to groundwater.

$$\text{Inputs} - \text{Outputs} > 0 = \text{Excess Nutrients}$$

Excess nutrients that move down below the root zone of crops are going to enter groundwater at some point depending on the soil profile and environmental conditions of a location.

Nutrients which move down below the crop root zone can impact groundwater. By requiring that Permittees follow a nutrient budget, the amount of excess nutrients moving to groundwater will be reduced and preventing discharges that cause or contribute to violations of water quality standards.

The permit conditions requiring Permittees to develop and follow a nutrient budget are the same between the state permit and combined permit. This is because the same activity will take place under both permits.

Resources for building nutrients budgets:

- Atmospheric deposition - AIRPACT-5 (Air-quality forecasting for the Pacific Northwest). Imagery showing monthly deposition of nitrogen and sulfur. Civil & Environmental Engineering (WSU-Pullman). <http://lar.wsu.edu/airpact/>
- Mineralization from manure – Sullivan, 2020. EM 8954-E Estimating Plant-available Nitrogen from Manure, OSU Extension. <https://catalog.extension.oregonstate.edu/em8954>
- Soil Nitrogen Mineralization – Sullivan, 2020. EM 9281 Baseline Soil Nitrogen Mineralization: Measurement and Interpretation, OSU Extension.
 - This publication provides a healthy discussion of the challenges in estimating nitrogen mineralization from soil samples. Authors conclude that “most laboratory tests for N mineralization are useful only as measures of relative changes in soil health.”

Application Rates

In order to accurately know how much nutrients are being land applied, a rate (application per unit time measurement) for any land application equipment (equipment calibration). It is essential that the rate of application is known in order accurately apply the nutrient budgets. Only basing application rates on a rough estimate is a quick way to break a nutrient budget and end up with either too much or not enough nutrients applied to a field.

Application Restrictions

The permit prohibits land application during certain times of year when fields are either bare of crops or crops are dormant, which is usually indicated by bare, frozen, snow covered, or saturated fields. The technical basis for the permit’s nutrient budget requirement is to land

apply nutrients so that they are available when crops need them and are able to use the nutrients, which is consistent with AKART and minimizes the risk of discharging excess nutrients to waters of the state. Also, if nutrients are land applied when the risk of nutrient loss is high or when crops are unlikely to take up the nutrients, land application may be considered disposal. Land application that is waste disposal requires a solid waste handling permit. See the previous section on [meeting the beneficial use definition](#).

Specific prohibitions on land application were drawn from guidance documents provided by NRCS and Whatcom Conservation District. The following requirements are paraphrased from the most recent State NRCS Practice Standard 590.

In the draft permit, nutrients must not be land applied:

- To fields with a frozen surface crust or deeper, or the soil is at or below 32 degrees F.
- To fields that are snow covered.
- During precipitation events large enough to cause field run-off in the Permittee's location.
- When crop nutrient utilization has stopped or is limited (e.g. no application to perennial grass crops before spring green-up)

The following requirements in the draft CAFO permits are based on the Whatcom Conservation District Application Risk Management guidance (2016). Nutrients must not be land applied:

- To fields with saturated soil (including surface ponding) or with soil moisture content $\geq$ 90%.
- If the water table is within 12 inches or less of the surface.
- If significant precipitation ($\geq$ 0.5 inches) is forecast in the next 72 hours by WSU AgWeatherNet or NOAA for the Permittee's location.

The permit conditions limiting land application during certain times are the same between the state permit and combined permit. This is because the same activity will take place under both permits.

Double Cropping, Winter Cover Crops, Perennial Crops

Following the permit requirement and technical assistance agencies agreement that a nutrient budget is necessary, and the reason for the nutrient budget is to appropriately land apply various sources of nutrients, land application may only occur when the nutrient budget says that crops will need the nutrients. Land application outside of when the nutrient budget says that the crops will need the nutrients would then not be following the budget. Permit condition S4.J.4 requires Permittees justify why land application needs to occur outside of when the nutrient budget says crops will need the nutrients, for example after crops have been harvested or when they are beginning to go dormant and why the nutrients currently available in the field soils are not enough for the non-growing (or limited growth for perennial crops) period. This

condition provides additional oversight to land application that takes place during times when crops have already been harvested, or are going into the non-growing season by ensuring that the crops actually do need extra nutrients that will not be provided by the soil.

Emergency Application

The permit restrictions on the time and place that land application may occur are intended to ensure compliance with AKART and reduce land application during times where there is a high risk of discharge that could cause or contribute to violations of surface or groundwater standards. Permit condition S4.J.5 is meant to address situations where land application during the restricted period involves less risk than an event such as waste storage pond overtopping. The noncompliance procedures in this section are slightly different than those in special condition S7.E because the Permittee has advanced knowledge of the noncompliance. By requiring advanced notification to Ecology or Agriculture, the State can provide timely technical assistance to ensure the safest land applications possible.

After the emergency application, the 6-month reporting requirement defines the point by when the Permittee and Ecology evaluate whether the facility is appropriately designed for current operations. Ecology expects the permittee to define the problem that led to the noncompliance, research options, and chose actions that prevent the noncompliance in the future. The action plan must be implemented within the time-frame stated in the permit.

However, the yearly field nutrient budget does require calculating the phosphorus needs for the crop. This will allow Ecology to gather information for the next permit cycle to better determine if, and how phosphorus needs to be addressed.

- i. Allow for phased implementation of phosphorus based nutrient management.

This permit cycle, nitrogen is the focus of the field nutrient budgets and MPPP as it is currently the primary nutrient of concern (e.g. high nitrates in groundwater in Yakima and Whatcom Counties). It is highly likely that if Ecology were to require phosphorus based nutrient budgets that many land application fields would no longer be available to use for manures due to the current phosphorus levels from many years of receiving manure.

Proposed Revisions

Ecology reorganized the list of required elements in a nutrient budget in S4.K.1. They are now grouped into stocks, sources, and sinks. Ecology also added the requirement to nutrient budgets that plant available nitrogen not exceed the nitrogen required to reach a crop's estimated yield. This makes clear that the budget must be balanced for available nitrogen. This was included in the provided nutrient budget worksheet developed for the previous permit, but not explicitly stated in the permit language.

In S4.K.3, Ecology is proposing to restrict land application to not just when the near surface soil profile is saturated, but when forecast precipitation will exceed the infiltration rate. This restriction is meant to limit the occurrence of land application discharges due to precipitation

that falls on top of an application that has not been incorporated into the soil. Ecology and WSDA have observed that this can occur 2 to 5 days after the application.

Ecology made changes to special condition S4.K.4 on land application procedures for double cropping, winter cover crops, and perennial crops. These changes improved readability, and clarify the requirement to evaluate soil nitrogen changes, but did not change previous permit requirements.

Similar improvements were made for readability to the Emergency Winter Land Application conditions at S4.K.5. Requirements were also formatted into a list to make clear the steps a permittee needed to take to comply with the condition. The requirement to collect a water sample when a discharge occurs was added. Discharges, authorized or unauthorized, must be monitored per 40 CFR § 122.44(i)(1)) and may be required under WAC 173-226-090(1). To provide clarity in requirements and prevent reoccurring emergency applications, Ecology is establishing a deadline, for which the work proposed in the work plan must be completed. The proposed deadline is 18 months after the first occurrence of an emergency application and is similar to the requirement for storage structure repairs conducted in accordance with S7.C. If work cannot be completed within 18 months, the permittee may request a time extension by preparing a rationale and work schedule. This request must be submitted to Ecology and a public noticed published. Time extensions are considered modifications of permit coverage.

Ecology is proposing to incorporate these revisions in both the Combined and State-only permits. These revisions are consistent with AKART and will ensure that manure applications are made at the right applications rate and at safe times when the risk to water quality is lower.

L. Adaptive Management of Land Application Fields

This permit condition uses a systematic, iterative adaptive management program to continually adjust management of a complex soil-plant-manure system. The slow and fast processes of making nitrogen available from carbon-rich manure depend not only on the manure characteristics, but soil and climate conditions. The adaptive management actions in this permit condition are meant to direct the permittee to adapt their land management plan based on recent data from their fields.

In the previous permit, Ecology developed the adaptive management matrix that assigns risk levels based on the nitrate concentration in a soil sample collected in the late summer or early fall after harvest. The soil nitrate thresholds in the permit and in **Error! Reference source not found.** below, are the same thresholds used by WSDA with dairy producers under chapter 90.64 RCW. These thresholds were based on the interpretive guidance for post-harvest soil nitrate tests first developed by University Extension researchers in Washington, British Columbia, and Oregon. The current extension publication titled “Postharvest Soil Nitrate Testing for Manured Grass and Silage West of the Cascades” (Sullivan et al, 2021a) provides historical background on the development of the test and interpretive guidance. For a summary of the recommended

soil nitrate threshold limits in the scientific literature that Ecology reviewed, see Table 7 in “Manure and Groundwater Quality Literature Review” (Redding, 2016).

Table 1 Field Risk Level

Field Risk Level	Fall Soil Test Nitrate Range in ppm	Fall Soil Test Nitrate Range in lbs/acre
Low	Less than 15	Less than 55
Medium	15 - 30	55 - 110
High	31 - 45	111 - 165
Very High	More than 45	More than 165

The risk levels are simplified interpretations of the post harvest nitrate soil data and the way Ecology determines adaptive management actions for the permittee. The higher the risk level, the greater the effort level the permittee must take in adjusting their cropping and management practices.

The postharvest soil nitrate data and the risk level categories are not intended to forecast the impact on groundwater. Nor do the results point to the cause of the excess soil nitrate. Rather, the researchers who proposed the post-harvest soil nitrate test (Sullivan and Cogger, 2003) developed it as a tool for evaluating past manure management practices (Redding, 2016). Ecology uses the soil test as a tool for guiding permittees when management practices need to be adjusted.

The amount of residual N left in the field is an indication of whether cropping and manure management practices needs to be adjusted. The first time a field is categorized as Medium, High, or Very High risk, the permittee must adjust their management practices according to the actions prescribed in the column titled “Required Actions after 1 year”. Each increased risk level leads to additional management actions. This suite of management actions were first developed for the 2017 permits and were based on University Extension guidance for nutrient management (Sullivan et al, 2021a; Sullivan et al, 2021b, Bary et al, 2016), discussions with producers and their technical advisors, and public comment on the 2016 draft permits. These actions and thresholds will satisfy AKART and prevent violations of water quality standards. Most of the actions involve revising the nutrients budgets that are required in special condition S4.J.1 Annual Field-Specific Crop Nutrient Budget.

The goal after one year of being in the High or Very High risk level is to reduce fall soil nitrate concentrations in land application fields to a risk level of Medium or less. Where that does not occur, the permittee must again follow the same actions in the column titled “Required Actions after 1 Year” and must follow the additional actions in the column titled “Required Actions after 2 Consecutive Years”. These actions involve hiring a professional with expertise in agronomy to

assist the permittee in preparing a nutrient budget and recommending application rates. The permittee must also reduce or stop nutrient applications depending on the field's risk category.

Ecology added a new requirement for fields categorized as Very High for the second year in a row. Permittees must collect deep soil samples, analyze them for nitrate concentration, and submit them to Ecology. Ecology will use the soil samples, along with site-specific data on groundwater recharge rate and climate in an analysis of the reasonable potential to impact groundwater. Ecology developed a mass balance loading model for this purpose (Pitz, 2014). When there is evidence of a reasonable potential to impact groundwater, Ecology will contact the Permittee to begin developing a groundwater monitoring plan according to S5.D Groundwater Monitoring.

The adaptive management program in the draft CAFO general permits utilizes the concepts of benchmarks similar to those used in Ecology's Industrial and Construction Stormwater general permits. The use of monitoring against a benchmark to drive changes in management practices to prevent discharges that may cause or contribute to violation of water quality standards is, in total, a narrative water quality-based effluent limitation. A benchmark itself is not a numeric effluent limit, i.e., it is not a violation if it is exceeded; it is an indicator value that, when reached or exceeded, requires the Permittee to change their application practices to reduce future end of season reporting values to below the benchmark. That is, reaching or exceeding a benchmark triggers the permit requirement to change how the field is managed. If a Permittee exceeds a benchmark and does not take the permit-required adaptive management actions, that would constitute a permit violation.

When Ecology is concerned about a potential over-application of nutrients and the associated risk to groundwater, we use multiple pieces of information from permittees to assess whether field applications are made at agronomic rates. Fall soil nitrate-nitrogen test results are only one piece of information that may be used to make a determination. We may consider field-specific nutrient application rates, budgets, and crop yield data submitted with post-harvest soil nitrate test results. Inspectors may review individual nutrient application records on-site and equipment maintenance records.

Proposed Revisions

Several changes were made to this permit condition to improve clarity for implementing the permit's adaptive management program. Ecology partitioned the adaptive management program into three steps. A copy of **Error! Reference source not found.**, above, was introduced to the permits as Step 1: Determine Field Risk Level.

The management action tables used in the previous permit were split into two tables, one for each climate type, and referenced in Step 2: Take Required Adaptive Management Actions. This formatting change makes it easier to determine the depths needed for additional soil samples. Ecology shortened the number of consecutive years that require additional action in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021).

Step 3: Submit Deeper Soil Test Results was added to explain how the permittee must collect additional soil samples for an assessment of potential impact to groundwater. After 2 consecutive post-harvest soil nitrate test results of more than 45ppm (Very High risk level), the permittee must collect deep soil samples for a groundwater impact analysis.

Deeper soil samples must be collected and analyzed to assess the potential impact to groundwater quality from nutrient applications on these fields. Ecology will review the soil tests results and determine if there is a potential to impact groundwater quality using the mass balance loading model developed by Ecology (Pitz, 2014). If Ecology determines the activity causes or contributes to a violation of water quality standards, we will notify the permittee in writing that they must submit a groundwater monitoring plan according to special condition S5.D.

Authority to include these requirements is based upon 40 CFR 122.44(i) and WAC 173-226-090. These changes are made in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021).

M. Irrigation Water Management

Irrigation is necessary in many areas of the state to provide water to growing crops. However, when improperly managed, irrigation water contributes to the movement of pollutants such as nitrate to groundwater, which is not consistent with AKART requirements in Chapter 90.48 RCW and could cause or contribute to violations of water quality standards. Nitrate is quickly mobilized in soil water and, when the soil's water holding capacity is exceeded, at risk of moving below the rooting depth of a crop. When nitrate is out of reach of the crop's roots, over time it will likely reach groundwater. See the discussion of nitrogen in the Wastewater Characterization section of this Fact Sheet for more on nitrogen transport and transformation.

Proposed Revisions

Ecology amended this condition to require that irrigation water be managed such that the water holding capacity of soil not exceed the crop root zone (approximately 8 inches to 4 feet depending on crop and location in the state). Exceeding the water holding capacity leads to leaching. Ecology received feedback that crops with deep roots are being increasingly used in irrigated areas. The revisions allow use of deeper rooting crops, which are useful in repairing fields after a history of overapplication of N. This revision satisfies AKART requirements for land treatment systems.

N. Field Discharge Management Practices

This condition in the permits serves to protect waters adjacent to land application fields. When there is space between fields with manure applications and the down gradient surface waters, the impact of polluted runoff to surface and groundwaters is reduced. Nutrients, bacteria, and sediments in the runoff, are intercepted, infiltrated, or treated depending on the soil, climatic, and vegetative conditions.

Ecology expects that the CAFO operator will seek technical assistance from Ecology, WSDA, Conservation Districts, NRCS, and other water quality professionals to determine which options work best for their fields. The permits are designed so that, as whole, runoff on land application fields does not cause or contribute to exceedances in water quality criteria. The discharge management practices required by this permit condition are an operator's last line of defense. Source control measures such as yearly nutrient budgeting (special condition S4.J.1), manure testing (special condition S4.H), and application timing (special condition S4.J.3) prevent the contamination of surface runoff.

Animal access in the field edges that are meant to filter or treat runoff will impact their function in pollution prevention. Therefore, animals must be excluded from field discharge management practices adjacent to surface waters. Ecology outlined how field staff evaluate streamside cover and document site conditions that we know contribute to water pollution in [*Clean Water and Livestock Operations: Assessing Risks to Water Quality*](#)³⁰ (Publication 15-10-020)

Compliance Options in Combined Permit

The Combined permit presents four options—riparian management zones, vegetated filter strips, application setbacks, and earthen berms. These options ensure compliance with AKART requirements in Chapter 90.48, and prevent discharges that may cause or contribute to violations of water quality standards.

Riparian Management Zones

Protecting stream and riparian areas is an important and holistic management practice for water quality protection. While a clear identification of stream and riparian area boundaries is difficult because these areas are not fixed in time and space, as used here riparian management zones are intended to refer to the stream channel, and the transition zones between upland areas and surface water.

Healthy riparian management zones generally contain a combination of native trees, shrubs, woody debris, riparian vegetation, litter layers, and soils. The design, construction, and maintenance of a riparian management zone are more complex than the vegetated buffer and manure setback options as they are intended to protect water quality and provide habitat for fish and wildlife. The plants and soils in the riparian management zone filter and reduce incoming sediments and pollutants in runoff from land application fields. Vegetation in riparian management zones shade streams maintaining cool temperatures needed by most fish. Plant roots stabilize stream banks and control erosion and sedimentation. Riparian vegetation moderates stream volumes by reducing peak flows during flooding periods and by storing and slowly releasing water into streams during low flows. Permittees interested in utilizing this option should refer to [*Appendix J: Restoration and Planting of Ecology's State Fiscal Year 2023*](#)

³⁰ <https://apps.ecology.wa.gov/publications/SummaryPages/1510020.html>

[*Funding Guidelines—Water Quality Combined Funding Program*](#)³¹. Permittees may qualify for financial support if they chose to implement this management practice.

Ecology is developing detailed guidance in [*Voluntary Clean Water Guidance for Agriculture Chapter 12: Riparian Areas*](#)³².

Vegetated Filter Strips & Manure Setbacks

Vegetated filter strips are areas of dense vegetative cover such as grass and shrubs that slow run-off and filter out nutrients and other contaminants. Manure setbacks are a specified distance from surface waters or potential conduits to surface waters where manure, litter, and process wastewater may not be land applied.

Federal requirements at 40 CFR part 122.42(e)(1)(vi) and 40 CFR § 412.4 specify that permittees must implement best management practices to control nutrient runoff. Specifically, Large CAFOs must use a 100-ft manure setback from surface waters or conduits to surface waters, a 35-foot vegetated buffer, or an equivalent alternative. Federal requirements at 40 CFR § 412.4(c)(5)(ii) state that the alternative must be equivalent or better in pollution reduction as the 100-ft manure setback. Ecology chose to retain these as options for controlling nutrient runoff to surface waters.

Berms

If properly designed to account for the field characteristics (e.g. slope, infiltration), environmental conditions (e.g. precipitation, storm events), and land application practices (e.g. method of land application, form of manure, litter, or process wastewater applied), berms prevent run-off leaving from a field. Berms may be used to redirect runoff away from surface waters or conduits to surface or groundwater. Ecology will verify the siting and orientation of berms at the time of permit coverage or modification. This option is based upon a best professional judgment determination that in appropriate circumstances, berms are equivalent or better in pollutant reduction than the 100-foot manure setback.

Alternative Compliance Practices

Permittees may propose alternative compliance practices that are equivalent or better in pollution reduction than the 100-ft manure setback. This equivalency requirement comes from CFR § 412.4(c)(5)(ii). Permittees considering an alternative practice should seek early technical assistance from Ecology, WSDA, Conservation Districts, NRCS, or other water quality professionals. Maps of the proposed locations for the alternative practices and documentation demonstrating equivalency must be provided in the MPPP that is submitted with the permit application. If a permittee wishes to propose an alternative compliance practice after they

³¹ <https://apps.ecology.wa.gov/publications/SummaryPages/2110028.html>

³² <https://ecology.wa.gov/About-us/Accountability-transparency/Partnerships-committees/Voluntary-Clean-Water-Guidance-for-Agriculture-Adv>

receive coverage, they must apply for a permit modification and public notice their modified application.

Proposed Revisions to Combined Permit

Ecology modified this condition to present the discharge management practices as a list of options that allows the permittee to select the most appropriate option for the field and waterbody. The riparian management zone option was added to identify a practice with water quality benefits beyond pollutant control, such as habitat, that a vegetated filter strip may not provide. Riparian management zones are site-specific designs for which management actions are tailored to maintain specific resource objectives. All of the practices, including the new riparian management zone, are equivalent or better in pollution reduction to surface waters as the 100-ft manure setback.

Ecology clarified in the draft permits that animals must be prohibited from the field discharge management areas established in special condition S4.M. Animal access in the streamside areas that are meant to filter or treat runoff will impact their function in pollution prevention. Ecology outlined how field staff evaluate streamside cover and document site conditions that we know contribute to water pollution in [*Clean Water and Livestock Operations: Assessing Risks to Water Quality*](#)³³ (Publication 15-10-020).

Ecology removed the public notice template from the alternative compliance practice option. An alternative compliance practice must be proposed through an initial permit application or an application for permit modification. Both actions involve public notice of the application package under the combined permit.

Requirement in State-only Permit

In the State-only permit this condition is titled “Field Discharge Prevention” to reflect that surface water discharges are not authorized under the State-Only permit. A facility with the State-only permit must use technologies, infrastructure, and practices that will prevent contaminated discharges. To achieve compliance, permittees should consider multiple complementary practices such as structural BMPs that reduce stormwater runoff volume or peak flows, treatment BMPs that remove pollutants, and management BMPs that exclude stormwater from manure. Permittees should consult recommended BMPs from [*Ecology’s Voluntary Clean Water Guidance for Agriculture*](#)³⁴, [*Stormwater Management Manuals*](#)³⁵, or conservation practice standards in the [*Natural Resource Conservation Service \(NRCS\) Field Office Technical Guide \(FOTG\)*](#)³⁶.

³³ <https://apps.ecology.wa.gov/publications/SummaryPages/1510020.html>

³⁴ <https://ecology.wa.gov/About-us/Accountability-transparency/Partnerships-committees/Voluntary-Clean-Water-Guidance-for-Agriculture-Adv>

³⁵ <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals>

³⁶ <https://efotg.sc.egov.usda.gov/#/state/WA>

Underground drains, such as tile drains that work to manage water in-field and outfall to surface waters, must be managed in a way to prevent the discharge of manure, litter, wastewater or organic by-products. Permittees may consider capping tile drains or adding additional treatment BMPs. If untreated tile drain water discharges to surface waters, Permittees may be required to apply for coverage under the Combined permit.

If there is a technology or practice that the permittee wishes to use that isn't included in either of the referenced resources, then the permittee must document the technical basis for the practice and provide this information to Ecology for approval with their application for permit coverage.

Proposed Revisions to State-only Permit

Ecology modified this condition to provide additional direction on complying with the surface water discharge prohibition on land application fields in response to [Wash. State Dairy Fed'n v. Dep't of Ecology \(2021\)](#).

As with the Combined Permit, Ecology clarified that animals must be prohibited from the field discharge prevention areas established in special condition S4.M.

O. Manure Export

Ecology is not proposing changes to S4.O.

Export is a way for an operation to remove excess nutrients from its facility when the facility produces more nutrients than its cropping system can use. Ecology has purposely chosen to use the term **export** instead of "transfer" (as used in 40 CFR § 122.42(e)(3)) of waste from one entity to another to provide a distinction between permit requirements and the NRCS Waste Transfer practice (Practice 634).

These requirements are based upon 40 CFR § 122.42(e)(3)). However, because export is used on all types of CAFO facilities, these requirements are included in both the state and combined permits.

Properly exported nutrients are no longer the responsibility of the Permittee. Export requires the Permittee to relinquish control of the manure, litter, digestate, or process wastewater to another party. Whether the Permittee delivers the manure, litter, and process wastewater, or the receiving party picks it up from the Permittee, until the control of the waste changes hands, the Permittee is responsible for managing the manure, litter, and process wastewater in a manner that prevents discharges. Examples of when export (and therefore control changing hands) occurring are provided in the permit. These are intended to clarify Ecology's position as to who the responsible party is should waste be discharged during the process of exporting waste. Examples of when waste export occurs, include, but are not limited to:

1. After the Permittee has completed delivery of waste to storage facilities of another party. In this case, if the Permittee is using its equipment to deliver waste, the receiving

party has no control over the waste until it is delivered. Because the Permittee maintains control until that point, it is still responsible if there is a discharge until each delivery is completed and control changes to the receiving party.

2. Another party picks waste up from the Permittee. The waste does not get applied to any fields the Permittee controls. In this case, the Permittee is in control of the waste until the waste is loaded into the receiving party's equipment and is off the Permittee's facility. Until that occurs, all permit requirements apply.
3. When a Permittee applies waste to a field, or fields, at the request of the person in control of the field. In this case, the Permittee is applying waste it controls to a field that it does not control. While waste application (and incorporation if supplied by the Permittee) is occurring, the Permittee is responsible for ensuring that there is no discharge from the field. The Permittee is also responsible for applying the amount and rate of manure, litter, or process wastewater specified by the person in control of the field. Once the application of manure, litter, or process wastewater is complete, then the transfer occurs because the Permittee is no longer in control.
4. A Permittee as a custom applicator. At times, a Permittee could apply manure, litter, or process wastewater not generated at the Permittee's facility to fields that another party controls. In this case the Permittee would be regulated for discharges the same as a non-permitted custom applicator. If the party in control of the field is another livestock operation (e.g. AFO), a discharge could result in that party being required to apply for CAFO permit coverage.

As part of the waste export process, the Permittee is required by 40 CFR § 122.42(e)(3) to provide the waste recipient with the most recent manure nutrient analysis. The Permittee must keep records of the date, waste recipient name, address, parcel the manure, litter, and process wastewater will be applied to and the approximate amount of water transferred to the recipient.

Another process is used by some producers where export takes place on the facility before manure is moved off-site. In this situation another party (contracted composter for lack of a better term) processes ("composting" or drying) manure solids on-site and then sells the processed manure solids for various purposes. The export occurs when control of the manure solids changes from the Permittee to the contracted composter even though the contracted composter is operating on the Permittee's facility. In order to ensure whole-facility nutrient balance, the amount of manure exported to the contracted composter must be tracked by the Permittee. However, even though the exported manure is still on-site, control has changed hands so any sales or movement of the processed manure off-site is not required to be tracked by the Permittee.

For those that are exporting digestate from digesters, nutrient analysis is required within the last 5000 cubic yards generated (WAC 173-350-250(2)(a) Table 250-A (3) and WAC 173-350-220(1)(b) Table 220-A (3-5) and WAC 173-350-220(4)(a)(x)(B)).

P. Emergency Procedures

Part of preventing and controlling discharges is planning for emergency situations when infrastructure fails. All emergency situations are not expected to be covered in the plan. What is expected is that the Permittee will consider the types of infrastructure failure that are likely to happen. Based on the types of possible failures, develop a general plan of how to deal with the problem. (WAC 173-226-070(3)). For example, if a pipe on the production area bursts the plan is to shut off flow to the pipe (bypassing with temporary pipe if necessary) until the pipe is repaired.

Proposed Revisions

The draft permits added the requirement for emergency procedures to include discharge sampling. Procedures for discharge sampling are in special condition S5.E Surface Water Monitoring.

Q. Training

Ecology is not proposing changes to S4.Q.

Ensuring facility infrastructure is maintained and problems are corrected promptly is a way of ensuring that discharges from the facility beyond those allowed by the permit do not occur. Visual inspections (i.e. monitoring) is a way to do this.

This permit condition was included to suggest a possible avenue for how visual inspection of the facility may be integrated into the work the Permittee and their employees are already performing, thus reducing the burden on the permitted facility. Visual inspection does not have to be separate from daily tasks. During routine work, the Permittee and their employees could look for the inspection items required in permit condition S5.A. If a problem is noticed as the Permittee or employee is performing their routine work, it could then be reported to the Permittee or designated individual during or after shift via a record sheet. If no problems are noted, a checkbox on the record sheet to this affect could be used.

S5. MONITORING

Ecology has the authority to require monitoring deemed reasonably necessary to ensure permit compliance(WAC 173-226-090). Monitoring is usually associated with collection and analysis of a discharge, for example monitoring effluent from a pipe. CAFOs covered under these permits however, do not have a continuous discharge to monitor. Monitoring for permit compliance on CAFOs should be in the form of facility inspections and sampling and nutrient analysis necessary to make safe nutrient applications. Permittees are required to keep records of monitoring activities for a minimum of five years (special condition S6), and periodically report the results to Ecology (special condition S7).

A. Operating and Maintenance

Ecology is not proposing changes to S5.A.

This condition requires the permittee to conduct routine, visual inspections of facility infrastructure and is important to identifying potential pollution issues early, before an unauthorized discharge occurs. The routine visual inspections are based on 40 CFR §412.37 and 412.47, which require large CAFOs to perform routine, visual inspections. The requirements and facilities are similar enough that Ecology requires all Permittees, as a good practice, to perform the same routine inspections. State regulations (WAC 173-226-070(3)(d)) allow Ecology to impose additional requirements to prevent or control discharges from spillage or leaks or materials handling or storage.

B. Manure, Litter, Process Wastewater, and Other Organic By-Products

This condition requires nutrient sampling be conducted according to the referenced university guidance and analyzed for the listed parameters. The permittee uses the results in preparing and following the field-specific nutrient budget (special condition S4.J), retains the records for five years (special condition S6), and reports the data to Ecology annually (special condition S7).

In order to know the amount of nutrients that should be applied to a crop field, the amount of nutrients in the various sources that will be used must be known (along with crop nutrient needs and nutrients already available in the soil). Sampling and analysis of nutrient sources provides this information.

In order to ensure that Permittee's appropriately calculate the amount of nutrient that they will land apply, sampling and testing of all the nutrient sources used by the Permittee is being required. Nutrient sources are the manure, litter, process wastewater, digestate, chemical fertilizer or other nutrient sources generated on site or imported to a facility. Chemical fertilizers have a certified nutrient analysis provided on the product container so they are not required to be sampled and tested.

The amount of nutrients contained in waste is going to depend on type of manure, method of collection and storage, kind and amount of bedding or litter used, and amount and type of feed. This is going to be different for every operation.

Book values are estimates but do not take into account differences between operations. Different herds, weather, storage, and local soil conditions all influence the amount of nutrients in the various sources. Because of these variations, book values are not accurate for determining field nutrient balances and land application amounts.

There are two options for sampling waste that is going to be land applied. One option is to sample the waste while it is still in storage. The other is to sample what is actually being land applied at the time of application.

Both options present difficulties. The option of sampling the stored manure, litter, and process wastewater means that when actually applied it is likely to have a different nutrient content due to the handling/application process. However, this option provides a nutrient analysis upon which a land application amount may be determined.

Sampling during the actual application provides a more accurate representation of nutrients applied to a field. The downside is that the application rate is a guess. Actual nutrient analysis is completed sometime after application if finished. This may not be an issue early in the season, but may be during later season applications and may cause the Permittee to exceed the amount of nutrients needed on a field.

Handling waste generally causes the more volatile compounds to volatilize (e.g. ammonia). One assumption that may be made is that the amount of nutrients stored in the waste storage pond will actually be higher than what is applied on a field (losses can be roughly between 15 and 80% of volatile nutrients during land application). This over-estimates the amount of nutrients that are applied. This is a more conservative approach to land application. The Permittee may sample during waste application or more frequently as well if it chooses, but for permitting purposes, the Permittee must sample the waste stored in its pond.

The parameters chosen to be included in sample analysis are the minimums necessary to develop a field nutrient budget. 40 CFR § 122.41(j)(4) requires that Ecology use analysis methods included in 40 CFR § 136 unless another method is required by 40 CFR subchapters N or O.

Guidance for appropriate methods for gathering samples varies. Ecology has chosen to use university guidance documents PNW 570-E, EM 8832-E, PNW 533, and PNW 673.

Rationale for inclusion in State Permit

WAC 173-226-090(1) requires that discharges authorized by a general permit be subject to monitoring requirements. Generally this applies to discharges, however land application is a slightly different case. Because discharges to ground are being authorized by the permit, the amount of nutrients being discharged to ground must be monitored instead of the actual

discharge itself. This plus crop nutrient uptake (crop yields) and other information required by the permit provide the ability to analyze (at least in a gross fashion) how much nutrients are being discharged to ground and eventually groundwater.

For consistency between the two permits, the required parameters are the same. The land application taking place under both the state and combined permits are the same, so it is reasonable to ensure that the monitoring requirements are also equivalent. This also allows comparisons between the activities taking place under both permits to provide a broader set of data to better understand impacts from the permitted activity.

Rationale for inclusion in Combined Permit

In addition to the requirements of WAC 173-226-090, 40 CFR § 122.42(e)(1)(vii), 40 CFR § 412.37(b) and (c), and 40 CFR § 412.47(b) require monitoring. Both state and federal monitoring requirements are incorporated. As stated above, Ecology is aligning monitoring requirements between the state and combined permits.

Proposed Revisions

The draft permit proposes to substitute a different nitrogen parameter – Total Kjeldahl Nitrogen (TKN) – for the organic nitrogen parameter. Currently no laboratories are accredited for the organic N method by Ecology. The same information about nitrogen content can be obtained from the three parameters, nitrate, ammonia, and TKN. TKN is the total concentration of organic N and ammonia. Total N is the combination of TKN and nitrate. Therefore, if a permittee wished to use organic N or TN in their nutrient management planning, they can calculate it from the parameters proposed.

Ecology made formatting changes to the nitrate and ammonia parameters and updated the webpage URLs.

C. Soil Monitoring

This condition requires soil sampling be conducted according to the referenced university guidance and analyzed for the listed parameters. The permittee uses the results in preparing field-specific nutrient budget and assessing management practices (special condition S4.J and S4.K), retains the records for five years (special condition S6), and reports the data to Ecology annually (special condition S7).

In order to develop a balanced nutrient budget for a crop, the operator needs to know the amount of nutrients available in the soil. Regular sampling and analysis of field soils provides this information. The parameters chosen to be included in sample analysis are the minimums necessary to develop a field nutrient budget. Ecology is also somewhat constrained by the type of analysis it can use for permit requirements. 40 CFR §122.41(j)(4) requires that Ecology use analysis methods included in 40 CFR § 136 unless another method is required by 40 CFR subchapters N or O. Some parameters such as total nitrogen do not have approved methods.

However, the components of total nitrogen, nitrate + nitrite and total kjeldahl nitrogen, have Part 136 methods.

Guidance for appropriate methods for gathering samples varies. Ecology has chosen to use the university guidance documents PNW 570E and EM 8832E.

The parameters that must be analyzed are the same for both permits. The type of activities taking place under both the state and combined permits are the same, so it is reasonable to ensure that the monitoring requirements are also equivalent. This also allows comparisons between the activities taking place under both permits to provide a broader set of data to better understand impacts from the permitted activity.

In addition to the requirements of WAC 173-226-090, 40 CFR 122.42(e)(1)(vii), 40 CFR 412.37(b) and (c), and 40 CFR 412.47(b) require monitoring. Both state and federal monitoring requirements are incorporated. As stated above, Ecology is aligning monitoring requirements between the state and combined permits.

Proposed Revisions

The draft permit proposes to substitute a different nitrogen parameter, Total Kjeldahl Nitrogen (TKN), for the Ammonia-N/Ammonium-N parameter. In soils with high organic matter and fields receiving organic forms of N, a plant available form of N may be released over time. To estimate how much soil N may be made available to plants during a growing season, an estimate of the total N content is best. Total N can be calculated from the two N parameters proposed in the draft permits, TKN and nitrate-N. TKN is the total concentration of organic N and ammonia. Total N is the combination of TKN and nitrate.

Ecology made formatting changes to the nitrogen parameters and updated the webpage URLs. Changes were also made to clarify that the monitoring schedule requirements are located in special condition S4.I.

D. Groundwater Monitoring

Permits require the permittee to measure the discharge, as opposed to the receiving water. Permits and Permittees must also assure compliance with water quality standards. To do this, we use best management practices and monitoring of discharges.

In some instances, monitoring the discharge is difficult. On land treatment sites, the fate and transport of pollutants in the vadose zone is complex and site-specific. As [Ecology's Guidance on Land Treatment of Nutrients, Wastewater, with Emphasis on Nitrogen](#) indicates, monitoring may be required for waste water, soils, crops, and ground water.

Ecology's permitting approach in this permit cycle is to establish assessments of CAFO activities and use those to determine if there is a reasonable potential to impact ground water quality. Where there is early indication of a potential to cause or contribute to a violation of water quality standards, we require Permittees to follow the procedures in special condition S5.D.

Routine monitoring of an impact to groundwater is required when a groundwater evaluation confirms a potential impact. This permit condition is a procedure that Permittees must follow when directed to by assessment results in other parts of the permits.

Installing a groundwater monitoring network is a multi-step project. In special condition S5.D Ecology has broken the project up into five phases:

1. Developing the work plan
2. Implement the work plan
3. Report results
4. Install network
5. Begin quarterly monitoring and reporting

These phases were based on the guidance in [Ecology's Implementation Guidance for Groundwater Quality Standards](#)³⁷. Permittees must develop and receive Ecology approval on a work plan for evaluating impacts to groundwater. The groundwater evaluation must be submitted to Ecology and if the results confirm an impact to groundwater, the Permittee must install a monitoring network and begin quarterly monitoring of the parameters listed in Table 10. The groundwater monitoring parameters and sample types were based on guidance in [Ecology's Implementation Guidance for Groundwater Quality Standards](#)³⁸

Before monitoring for the parameters listed in Table 10 begins, the Permittee must notify Ecology so that electronic DMR submittals can be turned on in the reporting website, WQ Portal.

Proposed Revisions

Ecology is proposing to include the details on the steps required by the Implementation Guidance for Groundwater Guidance. We expect this will help permittees in planning should they be required to conduct groundwater monitoring activities. Authority to include these requirements is based upon 40 CFR 122.44(i) and WAC 173-226-090. These changes are made in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021).

E. Surface Water Monitoring

If any surface water discharge occurs from the production area, whether authorized or not, the permittee must collect grab samples representative of the discharge, analyze samples, and record an estimate of the volume of material discharged.

Permittees with coverage under the Combined permit must collect discharges to surface water from land application areas unless all the following are true:

³⁷ <https://apps.ecology.wa.gov/publications/SummaryPages/9602.html>

³⁸ <https://apps.ecology.wa.gov/publications/SummaryPages/9602.html>

1. The discharge was generated by precipitation,
2. The discharge was not from the production area,
3. The discharge was not caused by human activities (e.g. land application, irrigation) even if the activity took place during precipitation, and
4. The CAFO was operating in accordance with their site-specific nutrient management plan and maintains records demonstrating compliance.

If the above conditions are met, then a precipitation related surface water discharge from a land application field is agricultural stormwater and permittees do not need collect a sample.

Dry weather discharges are never considered agricultural stormwater. See the previous section in this fact sheet for a longer discussion on [agricultural stormwater](#).

Examples of surface water discharges that permittees must collect from:

1. Any discharge of pollutants from the production area.
2. Discharges from overflowing waste storage structures.
3. Discharges resulting from land application that occur during dry weather, including those from tile drains.
4. Stormwater discharges that do not meet the definition of agricultural stormwater.

In most cases, Ecology expects that grab samples will be collected directly from the overflow point from a manure storage structure or the production area before it reaches surface waters such as a ditch or stream. Subsurface discharges to surface waters, such as through drain pipes or tile drains, should be collected from the outfall. It is not always possible to sample runoff in locations such as ditches or pipes where the flow is channelized. Sometimes the permittee may need to sample sheet flow before it is channelized or reaches the receiving water. Approaches to sampling sheet flow are described in [Ecology's Stormwater Sampling Manual: A guide for the Industrial Stormwater General Permit](#)³⁹. This manual was developed for implementation of the Industrial Stormwater General Permit, but permittees may find the guidance helpful.

Discharges that are continuous for several days must be monitored until they stop. When a discharge occurs over multiple days, Ecology expects multiple samples to be collected. At a minimum, there should be one sample per day.

When conditions are unsafe for sample, for example during a flood event, the special condition S5.E directs the permittee to record basic information about the discharge and notify Ecology. When it is safe, the permittee must collect and analyze a sample.

The permittee must report the water quality sample results to Ecology through the WQ WebPortal. Permittees with waivers may submit results via mail to the address listed in special condition S7.A How to Submit Documents to Ecology.

³⁹ <https://apps.ecology.wa.gov/publications/SummaryPages/1503044.html>

Proposed Addition

Ecology is proposing to add this permit condition to respond to the findings in the 2021 Court of Appeals decision. Authority to include these requirements is based upon 40 CFR 122.44(i) and WAC 173-226-070.

F. Laboratory Accreditation

Ecology is not proposing changes to S5.E

All samples must be analyzed by a laboratory registered or accredited under the provisions of Accreditation of Environmental Laboratories, Chapter 173-50 WAC. Accredited laboratories in Washington State can be found through [Ecology's Lab Search Database](https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Laboratory-Accreditation)⁴⁰.

⁴⁰ <https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Laboratory-Accreditation>

S6 RECORD KEEPING

The reporting and recordkeeping requirements of permit condition S6 are based on federal and state laws and regulations, which allow Ecology to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges. Section 308(a)(3)(A)(v) of the Clean Water Act, 40 CFR § 122.41(j), and 40 CFR § 122.43(e) provide federal authority. RCW 90.48, WAC 173-226-090 and WAC 173-226-180 provide state authority. Keeping records and reporting provide practical measures that allow the Permittee, public, and Ecology to assess compliance with the requirements of this permit.

A. Operations and Maintenance

Ecology is not proposing changes to S6.A.

Permit condition S4.H allows a reduction in spring manure sampling after three years if certain conditions are met. Records are necessary to verify that the conditions are met. Ecology is not requiring submittal of the records supporting reduced spring manure sampling, however records of the three years of testing need to be available for inspectors to review, even if it requires retention of those records beyond the five year minimum period. Like all permits Ecology issues, records must be available from the Permittee upon request from Ecology.

Permit conditions S5.B and C specify the analysis methods that Permittees are required to have used to analyze soil and manure, litter, and process wastewater samples. This satisfies the record keeping requirements of 40 CFR § 122.42(e)(1)(ix) for 40 CFR § 122.42(e)(1)(vii). Results of analysis are submitted as part of annual reports and field nutrient budgets.

Permit condition S4.J specifies that the Permittee must follow the field nutrient budgets submitted to Ecology as required by permit condition S7.C. The permit specified that the Permittee must use the nutrient budget worksheet provided by Ecology. This determines how the Permittee calculates its nutrient budget. This satisfies the record keeping requirement of 40 CFR § 122.36. The annual report also includes reporting of the total amounts of nitrogen and phosphorus applied to land application fields from all sources, so additional record keeping is not necessary.

40 CFR § 412.37(b) further requires record keeping for:

1. Weekly inspection of all manure and contaminated water handling devices.
2. Weekly inspection of all clean water diversion devices.
3. Daily inspection of clean water (e.g. drinking, cooling) lines.
4. Weekly inspections of manure storage, noting the depth of manure in liquid manure storage.
5. Date, time, location, estimated volume of any overflow (waste storage pond).
6. Documenting actions correcting deficiencies.

These record keeping requirements are included in a monthly record keeping template that Ecology developed for Permittee use. Permittees are not required to use the template, however if a Permittee chooses not to use the template, the same information must be recorded, retained and provided to Ecology on request.

Records documenting current manure storage structures including volume, volume for solids build up (in liquid storage), design treatment volume, total volume, number of days of storage capacity are captured as part of the MPPP in permit condition S4.R so no further record keeping is necessary.

40 CFR § 412.37 requires record keeping of mortality management including how many mortalities and how they were handled. Ecology does not intend to require the Permittee to record this information so long as the livestock mortalities are handled in accordance with permit condition S4.G.

B. Land Application

Records of land application must be kept so that the Permittee may satisfy the annual reporting requirements in permit condition S7.C as required by 40 CFR § 122.42(e)(4).

Proposed Revisions

Ecology made several formatting changes to improve the readability of the permit condition. Ecology also clarified the requirement to maintain records of the amount of nutrients applied to land. The amount of nutrients, whether manure, litter, process wastewater, organic by-products or commercial fertilizer, can be reported in gallons, tons, cubic feet, or pounds per acre.

C. Export Records

Ecology is not proposing changes to S6.C.

Export is a way for an AFO to remove excess nutrients from its facility when the facility has more nutrients available than its cropping system can use. Ecology has purposely chosen to use the term export instead of “transfer” (as used in 40 CFR § 122.42(e)(3)) of waste from one entity to another. This is to help provide a distinction between permit requirements and the NRCS Waste Transfer practice (Practice 634) and to note that properly exported nutrients are no longer the responsibility of the Permittee. For an indepth discussion of manure exports under this permit, refer to special condition S4.N in this Fact Sheet.

These requirements are based upon 40 CFR § 122.42(e)(3)). However, because export is used on all types of CAFO facilities, these requirements are included in both the state and combined permits.

D. Monitoring Records

The draft permit proposes to relocate the requirement for recording monitoring samples from Special Condition S5.F Laboratory Accreditation (previously S5.E Accrediation) to the Records section of the permit. Ecology based Special Condition S6.D on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-216-110).

E. Providing Permit Records

Ecology is not proposing changes to S6.D.

This condition specifies how the Permittee's MPPP should be made available to Ecology and WSDA. Periodically, Ecology may have need to review the MPPP or other documents required by this permit and will submit a written request to the Permittee to submit the documents. The Permittee has 14 days to provide a copy. Additionally, reports and records required by the permit must be maintained on site and provided to Ecology or WSDA during inspections.

Reports and records that are submitted to Ecology are available from Ecology either through the public facing [permit database \(PARIS\)](https://apps.ecology.wa.gov/PARIS)⁴¹ once uploaded, or through a [public records request](https://ecology.wa.gov/Footer/Public-records-requests)⁴².

The requirements in this condition are derived from 40 CFR 122.41(h) and WAC 173-226-090(3)(a).

F. Records Retention

Ecology is not proposing changes to S6.E.

Permittees must keep all records and documents required by this permit for five years. Ecology based this permit condition on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-226-090). If there is any unresolved litigation regarding the discharge of pollutants by the Permittee, they must extend the period of record retention through the course of the litigation (WAC 173-226-190).

⁴¹ <https://apps.ecology.wa.gov/PARIS>

⁴² <https://ecology.wa.gov/Footer/Public-records-requests>

S7 REPORTS

The reporting and recordkeeping requirements of permit condition S7 are based on the federal and state authorities, which allow Ecology to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges. Section 308(a)(3)(A)(v) of the Clean Water Act and 40 CFR § 122.41(l) provide federal authority. RCW 90.48, WAC 173-226-090 and WAC 173-226-180 provide state authority. Keeping records and reporting provide practical measures that allow the Permittee and Ecology to assess compliance with the requirements of this permit.

A. Electronic Reporting Requirements

Proposed Addition

Ecology proposes to require electronic reporting unless a Permittee obtains a waiver. This proposed electronic reporting requirement is expected to save time and resources for permittees and Ecology (e.g., eliminating paperwork, data entry workload, database errors) while improving compliance and protection of water quality. It will also enhance transparency and public accountability.

The electronic reporting waiver provisions are intended to allow a paper option for small business that may not have the ability to use the Water Quality Web Portal system (e.g. they do not have broadband internet or a business computer). The permit contains mailing instructions for permittees who receive a waiver. Permittees are responsible for ensuring that their reports are received on time.

Electronic submittals are through [Ecology's Water Quality Permitting Portal](https://secureaccess.wa.gov/ecy/wqwebportal)⁴³. Ecology maintains guidance and provides technical assistance to Permittees at [Ecology's WQWeb Portal](https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance)⁴⁴.

The requirement for electronic submittal makes progress with Ecology's obligation to comply with EPA's NPDES Electronic Reporting Rule (40 CFR Parts 122, 123, 127, 403, 501 and 503). RCW 43.17.095 also requires Ecology to offer electronic reporting options.

B. Submittal of MPPP

The proposed permit requires CAFOs applying for permit coverage submit their initial MPPP to Ecology for review. Applicants must refer to special condition S2.A How to Apply for Permit Coverage for application instructions. The requirements for the MPPP are specified in special condition S4.A. Pollution Prevention Plan.

⁴³ <https://secureaccess.wa.gov/ecy/wqwebportal>

⁴⁴ <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance>

CAFO permittees who make changes to their MPPP must submit them to Ecology for review according to special condition S4.A.4. See the discussion in this fact sheet at special condition S4.A Pollution Prevention Plan for permit modification procedures.

Proposed Revisions

Ecology made revisions to this condition to address procedures for Nutrient Management Plans. See [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021).

C. Waste Storage Structure Assessment

As discussed in earlier in the [section on special condition S1.A](#), waste storage facility construction varies across CAFOs in Washington. The current industry standard for agricultural waste storage facility construction is NRCS Conservation Practice Standard 313. Agricultural engineers use NRCS' Agricultural Waste Management Field Handbook to design new and refurbish waste storage facilities to the Practice Standard.

Ecology based special condition S7.C on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-226-090). Because Permittees under the state permit and combined permit are likely to have liquid and solid waste storage facilities the requirements for the waste storage structure assessment are the same in both permits.

Liquid Waste Storage Structures

In response to comments on the draft version of the previous permit, Ecology required the use of NRCS Engineering Technical Note 23 – Assessment Procedure for Existing Waste Storage Ponds to assess existing waste storage ponds. NRCS Engineering Technical Note 23 is the current industry standard for scoring the structural and site risk of existing waste storage ponds. The benefit of using this assessment in the CAFO general permits is that the assessment may be a prerequisite for [financial assistance through NRCS conservation programs](#)⁴⁵.

This assessment involves (1) documenting the current waste storage pond site and structure conditions and (2) comparing it to NRCS criteria in place at the time of construction. The results of the assessment are summarized into four categories with two to three subcategories. In the assessment, NRCS provides recommendations for whether the pond should continue to be used or would benefit from repairs, improvements or replacement. NRCS recommends continued use of waste storage ponds in assessment categories 1A, 1B, and 2A. All other assessment categories, NRCS recommends the CAFO operator discontinue use of the pond until minor or major repairs are completed or the pond is completely replaced.

Special condition S7.C.2 in the draft permits requires Permittees with waste storage ponds that do not have leak detection systems to employ a **qualified expert** to assess the condition of the

⁴⁵ <https://www.nrcs.usda.gov/wps/portal/nrcs/main/wa/programs/farmbill/>

ponds using NRCS Engineering Technical Note 23 – Assessment Procedure for Existing Waste Storage Ponds. If the results of the assessment recommend repairs or replacement, the Permittee must discontinue use of the waste storage pond and submit a plan to fix deficiencies. If the assessment identifies there is less than two feet of vertical space between the pond liner and the seasonal high water table, the Permittee is required to address the noncompliance with S4.C. This is to ensure identified problems are addressed to prevent water quality impacts.

Permittees are required to develop a plan to fix major deficiencies in the waste storage within 6 months and complete the work within 18 months of completing the waste storage pond assessment. Ecology used the Memorandum of Understanding between Ecology and the Conservation Districts to set the timeline for developing a plan to address high risk storage ponds. Ecology expects that in most cases, the Conservation Districts and NRCS will be involved in making improvements to existing waste storage ponds.

Ecology recognizes that in some circumstances major repairs or refurbishments of the waste storage ponds may take longer than 18 months, so an extension of time may be requested and approved through a modification of permit. Modification of permit coverage requires publically noticing the change request and it's technical basis.

Solid Waste Storage Structures

The draft permit conditions in S7.C.3 and 4 include assessment procedures for solids storage and composting areas where solid manure, bedding, and other organic by-products are dried, stacked, and sometimes composted for further use. It does not address disposal or composting of animal mortalities. Refer to special condition S4.G Livestock Mortality Management.

The draft permits require an assessment of the condition of the surface on which the solid material is stored or composted. Ecology approached the solid storage area assessment in a way similar to the liquid storage facilities. Structures that can be visually monitored for compliance with the requirements in S4.C. (impervious surfaces) have a different procedure than structures on soil pads. Ecology is requiring Permittees demonstrate adequate compaction in special condition S7.C.4. The assessment requires an evaluation by a qualified expert to confirm compliance with S4.C. Alternatively, a Permittee may submit results from a double-ring infiltrometer test. If the assessment identifies deficiencies in the structure, Permittees must collect and analyze soil samples from beneath the soil pad in addition to making repairs to the soil pad. If the results from the assessment and soil sampling indicate a reasonable potential to impact groundwater, Ecology will require a groundwater monitoring evaluation that follows procedures in S5.D.

Proposed Revisions

Ecology is proposing to require that all deficiencies identified in the assessment(s) be addressed within 18 months of the assessment. Previously, the permit condition required the repairs or replacement of waste storage ponds to reach Category 1. This was infeasible for some ponds

assessed as categories 3C or 4 due to site conditions. For example a pond built in an area of medium to high aquifer susceptibility with well-draining soils, will only ever reach Category 2A, regardless of modifications that reduce risk to water quality. In situations where the site risk is medium or high, the NRCS Agricultural Waste Management Field Handbook recommends considering other means of protecting the groundwater from discharges, such as a synthetic liner with a leak detection system. Ecology proposes to replace the requirement in the previous permit with NRCS' recommendation in Technical Note 23 to discontinue use until structural repairs are completed and additional practices to reduce discharge potential in the event of a structural failure are considered.

Ecology is clarifying that when deficiencies are identified in the assessment (i.e. medium or high structure risk), the permittee must discontinue using the waste storage pond until repairs are complete. This applies to all risk categories, including 2A and 2B. Previously, special condition S7.C did not specify the need for repairs to waste storage ponds in risk categories 2A and 2B, however S4.B required liquid storage structures to be repaired as necessary. The requirement introduced in S7.C is based on the recommended actions in Technical Note 23 and references the requirement in S4.B. This clarification was made to ensure that potential discharges are not made worse by continued use. These changes are made in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021).

Ecology is also proposing to address the need to define who is qualified to assess the condition of waste storage facilities and the risk to water quality. By specifying that only a "qualified expert" can conduct the waste storage assessment, Ecology is ensuring the results of the risk assessment are reliable and protective. Qualified expert is defined in Appendix A of the permit as "Individuals who: (1) Have received professional training in the aspects of waste storage facility design and construction; and (2) Are capable of evaluating the conditions of the facility that could impact water quality at the site as required by this permit." In the case of the waste storage ponds, if NRCS staff does not conduct assessment, then a qualified expert such as a professional engineer must conduct the assessment.

Ecology included requirements for evaluating the condition of solid storage structures. When manure, litter, and other solid organic-by products are stored in piles, their decomposition may produce leachate or contaminated runoff. The proposed assessment confirms compliance with S4.C and includes procedure when deficiencies are identified. These changes are made in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021).

D. Annual Report

WAC 173-226-090(3) requires that Permittees periodically report to Ecology. 40 CFR § 122.42(4)(i)–(viii) describes the federal annual reporting requirements for permitted CAFOs. All nine requirements were included in this form. In order to align the annual reporting requirements between Federal and State regulations, Ecology is requiring reporting on an annual basis in both permits.

The annual reporting form developed by Ecology as part of the draft permit contain the required reporting elements. The form is included in Appendix A of the permit and is accessible from [Ecology's CAFO Permit webpage](#)⁴⁶.

Field Nutrient Budgets

Ecology is prescriptive with minimum technical and operating standards in order to shift the permit paradigm away from the review and approval process set in Federal CAFO rules. The yearly field nutrient budget submittal is one of the pieces necessary to make this process work.

Each year, along with the annual report, the Permittee must submit a field nutrient budget for each field that they own, operate, lease, or otherwise control for land application. This does two things for the Permittee. First, it allows the Permittee to easily change fields in response to changing leases or other agreements. Fields that the Permittee owns, operates, leases, or otherwise controls can change on a yearly basis, which under the Federal CAFO rule requires a revision of the NMP, approval by Ecology, public notice, and a public comment period. Second, this allows the Permittee to change the crops they choose to grow on a yearly basis (which may otherwise require the review process). Based on the Federal CAFO rule, a NMP would need to include the crops that a Permittee is planning to grow for the next 5 years. In this scenario, any changes to require an update of the NMP, and approval by Ecology. Ecology posts these field nutrient budgets, along with the annual report, every year through our [permitting database PARIS](#)⁴⁷.

Field nutrient budgets are required to be submitted along with the annual report each year for each field that the Permittee controls. The nutrient budget is the expression of permit limits for land application of manure, litter, and process wastewater in terms of how much will actually be applied to each field over a season.

Proposed Revisions

Ecology is proposing formatting changes to this permit condition after multiple permittees failed to submit all of the required pieces in the annual report—the completed form, yearly nutrient budgets, and the certification statement. We expect this change will make the requirement clearer.

⁴⁶ <https://ecology.wa.gov/cafo>

⁴⁷ <https://apps.ecology.wa.gov/PARIS>

Ecology is proposing to require permittees to report the date samples were collected for the post-harvest soil tests. This will help Ecology better interpret results and determine compliance with S4.I. This change is reflected in annual report form appended to the permit. WAC 173-226-180 authorizes Ecology to establish permit conditions as necessary to achieve compliance with effluent standards, water quality standard, discharge limits, and other applicable requirements.

E. Reporting Permit Violations

These conditions require that the Permittee report instances of noncompliance to Ecology within 24-hours of becoming aware of an instance of noncompliance (e.g. unauthorized discharge) and follow up with a written report within five days. This type of reporting provides practical measures that allow the Permittee, public, and Ecology to assess noncompliance with the requirements of this permit and potential impacts to waters of the state.

The timing of noncompliance reporting and reports that must be submitted are the same as those in the combined permit based on 40 CFR § 122.41(l)(6) in order to maintain consistency across the two permits which cover the same type of activities.

Failure to report noncompliance is a violation of the permit and may constitute grounds for enforcement actions or termination of the permit coverage.

Permittees are required to report noncompliance to Ecology within 24-hours of the Permittee becoming aware of the instance of noncompliance. This must be followed up within five days with a written report detailing the noncompliance unless Ecology agrees to waive the written report.

CAFOs operate continuously in order to ensure that animals are cared for appropriately. It is likely that instances of noncompliance that occur outside of the 8am-5pm business hours. In the instances of noncompliance outside of standard business hours Permittees could leave a voice message instead of waiting until business hours the next day to report the noncompliance. A phone message in this case is like an email in that the receiver is not present for the message, but receives it at later date. For these reasons Ecology is providing the option for the Permittee to submit 24-hour noncompliance notification to Ecology via email. The option to report the noncompliance via phone call or voice message are still available.

Both the 24-hour report and the five day written report must both contain the information specified in 40 CFR § 122.41(l)(6). The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

WAC 173-226-180 authorizes Ecology to establish permit conditions as necessary to achieve compliance with effluent standards, water quality standard, discharge limits, and other applicable requirements. In addition to state requirements Federal regulations at 40 CFR §

122.41(l)(6) specifies when and how a Permittee must report noncompliance with their permit that may endanger human health or the environment. Ecology requires that if a Permittee violates permit conditions, it must take steps to stop the activity, minimize any violations, and report those violations to Ecology.

Proposed Revisions

Ecology is proposing to add the requirement to collect and analyze samples when discharges occurs. These changes are made in response to [Wash. State Dairy Fed'n v. Dep't of Ecology](#) (2021). Authority to include these requirements is based upon 40 CFR 122.44(i) and WAC 173-226-070.

Additionally, Ecology added the requirement that permittees contact regional phone numbers that accept reports 24 hours a day. This is to ensure that inspection staff at Ecology and WSDA receive timely notice.

F. Spills Reporting

Ecology is not proposing changes to the requirement in S7.F, but did change the title from S7.E to S7.F.

The Permittee must be prepared to mitigate for any potential hazardous spills and, in the event of a spill, perform the necessary cleanup, and notify the appropriate Ecology regional office (see RCW 90.48.080, and WAC 173-226-070).

RCW 90.56.280 and chapter 173-303-145 WAC require Permittees to report spills of oil or hazardous materials. The phone numbers for the Washington Emergency Management Division and National Response Center are provided in the permit.

S8 APPENDICES

Appendix A: Definitions and Appendix B: Annual Report are incorporated by reference into this permit.

Proposed Revisions

Ecology added three definitions to the permits. A definition of qualified expert was needed to clarify requirements for conducting assessments of waste storage facilities. The two climate types used in the permit were defined to improve readability in sections that referenced annual average precipitation amounts. Ecology also revised the term for lagoons to waste storage ponds to better align with NRCS' terminology.

Minor changes were made to the Annual Report in Appendix B. Ecology made several formatting changes to improve document accessibility for blind and low vision web users. Ecology updated the animal types listed to match those in the Permit Fee Rules (WAC 173-224).

Ecology is also proposing to require permittees to report the date samples were collected for the post-harvest soil tests.

GENERAL CONDITIONS

Ecology is not proposing changes to the General Conditions.

General Conditions are based on state and federal law and regulations and have been standardized for all NPDES and State Waste Discharge permits issued by the Ecology. Some of these conditions were developed for different types of discharges. Although Ecology is required by federal regulation to include them in the permit, they may not be strictly applicable.

General Conditions are the same in both CAFO permits.

G1 DISCHARGE VIOLATIONS

This condition requires discharges and activities authorized by the draft permit to be consistent with the terms and conditions of the permit in accordance with 40 CFR §122.41.

G2 PROPER OPERATION AND MAINTENANCE

This condition requires the Permittee to properly operate and maintain the facility systems that are intended to achieve compliance with the permit in accordance with 40 CFR 122.41(e) and WAC 173-226-080(1)(h).

G3 RIGHT OF ENTRY

This condition requires the Permittee to allow Ecology to access the facility and conduct inspections of the facility and records related to the permit in accordance with 40 CFR §122.41(i), RCW 90.48.090, and WAC 173-220-150(1)(e).

G4 PERMIT COVERAGE REVOKED

This condition identifies conditions for revoking coverage under the general permit in accordance with 40 CFR §122.62, 40 CFR §124.5, WAC 173-226-240, WAC 173-220-150(1)(d), and WAC 173-220-190.

G5 GENERAL PERMIT MODIFICATION AND REVOCATION

This condition identifies conditions that may result in modifying or revoking the general permit in accordance with 40 CFR §122.62, 40 CFR §124.5, and WAC 173-226-230.

G6 REPORTING A CAUSE FOR MODIFICATION

This condition requires the Permittee to notify Ecology when facility changes may require modification or revocation of permit coverage in accordance with 40 CFR §122.62(a), 40 CFR §122.41(l), WAC 173-220-150(1)(b), and WAC 173-201A-510(1).

G7 TOXIC POLLUTANTS

This condition requires the Permittee to comply with more stringent toxic effluent standards or prohibitions established under Section 307(a) of the Clean Water Act in accordance with 40 CFR §122.41(a)(1), WAC 173-220-120(5), and WAC 173-201A-240. It is included only in the Combined permit.

G8 OTHER REQUIREMENTS OF 40 CFR

This condition incorporates all other requirements of 40 CFR §122.41 and 122.42 by reference. It is included only in the Combined permit.

G9 COMPLIANCE WITH OTHER LAWS AND STATUTES

This condition prohibits the Permittee from using the permit as a basis for violating any laws, statutes or regulations in accordance with 40 CFR §122.5(c).

G10 ADDITIONAL MONITORING

This condition notifies the Permittee that additional monitoring requirements may be established by Ecology in accordance with 40 CFR §122.41(h). Ecology plans to develop procedures for additional monitoring requirements for CAFOs that have unauthorized discharges under the permit. These additional monitoring requirements would be site-specific and issued through an Administrative Order or a Compliance Schedule.

G11 PAYMENT OF FEES

RCW 90.48.465 requires Ecology to recover the cost of the water quality permit program. CAFO and dairy fees are established through a rule development process. Any new fee proposal will provide public comment opportunity in amending the existing fee regulation (Chapter 173-224 WAC).

Some facilities may qualify for and receive an extreme hardship fee reduction under the Wastewater Discharge Permit Fee Rule (Chapter 173-224 WAC). Extreme hardship applies only if the annual sales of goods or services produced using the processes regulated under the permit is \$100,000 or less and the fee poses an extreme hardship to the business.

G12 REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER A GENERAL PERMIT

This general condition specifies that Permittees may request their general permit coverage be replaced by an individual permit in accordance with 40 CFR 122.62, 40 CFR 124.5, and WAC 173-220-040.

G13 PENALTIES FOR VIOLATING PERMIT CONDITIONS

This condition describes the penalties for violating permit conditions in accordance with 40 CFR §122.41(a)(2) and

G14 SIGNATORY REQUIREMENTS

This condition requires responsible officials or their designated representatives to sign submittals to Ecology in accordance with 40 CFR §122.22, 40 CFR §122.22(d), WAC 173-220-210(3)(b), and WAC 173-220-040(5).

G15 APPEALS

This condition defines appeal options for the terms and conditions of the general permit and of coverage under the permit by an individual discharger in accordance with RCW 43.21B and WAC 173-226-190.

G16 SEVERABILITY

This condition invokes severability of permit provisions in accordance with RCW 90.48.904.

G17 DUTY TO REAPPLY

This condition requires the Permittee to reapply for coverage 180 days prior to the expiration date of this general permit in accordance with 40 CFR §122.21(d), 40 CFR §122.41(b), and WAC 183-220-180(2).

G18 MONITORING BEYOND PERMIT REQUIREMENTS

If the permittee conducts additional monitoring to document compliance, with this permit, the sampling and analysis must be an EPA-approved method. In certain circumstances where an EPA-approved test method is not available, Ecology may specify alternatives. This condition is in accordance with 40 CFR §122.41(l)(4)(iii). It is included only in the Combined permit.

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2. Review is by staff internal to Department of Ecology.
3. Review is by persons that are external to and selected by the Department of Ecology.
4. Documented open public review process that is not limited to invited organizations or individuals.
5. Federal and state statutes.
6. Court and hearings board decisions.
7. Federal and state administrative rules and regulations
8. Policy and regulatory documents adopted by local governments.
9. Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under other processes.
10. Records of best professional judgment of Department of Ecology employees or other individuals.
11. Sources of information that do not fit into one of the other categories listed.

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- Waste Discharge General Permit Program, WAC 173-226. Available from: [Classification: 7]
- Waste Discharge Permit Fees, WAC 173-224. [Classification: 7]
- Dairy Nutrient Management Act, Revised Code Washington (RCW) 90.64.[Classification: 5]
- Water Pollution Control, RCW 90.48. [Classification: 5]

Water Pollution Prevention and Control, 33 USC § 1251 etc. (2014). [Classification: 5]

Water Quality Standards for Groundwaters of the State of Washington, WAC 173-200.
[Classification: 7]

Water Quality Standards for Surface Waters of the State of Washington, WAC 173-201A.
[Classification: 7]

Water Resources Act of 1971 RCW 90.54. [Classification: 5]

Waterkeeper Alliance, Inc v. U. S. Env'tl. Prot. Agency, 399F.3d 486 (2nd Cir. 2005)
[Classification: 6]

APPENDICES

APPENDIX A: GLOSSARY OF TERMS

All definitions listed below are for use in the context of this permit only.

25-year, 24-hour Storm Event: Means the amount of precipitation from a 24-hour storm event that has the likelihood of occurring once in a 25-year period. The amount of precipitation from a storm event of this type varies by location.

Agricultural Stormwater: Discharges to surface water from land application fields generated only by precipitation provided that the following are true:

1. The discharge was not from the **production area**,
2. The discharge was not caused by human activities even if the activity took place during precipitation, and
3. Permittee is in compliance with their CAFO permit.

All known, available, and reasonable methods of prevention, control, and treatment (AKART):

A technology-based approach of engineering and economic decision-making for limiting pollutants from discharges. AKART represents the most current methodology for preventing, controlling, and abating pollution that can be reasonably installed or used at a reasonable cost. Described in chapters 90.48 and 90.54 RCW and chapters 173-201A, 173-204, 173-216 and 173-220 WAC.

Applicant: The person or entity applying for permit coverage.

Application for Coverage: Means the form developed by Ecology used by a discharger to apply for coverage under a **general permit**. It is specific to each general permit. Also referred to as a **Notice of Intent** or **NOI**.

Application Rate: Means the rate in quantity per acre (e.g. gallons/acre, tons/acre) that manure, litter, process waste, process wastewater, or other nutrients from all sources are applied to a land application field.

Beneficial Use: Means all existing and future uses of waters of the state as defined in WAC's 173-200-020(4), 173-201A-020, and 173-216-030(1). All uses have the same priority.

Best Management Practices (BMPs): Mean schedules of activities, prohibitions on practices, maintenance procedures, and other management techniques or strategies to prevent or reduce the discharge to **waters of the state**. BMPs also include treatment requirements, operating procedures, and physical interventions and barriers to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Control: Performing, directing, managing, overseeing, supervising, or giving instruction about, any action or decision.

Composite Sample: A series of grab samples collected over several locations within a field or **management unit** and combined together.

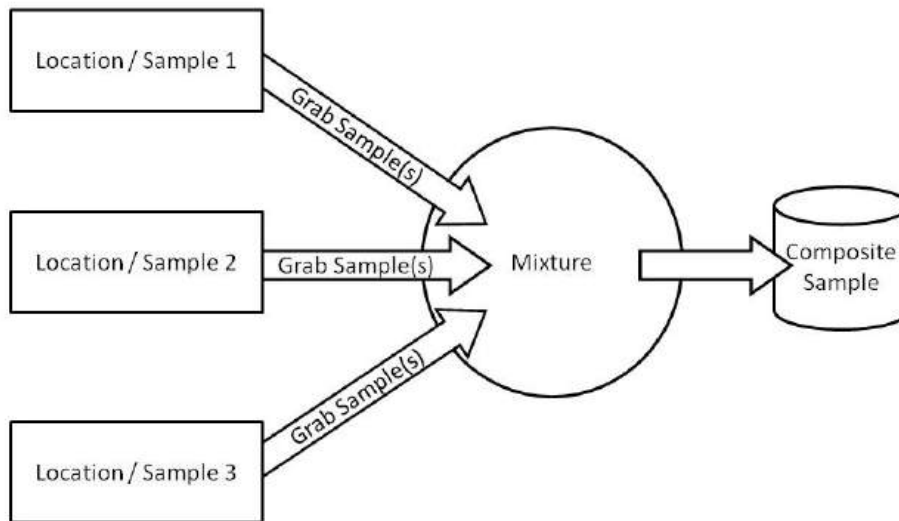


Figure 1 Composite Sample

Crest: Means the highest point of the structural (e.g. embankment) wall of a **waste storage pond** or other liquid storage structure.

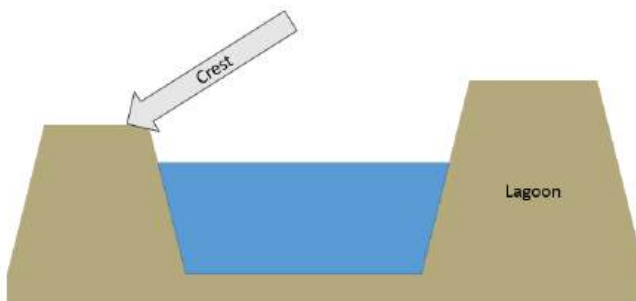


Figure 2 Crest of a waste storage structure

Discharge: Means the addition of any **pollutant** or combination of pollutants to **waters of the state**.

Discharger: Means the owner or operator of any commercial or industrial operation subject to regulation under chapter 90.48 RCW or the federal Clean Water Act due to a **discharge**.

Effluent Limitation: Means any restriction on timing, quantities, rates, and concentrations of **pollutants** discharged from point sources into waters of the state. Includes **best management practices**.

Existing Operation: An operation that began operating prior to the issuance date of this permit.

Export: Means the removal of manure, litter, and process wastewater, or other sources of nutrients from the CAFO's production system to another party that is not under the **control** of the Permittee.

Feed: Materials used for animal nutrition or that will be processed and used for animal nutrition that are stored by the CAFO such as silage, grain, vegetable leavings, or other materials used for animal nutrition.

Freeboard: Means the vertical distance from the maximum storage level (including normal storage plus storage volume for a 25-year, 24-hour storm event) of a waste storage pond to the lowest point on the pond **crest**.

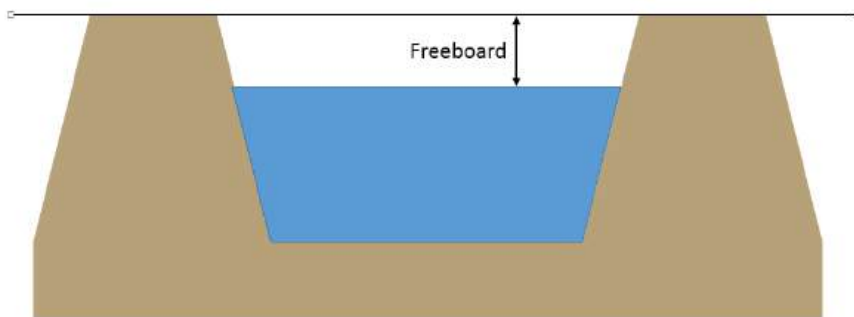


Figure 3 Freeboard

General Permit: Means a permit that covers multiple dischargers of a point source category within a designated geographical area in lieu of issuing individual site-specific permits to each discharger.

Geomembrane Liner: Means a type of waste storage pond liner material that is a synthetic polymer such as reinforced polypropylene, high density polyethylene (HDPE), or polyvinyl chloride (PVC) and that is usually between 35 and 60 mil thick.

Groundwater: Water located below the surface of the ground that is a **water of the state**. Surficially perched water is groundwater (Douma v. Ecology PCHB 00-019).

Indian Country: Means as defined in 18 USC 1151: "Except as otherwise provided in sections 1154 and 1156 of this title, the term "Indian country", as used in this chapter, means (a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation, (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state, and (c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same."

Land Apply/Application: Means the process of putting manure, litter, process waste, process wastewater, or other sources of nutrients on to a field to provide nutrients for crop growth.

Land Application Field: Means a single contiguous land unit under the control of the CAFO (excluding the production area) to which manure, litter, process wastewater, or other sources of crop nutrients are applied as a fertilizer or soil amendment.

Litter: Animal bedding, materials used in animal housing such as straw, sand, or shavings on the floor, or spilled **feed** that has come into contact with manure or other contaminants.

Management Unit: Means portions of a field or portions of multiple closely located fields which have the same or very similar soil and crop growth characteristics which allow them to be managed as a single **land application field**.

Manure: Liquid and solid livestock excrement.

New Operation: An operation that began operation after the issuance date of this permit.

Notice of Intent (NOI): A formal application or request for coverage under a **general permit** pursuant to WAC 173-226-200. See also **Application for Coverage**.

Notice of Termination (NOT): A request by the **Permittee** to Ecology to end the Permittee's permit coverage because the facility no longer requires a permit.

Over-Top: The addition of manure, litter, process waste, process wastewater, liquid, or other material including precipitation, to a waste storage pond until the level of the liquid in the pond rises over the pond **crest**.

Permit: Means an authorization, license, or equivalent control document issued by Ecology to implement chapter 90.48 RCW, the federal Clean Water Act, and associated statutes by allowing discharges of pollutants to **waters of the state** within constraints.

Permittee: Means the person or entity that holds a permit coverage allowing specific discharge(s) to waters of the state (surface or ground).

Point Source: Means 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.

Pollutant/Pollution: Means such contamination, or other alteration of the physical, chemical or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to

domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

It also means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

Process Wastewater: Any water that is used as part of the operation of a CAFO that has come into contact with **manure, litter, feed**, or digestate from anaerobic digesters, is used in the processing of products (e.g. egg washing) by the CAFO, or otherwise comes into contact with contaminants on the CAFO.

Production Area: Means the locations making up a CAFO facility that are used for animal confinement, **manure, litter, feed**, and **process wastewater** storage, product processing facilities (e.g. milking parlor, egg washing, feed mixing), and other areas used for the storage, handling, treatment, processing, or movement of raw materials, products, or wastes. This includes manure stockpiled on fields.

Sanitary Control Area: Means **groundwater** source protection areas as defined in WAC 246-290-135.

Saturated Soil: Means soil that no longer has the capacity to retain additional water within its pore structure.

Silage Leachate: Seepage from silage piles in bags, bunkers, silos, or other silage storage areas.

Synthetic Liner: Synonymous with **Geomembrane Liner**.

Top of the Bank: Means the point on the edge of a field past which the land drops quickly down into a drainage ditch, surface water, or depression in the land.

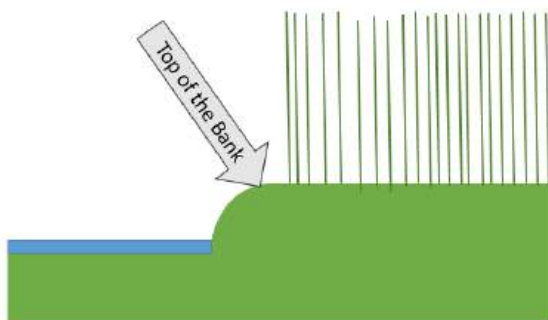


Figure 4 Top of the bank

Total Maximum Daily Load (TMDL): A calculation of the maximum amount of a pollutant that a water body can receive and still meet state water quality standards. Percentages of the total

maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations include a "margin of safety" to ensure that the water body can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation also accounts for seasonable variation in water quality.

Trust or Restricted Lands: Means as defined in 25 USC § 2201(4): “(i) ‘trust or restricted lands’ means lands, title to which is held by the United States in trust for an Indian tribe or individual, or which is held by an Indian tribe or individual subject to a restriction by the United States against alienation; and (ii) ‘trust or restricted interest in land’ or ‘trust or restricted interest in a parcel of land’ means an interest in land, the title to which interest is held in trust by the United States for an Indian tribe or individual, or which is held by an Indian tribe or individual subject to a restriction by the United States against alienation.”

Upset: Means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. See 40 CFR § 122.41.

Waste: Means discarded materials.

Waste Storage Pond: Means a structure designed for storage of liquid manure, process wastewater, digestate, or other liquids or slurries. May also be referred to as a temporary storage pond or lagoon.

Water Table: Means the level at, and below, which the ground is completely saturated with water.

Waters of the State: Includes lakes, rivers, ponds, streams, inland waters, underground waters (*groundwater*), salt waters and all other surface waters and watercourses within the jurisdiction of the state of Washington (RCW 90.48.020).

- **Water Quality Standards:** Means the current state and federal standards for water quality including, but not limited to: Surface Waters of the State of Washington (chapter 173-201A WAC).
- Ground Water Quality Standards (chapter 173-200 WAC).
- Sediment Management Standards (chapter 173-204 WAC).
- Human health based criteria in the National Toxics Rule (40 CFR § 131.36).

APPENDIX B: ACRONYMS AND UNITS OF MEASURE

AFO: Animal Feeding Operation

AKART: All known, available, and reasonable methods of pollution control, prevention, and treatment

BAT: Best Available Technology Economically Achievable

BCT: Best Conventional Pollutant Control Technology

BPJ: Best Professional Judgment

BPT: Best Practicable Control Technology Currently Available

BOD: Biological Oxygen Demand

CAFO: Concentrated/Confined Animal Feeding Operation

CFR: Code of Federal Regulations

COD: Chemical Oxygen Demand

CWA: Federal Clean Water Act

DNMA: Dairy Nutrient Management Act, chapter 90.64 RCW

EPA: United States Environmental Protection Agency

FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

FWPCA: Federal Water Pollution Control Act, synonym for CWA

MOA: Memorandum of Agreement

MPPP: Manure Pollution Prevention Plan

NMP: Nutrient Management Plan

NOI: Notice of Intent (also referred to as the Application for Coverage)

NOT: Notice of Termination

NPDES: National Pollutant Discharge Elimination System

NRCS: Natural Resource Conservation Service

NSPS: New Source Performance Standards

PCHB: Pollution Control Hearings Board

RCW: Revised Code of Washington

SEPA: State Environmental Policy Act, RCW 43.21C, WAC 197-11

TMDL: Total Maximum Daily Load

TSP: Technical Service Provider

WAC: Washington Administrative Code

WSDA: Washington State Department of Agriculture

USC: United State Code

USDA: United States Department of Agriculture

APPENDIX C: RESPONSE TO COMMENTS

Ecology will append responses to comments after the public comment periods has concluded.

Issuance Date: December 7, 2022

Effective Date: January 6, 2023

Expiration Date: January 5, 2028

CONCENTRATED ANIMAL FEEDING OPERATION GENERAL PERMIT

A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
AND STATE WASTE DISCHARGE GENERAL PERMIT

State of Washington
Department of Ecology
Olympia, Washington

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

Until this permit expires, is modified or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions, which follow.



Vincent McGowan, P.E.
Water Quality Program Manager
Washington State Department of Ecology

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TABLE OF CONTENTS

TABLE OF CONTENTS	3
LIST OF TABLES	4
LIST OF FIGURES	5
ADA ACCESSIBILITY	5
SUMMARY OF PERMIT SUBMITTALS	6
SPECIAL CONDITIONS	8
S1. PERMIT COVERAGE	8
S2. PERMIT ADMINISTRATION	10
S3. DISCHARGE LIMITS	14
S4. MANURE POLLUTION PREVENTION	15
S5. MONITORING	36
S6. RECORD KEEPING	46
S7. REPORTS AND SUBMITTALS	48
S8. APPENDICES.....	52
GENERAL CONDITIONS	53
G1. DISCHARGE VIOLATIONS	53
G2. PROPER OPERATION AND MAINTENANCE	53
G3. RIGHT OF ENTRY	53
G4. PERMIT COVERAGE REVOKED	53
G5. GENERAL PERMIT MODIFICATION AND REVOCATION	54
G6. REPORTING A CAUSE FOR MODIFICATION.....	54
G7. TOXIC POLLUTANTS	54
G8. OTHER REQUIREMENTS OF 40 CFR	55
G9. COMPLIANCE WITH OTHER LAWS AND STATUTES	55
G10. ADDITIONAL MONITORING	55
G11. PAYMENT OF FEES	55
G12. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER A GENERAL PERMIT	55

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS	56
G14. SIGNATORY REQUIREMENTS	56
G15. APPEALS	57
G16. SEVERABILITY	57
G17. DUTY TO REAPPLY.....	57
G18. MONITORING BEYOND PERMIT REQUIREMENTS	58
APPENDIX A: Definitions.....	59
APPENDIX B: CAFO General Permit Annual Report Form	67
Permittee Information	67
Operator Information.....	67
Facility Information	67
Discharge Information	68
Nutrient Source Content Analysis.....	69
Field Application Information	70
Field Nutrient Budgets	72
Certification.....	72
Paper Submittal Instructions.....	72
Questions	72
APPENDIX C: Nitrate Priority Areas	74

LIST OF TABLES

Table 1 Summary of Permit Reports and Submittals.....	6
Table 2 Size of CAFO by Animal Type.....	9
Table 3 Field Risk Level	30
Table 4 Adaptive Management Actions for areas in drier climates	32
Table 5 Adaptive Management Actions for areas in wetter climates	33
Table 6 Routine Visual Inspections	36
Table 7 Manure, Litter, and Process Wastewater Sampling	37
Table 8 Pre-Land Application Soil Monitoring	38
Table 9 Post-Harvest Soil Monitoring	39
Table 10 Groundwater monitoring	42

Table 11 Surface Water Monitoring	44

LIST OF FIGURES

Figure 1 Composite Sample	60
Figure 2 Crest of a waste storage structure.....	60
Figure 3 Freeboard.....	61
Figure 4 Top of the Bank.....	65

ADA ACCESSIBILITY

To request ADA Accommodation, contact Water Quality Reception at 360-407-6600 or visit [Ecology's ADA Accessibility web page](https://ecology.wa.gov/accessibility)¹. For Relay Services or TTY call 711 or 877-833-6341.

For document translation services, call Water Quality Reception at 360-407-6600. Por publicaciones en español, por favor llame Water Quality Reception al 360-407-6600.

¹ <https://ecology.wa.gov/accessibility>

SUMMARY OF PERMIT SUBMITTALS

Refer to the Special and General Conditions for details on permit report and submittal requirements. The text of this permit contains words and phrases in ***bold and italics***. These words and phrases are the first usage in the permit and are defined in Appendix A.

Table 1 Summary of Permit Reports and Submittals

Permit Section	Forms & Reports	Description	Frequency	First Due Date
S2.A	Permit Application (i.e. Notice of Intent, NOI)	Applying for permit coverage and submitting initial MPPP	One-time	As necessary
S2.D	Transfer form	Transfer Permit Coverage To a New Owner or Operator	As necessary	Prior to transfer
S2.E	Termination request form	Applying for cancellation of permit coverage	As necessary	As necessary
S4.A.5	Update the MPPP	Update the MPPP	As necessary	30 days from a change or 14 days from a notification of deficiency
S4.K.5.a	Email to Ecology	Prior to making any emergency land applications	As necessary	As necessary
S4.K.5.d	Email to Ecology	After making any emergency land applications	As necessary	Within 24 hours of the emergency land application
S4.K.5.e	Compliance Plan	Compliance Plan following emergency land applications	As necessary	Within 6 months of the emergency land application
S4.K.5.f	Time extension request	Extend deadline for compliance plans for emergency land applications	As necessary	As necessary
S4.L	Nutrient Budgets for Very High Risk Fields	Proposing a nutrient budget for the upcoming growing season	As necessary	Ecology must provide written approval prior to application
S5.D.1.a;	Groundwater Monitoring Work Plan	Monitoring Plan for Medium and Large CAFOs located in Nitrate Priority Areas	One-time; As necessary	Within 6 months of receiving permit coverage
S5.D.2.a	Groundwater Monitoring Work Plan	Groundwater evaluation study plan for Small CAFOs and all CAFOs located outside of Nitrate	As necessary	Within 6 months of receiving Ecology's determination

Permit Section	Forms & Reports	Description	Frequency	First Due Date
		Priority Areas meeting certain conditions		
S5.D.2.c	Groundwater Evaluation Study Results	Results of groundwater evaluation study for CAFOs meeting certain conditions	As necessary	As necessary
S5.D.1.c; S5.D.2.e	Begin Groundwater Monitoring Notification	CAFOs required to monitor groundwater water	One-time; As necessary	30 days before first monitoring report
S5.E	Phone Call to Ecology	Reporting surface water discharge	As necessary	As necessary
S5.E	Reporting Results from a Surface Water Discharge	Laboratory results of water quality samples collected after a discharge	As necessary	As necessary
S6	Ecology Request for Permit Records	Providing items such as updated MPPP or land application records	As necessary	Within 14 days of Ecology's written request
S7.C	Storage Structure Assessment	Compliance reports for each solid and liquid storage structure	One-time	Within 2 years of permit coverage
S7.C	Storage Structure Repair and Improvement Plan	Plan for repairs and improvements to waste storage structures	One-time; As necessary	6 months after initial storage assessment
S7.D	Annual Report	Report of production numbers, monitoring results, and land applications	Annually	February 1, 2024
S7.E	Reporting Permit Violations	Verbal and written notifications of permit violations	Each noncompliance	Within 24 hours and in 5 days
S7.F	Spills Reporting	Verbal report of spills oil or hazardous materials	Each noncompliance	Within 24 hours
G6	Permit Modification	Significant change in production or process	As necessary	Prior to change
G17	Permit Application	Renewal of permit coverage	One-time	180 days before expiration date of this general permit

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

S1.A. Facilities Required to Seek Coverage under This General Permit

This **permit** applies to lots or facilities (other than aquatic animal production facilities) defined as concentrated animal feeding operations (CAFOs) in 40 CFR 122.23. The permit requires the owner or operator of a CAFO to apply for coverage under this permit if all of the following conditions are met:

- The facility has a **discharge** to surface water, or to surface and **groundwater**.²
- Animals are or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period.³
- Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility where the animals are confined.
- The facility is either a medium or large CAFO as defined in Table 2, or Ecology has designated the facility a significant contributor of **pollutants** to **waters of the state** in accordance with the procedures in S1.A.1 below.

1. How Ecology Determines Significant Contributors of Pollutants

Facilities that meet all of the above conditions, but do not meet the definition of a medium or large CAFO may be designated a small CAFO if Ecology determines the facility is a significant contributor of pollutants under 40 CFR 122.23(c).

If Ecology has designated the CAFO to be a significant contributor of pollutants to surface water, the owner or operator of a small CAFO must apply for coverage under this permit.

2. Multiple Facilities with common ownership

Two or more CAFOs under common ownership are considered a single CAFO for the purposes of permitting if they adjoin each other or if they use a common area or system for handling **manure, litter, process wastewater, and other organic by-products**.

² CAFOs discharging only to groundwater must apply for coverage under either this permit or the CAFO State Waste Discharge General Permit.

³ The same animal individuals need not be confined for the entire 45 day period.

Table 2 Size of CAFO by Animal Type

Animal Type	Number of Animals in Medium CAFO ^c	Number of Animals in Large CAFO ^d
Mature Dairy Cows ^a	200-699	700 or more
Veal Calves	300-999	1,000 or more
Other Cattle ^b	300-999	1,000 or more
Swine (55 lbs. or more)	750-2,499	2,500 or more
Swine (less than 55 lbs.)	3,000-10,000	10,000 or more
Horses	150-499	500 or more
Sheep and Lambs	3,000-9,999	10,000 or more
Turkeys	16,500-54,999	55,000 or more
Laying Hens or Broilers, with liquid waste system	9,000-29,999	30,000 or more
Chickens, other than layers, with dry waste system	37,500-124,999	125,000 or more
Laying Hens, with dry waste system	25,000-81,999	82,000 or more
Ducks, with liquid waste system	10,000-29,999	30,000 or more
Ducks, with dry waste system	1,500-4,999	5,000 or more

^a Milked or Dry^b Including, but not limited to Heifers, Steers, Bulls, Cow/Calf Pairs^c 40 CFR 122.23(b)(6)^d 40 CFR 122.23(b)(4)**S1.B. Activities Covered Under This Permit**

This statewide **general permit** conditionally authorizes the discharge of pollutants to both surface and groundwater from the **production area** and **land application fields** that result from operating a CAFO.

S1.C. Geographic Area Covered

This permit covers the activities listed in special condition S1.A within the State of Washington. This permit does not apply to **Indian Country** and **trust or restricted lands** except portions of the Puyallup Reservation as noted. Puyallup Exception: Following the Puyallup Tribe of Indians Land Claims Settlement Act of 1989, 25 U.S.C. §1773; this permit does apply to land within the Puyallup Reservation except for discharges to surface water on land held in trust by the federal government.

Some conditions in this permit include separate requirements for wetter and drier climates. **Wetter climates** are defined as receiving 25 inches of precipitation or more per year, while **drier climates** are defined as receiving 25 inches of precipitation or less annually.

S2. PERMIT ADMINISTRATION

S2.A. How to Apply for Permit Coverage

Unpermitted CAFOs seeking coverage under this permit must do the following:

1. Submit an application

Submit a complete and signed **Notice of Intent** form (NOI) and a Manure Pollution Prevention Plan (MPPP) that meets the requirements of special conditions S4 *Manure Pollution Prevention* in this permit. A Responsible Person, in accordance with General Condition G14 *Signatory Requirements*, must sign the signature page of the NOI and submit it to Ecology.

Submit the NOI and MPPP using Ecology's Water Quality Permitting Portal. If the **applicant** is unable to submit electronically (for example, they do not have access to the internet), contact Ecology to request an Electronic Reporting Waiver form and submit the completed form to Ecology at:

Department of Ecology
Water Quality Program
Attn: CAFO Permit Administrator
PO Box 47600
Olympia, WA 98504

2. Revise application, if needed

Ecology will review the NOI and MPPP for completeness and may request additional information from the applicant if it is necessary to complete the NOI and MPPP or to clarify, modify, or supplement previously submitted material. Ecology will notify the applicant of the application's status within 30 days.

3. Publish public notice

When Ecology determines that the NOI and MPPP are complete, the applicant must publish a public notice using the template on the NOI. The public notice must be published once a week for two (2) weeks with at least seven (7) days between publications in a single newspaper of general circulation in the county where the operation is located.

Publish the public notice only after Ecology has made a preliminary determination and notified the applicant in writing that the **application for coverage** is complete.

The second publication date of the public notice starts a thirty (30)-day public comment period. At the end of the thirty (30)-day public comment period, Ecology will consider any comments received about the applicability of this permit to the operation before issuing a decision on permit coverage pursuant to special condition S2.B *When Permit Coverage is Effective*.

Ecology may, at its option, publish public notice of multiple applications for coverage under this permit at one time in the Washington State Register (WSR) which is published the first and third Wednesday of the month. If Ecology publishes public notice in the WSR, the permit coverage timeline will be longer than the timeline listed in special condition S2.B *When Permit Coverage is Effective*.

S2.B. When Permit Coverage is Effective

Ecology will notify the applicant in writing of the final decision. Once Ecology issues permit coverage, the CAFO owner or operator who applied for coverage becomes a **Permittee**.

When Ecology needs additional time to reach a decision, we will notify the applicant in writing within 30 days of receiving the application for coverage and identify the issues that the applicant must resolve before Ecology can reach a decision. Ecology may need additional time to review the application:

1. If the application is incomplete.
2. If the application requires additional site-specific information.
3. If the public requests a public hearing about the applicability or non-applicability of this permit to the operation proposed for coverage.
4. If members of the public submit comments.
5. When more information is necessary to determine whether coverage under the general permit is appropriate.

S2.C. How to Transfer Permit Coverage

Coverage under this general permit shall automatically transfer to a new **discharger**, if all of the following conditions are met:

1. The original Permittee and the new Permittee submit to Ecology a complete, written, signed agreement (Transfer of Coverage Form) containing a specific date for transfer of permit responsibility, coverage and liability. The Transfer of Coverage form is available on the [CAFO permit webpage](https://ecology.wa.gov/cafo)⁴.
2. The volume and characteristics of the wastewater and management practices remain substantially unchanged.
3. Ecology does not notify the Permittee of the need to submit a new application for coverage under the general permit or for an individual permit pursuant to Chapters 173-216, 173-220, and 173-226 WAC.

The original Permittee remains responsible for, and subject to, all permit conditions and permit fees until the transfer of permit coverage is effective.

⁴ <https://ecology.wa.gov/cafo>

As part of the transfer, the original Permittee must supply the new Permittee with copies of all permit documents, based on current facility conditions, used to comply with this permit.

Once the permit has been transferred, the new Permittee is required to use the existing permit documents (e.g. MPPP) provided by the original Permittee until the new Permittee updates the documents to reflect any changes to facility operation the new Permittee makes.

S2.D. How to Terminate Permit Coverage

1. Eligibility for Terminating Permit Coverage

A Permittee may request termination of their permit coverage when one of the following conditions is met:

- a. The Permittee can document that they no longer have a discharge to surface or groundwater from their production area or land application fields except for **agricultural stormwater** from their land application fields.
- b. The Permittee did not have a discharge but voluntarily obtained permit coverage, no longer wishes to be covered by this permit, and the Permittee has or had no discharge to surface or groundwater from their production area or land application fields except for agricultural stormwater from their land application fields.
- c. The Permittee operates a CAFO and reduces the CAFO size to a small CAFO pursuant to special condition S1.A *Facilities Required to Seek Coverage under This General Permit*. When Ecology receives a request to terminate permit coverage because of a reduction in facility size to a small CAFO, Ecology will make a significant contributor determination pursuant to special condition S1.A.1. *How Ecology Determines Significant Contributors of Pollutants* to determine if the CAFO must remain covered by the permit.
- d. The Permittee no longer meets the definition of a CAFO pursuant to special condition S1.A. *Facilities Required to Seek Coverage under This General Permit*.

2. Facility Cleaning Requirements

If the Permittee no longer meets the definition of a CAFO pursuant to special condition S1.A. *Facilities Required to Seek Coverage under This General Permit*, the permittee must clean, re-purpose, or decommission facility infrastructure that will no longer be used. The following facility cleaning and re-purposing requirements must be completed before the termination of permit coverage:

- a. All manure, litter, **feed**, process wastewater, and other organic by-products must be removed from storage, management, and other facility infrastructure and land applied in accordance with the Permittee's yearly nutrient budgets, or **exported** in accordance special condition S4.O *Manure Export* as appropriate.

- b. All manure, litter, feed, process wastewater, and other organic by-product management systems and facilities that could fill with water from precipitation must be flushed with clean water. The water from flushing must be land applied in accordance with the Permittee's yearly nutrient budgets or exported in accordance with special condition S4.O *Manure Export*.
- c. After flushing/cleaning, if the manure, litter, feed, process wastewater, and other organic by-product storage, management, and other facility infrastructure will no longer be used, the infrastructure must be modified, if necessary, so it is not a conduit for any pollutants to enter surface or groundwater.
- d. Temporary closures, permanent decommissioning, or other changes to **waste storage ponds** must follow the relevant requirements in special condition S4.C.4 *Waste Storage Pond Closure Procedures*.

3. Requesting Termination of Permit Coverage

The Permittee may request termination of permit coverage using the **Notice of Termination** form available on the [CAFO permit webpage](https://ecology.wa.gov/cafo)⁵. The Permittee must submit the signed form through [Ecology's Water Quality Permitting Portal](https://secureaccess.wa.gov/ecy/wqwebportal)⁶.

If the Permittee is unable to submit electronically (for example, they do not have access to the internet), they must contact Ecology to request an Electronic Reporting Waiver form and submit the completed form to Ecology at:

Department of Ecology
Water Quality Program
Attn: CAFO Permit Administrator
PO Box 47600
Olympia, WA 98504

The termination of permit coverage is effective on the date 61 days after Ecology receives the complete Notice of Termination form, unless Ecology notifies the Permittee in writing that their request is denied because either the Permittee has not met the eligibility requirements or information is insufficient to make a determination.

The Permittee will continue to incur an annual permit fee (chapter 173-224 WAC) until they submit a completed Notice of Termination form signed in accordance with general condition G14 and Ecology terminates the permit coverage. The Permittee will receive a letter from Ecology notifying them that their permit coverage is terminated.

⁵ <https://ecology.wa.gov/cafo>

⁶ <https://secureaccess.wa.gov/ecy/wqwebportal>

S3. DISCHARGE LIMITS

Discharges conditionally authorized by this permit must not cause or contribute to a violation of **water quality standards**. Discharges not in compliance with these standards are not authorized. The Permittee must also be in compliance with other discharge limits (e.g. special condition S4. Manure Pollution Prevention) in order for discharges to be conditionally authorized.

S3.A Total Maximum Daily Loads (TMDL)

Discharges conditionally authorized by this permit to waterbodies which have an EPA-approved TMDL must not exceed an established waste load allocation for CAFOs. Discharges not consistent with an approved TMDL are not authorized. To determine if a discharge may be to a waterbody with a TMDL in place, refer to [Ecology's list of TMDLs](https://ecology.wa.gov/TMDLs)⁷.

S3.B Impaired Waterbodies

Discharges conditionally authorized by this permit to an EPA-approved 303(d)-listed waterbody (Category 5) that do not have a completed TMDL in place must not contain the pollutant(s) for which the waterbody is listed as impaired.

To determine if a discharge may occur to an impaired waterbody, refer to [Ecology's impaired waterbody database](https://ecology.wa.gov/303d)⁸.

S3.C Production Area

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 both conditions are met:

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 storm event** for the location of the facility and still have waste storage pond design **freeboard**; and
2. The production area is operated in accordance with the applicable inspection, maintenance, recordkeeping, and reporting requirements of this permit.

⁷ <https://ecology.wa.gov/TMDLs>

⁸ <https://ecology.wa.gov/303d>

S3.D Land Application Fields

The Permittee is prohibited from discharging manure, litter, feed, process wastewater, or other organic by-products from their land application fields, unless the discharge meets the definition of agricultural stormwater.

S4. MANURE POLLUTION PREVENTION

S4.A Pollution Prevention Plan

1. General Requirements

All Permittees and applicants for coverage under this permit must prepare, keep up-to-date, and implement a Manure Pollution Prevention Plan (MPPP) for their CAFO. The MPPP must specify the site-specific practices and procedures that:

- Meet the pollution prevention performance objectives in special conditions S4.A through S4.Q.
- Ensure the discharge of manure, litter, process wastewater, other organic by-products, and other sources of **pollution** related to the operation of a CAFO does not cause or contribute to a violation of the water quality standards.
- Comply with applicable federal requirements in 40 CFR 122.42(e)(1).

The MPPP must include a narrative description of how the CAFO will meet the performance objectives in special conditions S4.A through S4.Q and, if applicable, drawings or diagrams of facility infrastructure. If a performance objective in special conditions S4.A through S4.Q does not apply to a facility, the Permittee or applicant must explain why the performance objective does not apply to their operation.

Some permit conditions include separate requirements for wetter and drier climates. **Wetter climates** are defined as receiving 25 inches of precipitation or more per year, while **drier climates** are defined as receiving 25 inches of precipitation or less annually.

The Permittee or applicant must prepare and submit their initial MPPP with the application for permit coverage or renewal according to procedures in special condition S2.A. *How to Apply for Permit Coverage* and general condition G17 *Duty to Reapply*.

When permit coverage is granted, the MPPP becomes an enforceable **effluent limitation** of the permit and the permittee must implement the MPPP.

2. Production Area Drawings and Maps

The MPPP must have map and/or aerial photos of the CAFO production area clearly indicating the location of the following items:

- a. Solid and liquid manure and process wastewater storage structures (e.g. pits, tanks), including those used for moving liquid manure and process wastewater around the facility.
- b. Composting facilities.
- c. Feed storage (e.g. silage bunker) structures.
- d. Known underground piping for liquid manure and process wastewater.
- e. Electrical lines that control pumps or valves that if broken would result in uncontrolled flow of liquid manure or process wastewater.
- f. Animal housing.
- g. Areas where animal mortalities are stored or composted.
- h. Direction(s) of run-off or overland flow on the production area.
- i. Groundwater wells, noting their use (e.g. drinking, livestock watering, irrigation) and well tag or ID number.

3. Land Application Drawings and Maps

The MPPP must have maps and/or aerial photos of the land application fields clearly indicating the following items:

- a. A unique field identifier (e.g. field name, field code, name used for WSDA Dairy Nutrient Management Program required records) for each field that will be used to reference the field on all permit records and reports.
- b. Field discharge management practice location, type, and width (special condition S4.N *Field Discharge Management Practices*).
- c. Other areas that must not have manure, litter, process wastewater, or other organic by-products applied to them because application to those areas would result in a discharge.
- d. Known tile drain inlets and outlets.

4. Facility Information

The following documentation about the Permittee's facility must be included in the MPPP and kept up-to-date as changes are made to the facility.

- a. Information about existing site conditions (topography, drainage, soils, vegetation, etc.).
- b. The maximum number of animals the current infrastructure was designed to manage and store manure, litter, process wastewater, or other organic by-products from.
- c. Potential surface or groundwater discharge problem areas (e.g. high risk areas).

- d. Whether the facility is located within an area where there are higher risk conditions for groundwater contamination. Use Ecology's Nitrate Priority Areas Map in Appendix C to determine if the facility is within a priority area.
 - i. If the facility is located within a **Nitrate Priority Area**, the applicant must complete the requirements in S5.D *Groundwater Monitoring*.
 - ii. If a facility is located outside of a Nitrate Priority Area, the facility may be required to monitor groundwater if the groundwater impact monitoring (special condition S4.L) or the results of waste storage structure assessment (special condition S7.C) indicates that an adverse impact to groundwater may be occurring. See the requirements in S5.D *Groundwater Monitoring*.
- e. The total long-term storage capacity for all manure, litter, feed, process wastewater, and other organic by-product storage structures (e.g. waste storage pond, above ground or in-ground storage tank, bunker, concrete storage pad). This does not include structures intended to only hold manure, litter, feed, process wastewater, or other organic by-products on a temporary basis while pumping from one location to another or while processing the materials, for example pits used for pumping liquid manure from one location to another or equipment/buildings used to process feed into a mixed ration. This also does not include structures used to control clean water pursuant to special condition S4.E *Diversion of Clean Water*.
- f. Information about each storage structure. The MPPP must include:
 - The total designed storage volume.
 - The number of days of storage capacity as designed and as currently maintained.
 - Design treatment volume (liquid storage structures only).
 - Volume available for solids build-up (liquid storage structures only).
 - Leak detection plan if the storage structure has a leak detection system. The plan must describe how the Permittee will test and monitor for leaks.

5. Update of the MPPP

a. When the Permittee proposes changes to the facility

Whenever the permittee proposes a change in design, construction, operation, or maintenance of the Permittee's facility infrastructure that will increase the risk of manure, litter, feed, process wastewater, or other organic by-products entering surface or groundwaters, the Permittee must update their MPPP and submit the updated MPPP at least 60 days prior to implementing any proposed changes.

Ecology will review the modified MPPP and may request additional information to clarify, modify, or supplement previously submitted material. If Ecology determines the changes to the modified MPPP are substantial, we will notify the Permittee of the need to publish public notice.

When Ecology determines that the modified MPPP is complete, the Permittee must publish a public notice using the template on the Coverage Modification form. The public notice must be published once a week for two (2) weeks with at least seven (7) days between publications in a single newspaper of general circulation in the county where the operation is located.

The second publication date of the public notice starts a thirty (30)-day public comment period. At the end of the thirty (30)-day public comment period, Ecology will consider any comments received on the proposed changes before issuing a decision on the coverage modification.

b. When Ecology, WSDA, or Permittee assessments require MPPP updates

If Ecology or WSDA staff determine that the MPPP is, or would be, ineffective in eliminating discharges not authorized by this permit, the Permittee must submit an updated MPPP within 14 days of a notification of the deficiency by Ecology or WSDA. The Permittee must also immediately begin the process to fully implement and maintain appropriate source control and/or treatment practices, addressing the deficiencies no later than 45 days from date of notification.

If Permittee assessments per S4.K.5, S7.C, or S7.E identify deficiencies, the Permittee must update the MPPP and submit it to Ecology along with the associated repair or compliance plans according to the timelines set in the applicable special condition.

If installation of necessary infrastructure or practices is not feasible within 45 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 45-day period.

Ecology will review the modified MPPP and may request additional information to clarify, modify, or supplement previously submitted material. If Ecology determines the changes to the modified MPPP are substantial, we will notify the Permittee of the need to publish public notice. If the permittee requests a time extension for facility improvement, public noticing is required. To publish a public notice, the Permittee must use the template on the Coverage Modification form. The public notice must be published once a week for two (2) weeks with at least seven (7) days between publications in a single newspaper of general circulation in the county where the operation is located.

The second publication date of the public notice starts a thirty (30)-day public comment period. At the end of the thirty (30)-day public comment period,

Ecology will consider any comments received on the proposed changes before issuing a decision on the coverage modification.

c. When the Permittee proposes alternatives

Permittees proposing alternative procedures or practices under S4.J.3 *Application Restrictions* or S4.N *Field Discharge Management Practices* must submit a modified MPPP with supporting information. Ecology will review the proposal and may request additional information to clarify, modify, or supplement previously submitted material.

When Ecology determines that the modified MPPP is complete, the Permittee must publish a public notice using the template on the Coverage Modification form. The public notice must be published once a week for two (2) weeks with at least seven (7) days between publications in a single newspaper of general circulation in the county where the operation is located.

The second publication date of the public notice starts a thirty (30)-day public comment period. At the end of the thirty (30)-day public comment period, Ecology will consider any comments received on the proposed changes before issuing a decision on the coverage modification.

S4.B Production Area Run-off Controls

The Permittee must prevent discharges to surface water from its production area except in accordance with special condition S3.C *Production Area*. The confinement areas, and waste handling and waste storage facilities must be 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.

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. Materials cleaned-up on from the roadway must be disposed of appropriately and may not be placed in ditches, other conduits to surface or groundwater, or left along right-of-ways.

Vegetated treatment areas may be used to treat and infiltrate run-off into the ground, provided the treatment area's hydraulic capacity is greater than design flows and the vegetation cover is suitable to the site and run-off treatment performance needs. A site is not suitable if the vegetated treatment area will cause a violation of groundwater standards. The Permittee must document the treatment design, including nutrient uptake and hydraulic capacity, and the operation and maintenance plan in the MPPP.

If a discharge to surface waters occurs from the production area, including a vegetated treatment area, the discharge must be monitored according to S5.E *Surface Water Monitoring*.

S4.C Storage of Manure, Litter, Process Wastewater, Other Organic By-Product, and Feed

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 in order to comply with special condition S3 *Discharge Limits*. The following are performance objectives for storage of liquid and solid materials:

1. Liquid Waste Storage Structures

Liquid waste storage structures must be 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.

Liquid waste storage structures must be designed, constructed, and maintained to have a maximum water specific discharge of $1 \times 10^{-6} \text{cm}^3/\text{cm}^2/\text{s}$ without consideration for manure sealing and there must be a minimum of two feet of vertical separation between the bottom of the waste storage pond (inside the pond above the liner) and the seasonal high **water table**.

Design and installation of waste storage ponds and other liquid storage structures being built, expanded, or having major refurbishment must be overseen by a licensed professional engineer.

Permittees must have a depth gauge in each liquid storage structure that clearly indicates the minimum capacity necessary to contain the contaminated runoff and direct precipitation from a 25-year, 24 hour precipitation event and still have design freeboard.

2. Solid Materials Storage Facilities

Permittees must design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants from solid manure, litter, compost, and feed storage areas. At a minimum:

- a. Locate structures on impervious surfaces (such as concrete) or soil pads with low permeability.
- b. Direct contaminated runoff to structures designed to store liquid manure and process wastewater or through a vegetated treatment area designed and operated in accordance with S4.B *Production Area Run-off Controls*.
- c. If the storage area is covered (e.g. tarp, roof), divert clean water in accordance with special condition S4.E *Diversion of Clean Water*.

3. Maintain Storage Facilities

The permittee must conduct weekly visual inspections of manure, litter, process wastewater, other organic by-product, and feed storage facilities according to provisions in special condition S5.A *Operations and Maintenance*. If a storage

facility is equipped with a leak detection system, the permittee must monitor for leaks according to the leak detection plan included in the MPPP.

The Permittee must prevent damage and maintain the integrity of their storage facilities by controlling vegetation and animals on the structure and by repairing structures as necessary to bring it back up to design specifications.

If necessary, the Permittee must periodically remove accumulated solids from liquid storage structures in order to maintain design volume. Ensure that any liner in the liquid storage structure is not damaged during maintenance. The MPPP must specify how leaks, if using a **synthetic liner** (e.g. punctures in the plastic), will be detected and repaired.

4. Waste Storage Pond Closure Procedures

d. Temporary Closures

If the Permittee has a waste storage pond or other liquid storage structure that is temporarily not in use, but will be used again, the pond must be maintained as though it were in use so that it remains in good working order.

e. Permanent Decommissioning

If a waste storage pond or other liquid storage structure is being decommissioned, the permittee must render the pond unusable and minimize the risk of leftover nutrients converting to mobile forms (e.g. ammonia to nitrate) which pose a risk to groundwater by implementing the following requirements:

- i. Any manure, litter, feed, process wastewater, or other organic by-products contained in the structure must be removed and land applied in accordance with the Permittees yearly nutrient budgets or exported in accordance with special condition S4.O *Manure Export*.
- ii. If converting the site to another use requires complete removal of the structure, high nutrient soils above grade must be land applied according to the Permittee's yearly nutrient budgets (special condition S4.K.1 *Annual Field-Specific Crop Nutrient Budget*) or exported in accordance with special condition S4.O *Manure Export*.
- iii. If the pond has a synthetic liner, the liner must be removed and disposed of or recycled in a lawful manner. If the liner prevented nutrients from building up in the soils of the structure, special condition S4.C.4.b.ii above does not apply.
- iv. After completion of special condition S4.C.4.b.i through S4.C.4.b.iii, any earthen structure must be filled with soil, made unable to contain liquid, or returned to grade matching the surrounding area. All exposed soil must be seeded with site appropriate plant species or site appropriate land management implemented to prevent erosion unless

the Permittee is planning to build a structure on the site where the waste storage pond existed within 3 months of pond decommissioning.

f. Use as Irrigation Pond

If a waste storage pond or other liquid storage structure will no longer be used to store manure, litter, process wastewater, or other organic by-products, and will be used as an irrigation pond the Permittee must remove all manure, litter, feed, process wastewater, or other organic by-products, and **land apply** the removed materials in accordance with their yearly field nutrient budgets or exported in accordance with special condition S4.O *Manure Export*.

S4.D. Other Above and Below Ground Infrastructure

The Permittee must operate and maintain infrastructure used on-site to prevent discharges due to physical failure of the infrastructure.

Other infrastructure (such as pipes, valves, tile lines, etc.) used to manage manure, litter, feed, process wastewater, and other organic by-products must be regularly inspected according to special condition S5.A *Operations and Maintenance* and tested (if applicable) to ensure it is in proper working order. Results from inspections must be used to make repairs or replacements to infrastructure in a timely manner. Document the reasons that repairs were not completed in a timely manner in the Manure Pollution Prevention Plan (MPPP) and include a schedule of when the work will be completed.

Discharge to groundwater from backflow through wells is prohibited and must be prevented.

S4.E Diversion of Clean Water

Clean water that has not come into contact with manure, litter, feed, process wastewater, other organic by-products, or other contaminants generated by the CAFO may be diverted from the CAFO production area instead of being stored. Clean water must be diverted to a location that is able to handle the volume of clean water generated and not cause other water quality problems (e.g. erosion, sediment build-up, flooding).

If the Permittee chooses to divert clean water from storage, they must describe how the diversion will prevent contact with contaminants, the location where the diverted clean water will go, and how that location is able to handle the volume of clean water generated without causing water quality problems.

S4.F Prevent Direct Animal Contact with Water

Livestock must not be allowed to come into contact with surface waters or cause pollutants to enter surface waters. This prohibition does not apply to small amounts of standing water (e.g. puddles, saturated areas) on pastures, land application fields

where livestock are temporarily housed, or in the production area as long as they are not draining to other surface waters or conduits to surface waters.

Livestock must be excluded from the field discharge management areas established according to S4.N *Field Discharge Management Practices*.

S4.G Chemical Handling

All chemicals (e.g. pesticides, cleaning agents) must be disposed of in accordance with the disposal requirements of the chemical's Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) product label or Safety Data Sheet (SDS) if it is not a FIFRA labeled product.

Excess or unused chemicals and empty chemical container wash water may not be disposed of in manure, litter, feed, process wastewater, or other organic by-product management systems, or any surface waters or conduits to surface or groundwater.

The Permittee must have and implement emergency procedures for containment and clean-up in the event of a chemical spill that could impact surface or groundwater.

S4.H Livestock Mortality Management

Mortalities must be handled such that they do not pose a threat to surface or groundwater quality. Until properly disposed of, mortalities must be stored in a location that does not allow run-off to surface waters or leaching to groundwater. All runoff from stored mortalities must be directed to liquid storage facilities. Mortalities must not be disposed of in a waste storage pond or other liquid storage structure unless it is specifically designed to handle mortalities.

Unless prohibited by local ordinances, the Permittee must follow state requirements for mortality handling including WAC 16-25-025. Examples of mortality management include composting, rendering, burial and natural decomposition. If on-site composting is used, it must be conducted compliance with chapter 70A.205 RCW and chapter 173-350 WAC.

S4.I Manure, Litter, Process Wastewater, and Other Organic By-Products Sampling and Nutrient Analysis

The Permittee must sample all sources of manure, litter, process wastewater, and other organic by-products that will be land applied and analyze the samples for nutrient content prior to **land application**. Sampling and analysis must follow the requirements of special condition S5.B *Manure, Litter, and Process Wastewater Monitoring* and should be representative of the nutrient source as applied.

During the application season, if the permittee begins to use a new source of manure, litter, process wastewater or other organic by-product, the Permittee must sample and analyze the new source for nutrient content prior to land applying the new source.

The Permittee must sample and analyze all sources of manure, litter, process wastewater, and other organic by-products at least three times, spaced evenly throughout the land application season.

The Permittee is not required to sample and analyze the commercial chemical fertilizers for nutrient content, but is required to record the amount of nutrients applied according to special condition S6.B *Land Application Records*.

S4.J Soil Sampling and Nutrient Analysis

The Permittee must sample and analyze all land application fields to which they apply manure, litter, process wastewater, or other organic by-products for nutrient content at least twice each year—before land application and in the late summer or early fall.

1. Soil Sampling Depth

Soil samples must be taken at the depths specified according to annual precipitation:

- Drier climates must collect separate composite soil samples for the 0-12 inch depth and the 12-24 inch depth.
- Wetter climates must collect one composite soil sample for the 0-12 inch depth.

If the field does not have the required soil depth before refusal or groundwater is reached, the Permittee must take samples in 12-inch increments until reaching refusal or groundwater. The Permittee must indicate in its records and annual report (special conditions S6.B and S7.D) at what depth refusal or groundwater was reached.

2. Spring Soil Sampling and Analysis

Soil samples collected and analyzed early in the growing season must be considered when developing or updating the field nutrient budget in that same season. Samples must be collected and analyzed before land application begins, unless applied in accordance with special condition S4.K.4 *Double Cropping, Winter Cover Crops, Perennial Crops*.

3. Late Summer-Early Fall Soil Sampling and Analysis

Post-harvest soil samples are primarily used to assess nitrogen management, but may also be used in nutrient budgeting of double or winter crops.

Post-harvest soil samples must be taken after harvest of annual crops and before 3 inches of rainfall accumulates. Use September 1 as start date for tallying the accumulation of rainfall.

If the soil sample is taken after 3 inches of rainfall accumulates or if the field was categorized as high or very high risk level the previous year (special condition S4.L *Adaptive Management of Land Application Fields*), the Permittee must take an

additional composite soil sample at the next vertical foot to account for nutrient leaching:

- Drier climates must collect an additional composite soil samples for the 24-36 inch depth.
- Wetter climates must collect an additional composite soil sample for the 12-24 inch depth.

4. Sampling and Analysis Methods

Soil sampling and analysis must follow the monitoring requirements of special condition S5.C *Soil Monitoring*.

S4.K Land Application

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 to comply with permit conditions. 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.

1. Annual Field-Specific Crop Nutrient Budget

The Permittee must develop a field-specific nutrient budget for each land application field they will **control** and plan to apply manure, litter, process wastewater, or other organic by-products. The permittee shall ensure that plant-available nutrients do not exceed nutrients required to reach crop's estimated yield. The yearly nutrient budget determines the maximum amount of nitrogen and phosphorus that may be land applied to the field.

Annual nutrient budgets must be developed before the first land application of the growing season, and should be developed to cover the entire growing season (annual and double crop until final harvest). If the Permittee makes changes to their annual nutrient budget for a land application field they must update the nutrient budget to reflect the changes. The yearly nutrient budget must include:

- a. Current calendar year.
- b. Field ID identical to the field ID on maps in the MPPP.
- c. Field acreage.

- d. Field risk level as determined by end of season soil sample nitrate-N analysis values in special condition S4.L *Adaptive Management of Land Application Fields*.
- e. Adaptive management actions required by special condition S4.L *Adaptive Management of Land Application Fields*.
- f. Crop(s).
- g. Estimated planting date (or note as perennial).
- h. Estimated harvest date.
- i. Crop yield estimate for the field based upon prior years or expert guidance. Examples of sources for yield estimates include the field's 3-year average yield, a nearby similar field's 3-year average yield, land grant university guidance, commercial chemical fertilizer guides, or other national data sources.
- j. Total amount of nitrogen and phosphorus required by the crop to reach the yield estimate.
- k. Soil nitrogen and phosphorus content measured from the most recent soil sample required by special condition S4.J *Soil Sampling and Nutrient Analysis*. Nutrient budgets developed prior to a spring soil test must be updated after sample is analyzed.
- l. Estimate of nitrogen from mineralization of:
 - Soil organic matter.
 - Crop residues, including grass
 - Past applications of manure, process wastewater, or other organic by-products.
- m. Estimate of nitrogen and phosphorus from other sources (e.g. precipitation, irrigation, atmospheric deposition).
- n. Estimated loss of nitrogen due to volatilization during land application.

A nutrient budget worksheet that incorporates requirements of special condition S4.K.1 is available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)⁹.

If the Permittee chooses to use their own form, it must account for the same parameters as the Ecology form and show the calculations used to reach the final maximum amount of nutrients that may be land applied to each field for the year.

⁹ <https://ecology.wa.gov/cafo>

2. Application Rates

Land application of manure, litter, process wastewater, and other organic by-products must be at times and at rates which can be utilized by the crop.

The Permittee must base their **application rates** on the most current manure, litter, process wastewater, and other organic by-product nutrient analysis required by special condition S4.I and crop needs.

Equipment used for land application of manure and other material that can have a variable application rate (e.g. pumps, injectors, sprinklers, splash plate applicators) must be calibrated so that the Permittee has an accurate measure of how much manure is applied per unit of time or area (e.g. x gallons per hour, y gallons per acre).

The Permittee must use the applicable adaptive management actions specified in special condition S4.L *Adaptive Management of Land Application Fields* to modify their land application of nutrients.

During land application, the Permittee must not cause direct, indirect, or precipitation related discharge to surface waters and must follow the minimum field discharge management practices required by special condition S4.N *Field Discharge Management Practices*. The permittee must visually monitor land application fields for surface and tile drainage discharges when land applying manure, litter, process wastewater, or other organic by-products. If a discharge occurs, the permittee shall follow sampling procedures in special condition S5.E *Surface Water Monitoring* and reporting requirements in special condition S7.E *Reporting Permit Violations*.

3. Application Restrictions

The Permittee must not land apply more nitrogen and phosphorus to a field than calculated in their yearly nutrient budget (special condition S4.K.1) for that field.

No land application of manure, litter, process wastewater, or other organic by-products may occur:

- a. To fields with a frozen surface crust (2 inches) or deeper, or if the soil is at or below zero degrees Celsius (32 degrees Fahrenheit).
- b. To fields that are snow covered.
- c. To fields with soils that are or will become **saturated** with forecasted precipitation prior to infiltration or incorporation.
- d. If the water table is within 12 inches or less of the surface.
- e. If precipitation is forecast in the next 24 hours for the facility location that will cause a discharge from the Permittee's land application fields.

- f. After October 1 and prior to **T-SUM 200** unless applied in accordance with special condition S4.K.4 *Double Cropping, Winter Cover Crops, Perennial Crops*.
- g. To fields that are bare (no perennial crop) unless the Permittee is preparing the bare field for the current year's annual crop (planting within 30 days of land application).

The Permittee may use an alternative to T-SUM 200 restriction above if the alternative demonstrates that crop growth and nutrient uptake begins before TSUM200. The alternative method must be approved by Ecology prior to utilizing the alternative to TSUM200. Submit an updated MPPP to Ecology per S4.A.5.c *When the Permittee proposes alternatives*. The alternative starting application dates must be site and crop specific. The updated MPPP must include supporting information demonstrating that the alternative method will be as effective as the T-SUM200 method in determining that crop growth and nutrient uptake is adequate to prevent discharges of excess nutrients to surface and groundwaters.

4. **Double Cropping, Winter Cover Crops, Perennial Crops**

After late summer or early fall soil sampling, any land application taking place must be demonstrated to be necessary because current soil nitrogen plus estimated nitrogen mineralization will not provide the nutrients necessary for the double crop, winter cover crop, or perennial crop.

Before land application may take place for a double crop, winter cover crop, or perennial crop the Permittee must have taken fall soil samples, had the soil samples analyzed as required by special condition S4.J *Soil Sampling and Nutrient Analysis*, and shown how a land application of nitrogen is necessary to support estimated crop yield according to special condition S4.K.1 *Annual Field-Specific Crop Nutrient Budget*.

If the nutrient budget shows that soil nitrogen plus estimated nitrogen mineralization will not provide the nutrients necessary during the winter for a double crop, cover crop, or perennial crop, the Permittee may land apply manure, litter, process wastewater, or other organic by-products in compliance with the land application restrictions in special condition S4.K.1 through S4.K.3 above.

5. **Emergency Winter Land Application**

Land application of manure, litter, process wastewater, or other organic by-products outside of the limits set by special condition S4.K.1 through S4.K.4 or in amounts greater than the Permittee's yearly field nutrient budgets is a violation of this permit. Any land application outside of the permit requirements must be due to the need to protect public health and safety (e.g. to prevent waste storage pond **over-topping**).

In the event that a Permittee makes an emergency land application outside of permit requirements, the Permittee must follow the noncompliance procedure:

- a. Prior to making any emergency land applications, notify Ecology by phone or email at cafopermit@ecy.wa.gov.
- b. Document the reason for emergency application and keep records of:
 - i. Dates and times of land application
 - ii. Field IDs for the fields where land application took place
 - iii. Nutrient content of applied material
 - iv. Amount of material (e.g. gallons) land applied
- c. Monitor fields and tile drain outlets for discharges to surface waters or conduits to surface waters. If a discharge occurs, collect and analyze a sample or samples representative of the discharge. Follow sample collection and analysis procedures in S5.E *Surface Water Monitoring*. Report the results to Ecology within 15 days of collecting the sample(s) using the Water Quality Permitting Portal, unless granted a waiver from electronic reporting according to S7.A *How to Submit Documents to Ecology*.
- d. Within 24 hours of the application, report the information recorded in b. to Ecology via email at cafopermit@ecy.wa.gov.
- e. Develop a plan to remain in compliance with the permit within 6 months of the emergency winter land application and submit that plan and an updated MPPP if necessary, to Ecology according to the procedure in special condition S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*.
- f. Work proposed in the plan must be completed within 18 months of the emergency land application.

To request a time extension, a Permittee shall submit a detailed explanation of why it is making the request (technical basis) to Ecology in accordance with special condition S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*, 120 days prior to the deadline. The permittee must publicly notice this request for modification of coverage following the procedures in S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*. Ecology will approve or deny the request within 60 days of receipt of a complete request.

S4.L Adaptive Management of Land Application Fields

The Permittee must use adaptive management to prevent the build-up of excess nutrients in the soil. The goal is to reduce fall soil nitrate concentrations in land application fields to a Risk Level of Medium or less.

1. Step 1: Determine Field Risk Level

Use Table 3 below to determine land application field risk level.

- For each field in drier climates, use the fall soil test nitrate results (special condition S4.J *Soil Sampling and Nutrient Analysis*) from the second foot (12-24 inches) to determine the field risk level.
- For each field in wetter climates, use the fall soil test nitrate results (special condition S4.J *Soil Sampling and Nutrient Analysis*) from first foot (1-12 inches) to determine the field risk level.

Table 3 Field Risk Level

Field Risk Level	Fall Soil Test Nitrate Range in ppm	Fall Soil Test Nitrate Range in pounds per acre
Low	Less than 15	Less than 55
Medium	15 - 30	55 - 110
High	31 - 45	111 - 165
Very High	More than 45	More than 165

2. Step 2: Take Required Adaptive Management Actions

Take the required adaptive management actions specified in the *Required Actions* column corresponding to the field risk level.

- Use Table 4 Adaptive Management Actions for areas in drier climates.
- Use Table 5 Adaptive Management Actions for areas in wetter climates.

Where the field risk level remains High or Very High for two consecutive years, in addition to taking the actions in the *Required Actions* column, take the actions in the *Required Actions Based upon Trends* column. Continue these actions until the field risk level is reduced to Medium or Low risk.

- Use Table 4 Adaptive Management Actions for areas in drier climates.
- Use Table 5 Adaptive Management Actions for areas in wetter climates.

3. Step 3: Submit Deeper Soil Test Results

For fields in the Very High risk category for two consecutive years, the Permittee must sample and analyze soil at the depths specified in the *Required Actions Based upon Trends* column of Table 4 or Table 5.

Collect and analyze these soil samples in the fall according to timings in special condition S4.J *Soil Sampling and Nutrient Analysis*. Collect the samples according to procedures in special condition S5.C. *Soil Monitoring*. Analyze the samples for parameters in Table 9 of special condition S5.C. *Soil Monitoring*.

Submit these results to Ecology using WQWebPortal as described in special condition S7.A *How to Submit Documents to Ecology*. If results of a nitrate loading analysis demonstrate a potential to impact groundwater, Ecology will notify the

Permittee of the need to develop a groundwater monitoring plan according to procedures in S5.D *Groundwater Monitoring*.

Table 4 Adaptive Management Actions for areas in drier climates

Field Risk Level	Required Actions After 1 Year	Required Actions After 2 Consecutive Years
Low	No changes to current practices required.	N/A
Medium	- Reevaluate nutrient budget assumptions for estimated crop yield, nitrogen volatilization, mineralization (special condition S4.K), and other sources of nutrients (e.g. irrigation water and atmospheric/precipitation deposition). - Verify actual land application rates and recalibrate land application equipment if necessary.	N/A
High	Continue the actions required by Medium risk level and: - Document reason(s) for fall soil sample analysis result and associated risk level in Annual Report (special condition S7.D). - Adjust land application timing so nutrient availability aligns with peak crop uptake. - Stop land application after peak crop uptake. - Collect and analyze an additional late-summer/early fall soil sample at the third foot depth (25-36 inches) according to special condition S4.L.3.	Continue the actions in the Required Action column for Medium and High risk levels and: - Reduce nutrient application to the field. - Hire a professional/consultant to develop yearly nutrient budgets and application rates.
Very High	Continue the actions required by High risk level and: - Assume no nitrogen losses from denitrification and volatilization on the yearly nutrient budget for this field. - Submit the yearly nutrient budget for this field prior to land application for approval by Ecology. - Enhance nutrient removal via cropping. - Reduce nutrient application amount to field.	Continue the actions required by Very High, High, and Medium risk levels and: - Stop land application of nutrients to the field. - Hire a professional/consultant to develop yearly nutrient budgets and application rates. - Collect additional fall soil samples at the third, fourth, and fifth foot depth or until refusal or groundwater is reached and analyze for nitrate. Follow procedures in Step 3.

Table 5 Adaptive Management Actions for areas in wetter climates

Field Risk Level	Required Actions	Required Actions After 2 Consecutive Years
Low	No changes to current practices required.	N/A
Medium	- Reevaluate nutrient budget assumptions for estimated crop yield, nitrogen volatilization, mineralization (special condition S4.K), and other sources of nutrients (e.g. irrigation water and atmospheric/precipitation deposition). - Verify actual land application rates and recalibrate land application equipment if necessary.	N/A
High	Continue the actions required by Medium risk level and: - Document reason(s) for fall soil sample analysis result and associated risk level in Annual Report (special condition S7.D). - Adjust land application timing so nutrient availability aligns with peak crop uptake. - Stop land application after peak crop uptake. - Collect and analyze an additional fall soil sample at the second foot depth (12-24 inches) according to special condition S4.L.3.	Continue the actions in the Required Action column for Medium and High risk levels and: - Reduce nutrient application to the field. - Hire a professional/consultant to develop yearly nutrient budgets and application rates.
Very High	Continue the actions required by High risk level and: - Assume no nitrogen losses from denitrification and volatilization on the yearly nutrient budget for this field. - Submit the yearly nutrient budget for this field prior to land application for approval by Ecology. - Enhance nutrient removal via cropping. - Reduce nutrient application amount to field.	Continue the actions in the Required Action column for Very High, High, and Medium risk levels and: - Stop land application of nutrients to the field. - Hire a professional/consultant to develop yearly nutrient budgets and application rates. - Collect additional fall soil samples at the second, third, and fourth foot depth or until refusal or groundwater is reached and analyze for nitrate. Follow procedures in Step 3.

S4.M Irrigation Water Management

The Permittee must prevent the downward movement of nitrate by managing their irrigation water so that the amount of water applied from precipitation and irrigation does not exceed the water holding capacity of the soil beyond the crop rooting depth.

S4.N Field Discharge Management Practices

The Permittee must use field discharge management practices on each land application field to limit the discharge of manure, litter, process wastewater, and other organic matter as follows:

1. Use field discharge management practices to limit the discharge of pollutants to any down-gradient surface waters, open tile line intake structures, sinkholes, agricultural or drinking water well heads, or other conduits to surface or groundwater.
2. Field discharge management practices are not considered part of the Permittee's land application area for calculating yearly field nutrient budgets and may not have manure, litter, process wastewater, or other organic by-products applied to them. Livestock must be excluded from these areas.
3. Include one or more of the following compliant field discharge management practices used singly or in combination:
 - a. Vegetated **filter strip** between land application fields or pastures and down gradient surface water conveyances. Filter strips must be at least 35 feet wide measured horizontally from the **top of the bank** on the surface water or conduit to surface water that is being protected.
 - b. Land application setback where manure, litter, or process wastewater may not be applied closer than 100 feet from the top of the bank on the surface water or conduit to surface water that is being protected.
 - c. Berm which prevents surface water discharge from the land application field and where application of manure, litter, process wastewater, or other organic by-products is prohibited. Berms must be designed, installed, and maintained to perform their function considering the following factors:
 - i. Weather characteristics for the area where the facility is located such as precipitation, storm events, and volume of field run-off.
 - ii. Land application methods used by the Permittee, form of land applied manure, litter, process wastewater, or other organic by-products, timing of land application, and application rates.
 - iii. Field characteristics such as soil types, infiltration rates, field slope, presence of other conduits to surface waters (e.g. drainage ditches, tile drains), crop type, cropping cycles, and flooding.
 - iv. Installation timing, time from installation to full performance, and maintenance period and activities.

- d. An approved alternative management practice that provides pollutant reductions equivalent to or better than the reductions that would be achieved by the 100-foot setback. Alternative practices must be approved by Ecology prior to use. Submit an updated MPPP to Ecology according to procedures in S4.A.5.c *When the Permittee proposes alternatives*. The updated MPPP must include maps showing the field IDs and locations where the practice will be implemented and supporting information demonstrating that the practice will be as effective as the 100-foot application setback.

S4.O Manure Export

Manure is exported from the Permittee's CAFO to an unaffiliated party when the Permittee no longer has control of how the manure is used.

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. If the Permittee is exporting digestate, the nutrient analysis must be from within the last 5000 cubic yards (approximately 1,010,000 gallons) of digestate generated.

The Permittee must keep records of its manure exports as required by special condition S6.C *Export Records*.

If the Permittee has an agreement with another party (contracted composter) for the contracted composter to process (manure "composting" or drying) manure solids from the Permittee on-site, the solids which go to the contracted composter must be tracked as export by the Permittee. After the solids are under the control of the contracted composter, the Permittee is not responsible for tracking sales and movement off-site of the processed manure solids as part of export unless the solids come under the Permittee's control again.

S4.P Emergency Procedures

The Permittee must develop emergency procedures in the event of a failure in their infrastructure (e.g. burst pipe, waste storage pond embankment failure) that will direct the Permittee's actions to prevent, control, or reduce discharges to ground and surface waters. Emergency procedures must include discharge sampling as required by this permit. The emergency procedures must include the noncompliance notification requirements required by special condition S7.E *Reporting Permit Violations* and special condition S7.F *Spills Reporting*.

S4.Q Training

Either the Permittee or at least one of the Permittee's employees must be familiar with the monitoring and inspections required by special condition S5.A *Operations and Maintenance*.

If the Permittee chooses to train their employee(s) to look for and notice problems with facility infrastructure during their daily work to meet the visual inspection/monitoring requirements of special condition S5.A *Operations and Maintenance* so that these requirements do not become a separate activity, the employee training must incorporate what to look for, who to notify (if there is a

designee other than the Permittee) about problems or potential problems, and where and how to record the information at the end of shift as required by special condition S6.A *Operations and Maintenance*.

S5. MONITORING

S5.A. Operations and Maintenance

The Permittee must perform the visual inspections of the facility indicated in Table 6 below, to ensure that equipment, infrastructure, and field discharge management practices are in proper working order.

Table 6 Routine Visual Inspections

Inspection	Frequency
Clean and wastewater lines	Daily
Clean water diversion (e.g. roof gutters)	Weekly
Storage ponds and waste handling infrastructure	Weekly
Field run-off management	Monthly

The Permittee must record the outcome of the visual inspections according to special condition S6.A *Operations and Maintenance Records*. A template for this record keeping is available on [Ecology's CAFO Permit webpage](https://ecology.wa.gov/cafo)¹⁰.

Other templates which document the required information may be used. For example, the most recent Oregon Department of Agriculture Large CAFO Record Keeping Calendar, which is available (at the time this permit was issued) under the [Resources section of the Oregon CAFO web page](#)¹¹:

S5.B. Manure, Litter, and Process Wastewater Monitoring

1. When to collect and analyze samples

The Permittee must sample the manure, litter, process wastewater, and other organic by-products prior to its application to land, up to three times annually as laid out in the schedule in Table 7.

During the land application season, if the Permittee begins to use a new source of nutrients for crops, the Permittee must have the new source sampled and analyzed for nutrient content prior to land applying the new source.

The Permittee is not required to have commercial chemical fertilizers sampled and analyzed for nutrient content, but is required to record the amount of nutrients applied in special condition S6.B *Land Application Records*.

2. How to collect and analyze samples

Manure, litter, process wastewater, and other organic by-product samples must be representative of the source (**composite sample**), and taken following the most

¹⁰ <https://ecology.wa.gov/cafo>

¹¹ <http://www.oregon.gov/ODA/programs/NaturalResources/Pages/CAFO.aspx>

recent guidance provided in either Extension Publication PNW 533¹² or PNW 673¹³. Copies of these documents are available on [Ecology's CAFO permit webpage](#)¹⁴.

The permittee must use the analytical methods specified in Table 7 unless a different method used is sufficiently sensitive and produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136. If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, detection level (DL), and quantification level (QL) on the discharge monitoring report or in the required report. If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a QL to Ecology with appropriate laboratory documentation.

If a waste storage structure is equipped with a leak detection system, monitor for leaks according to the leak detection plan included in the MPPP.

Table 7 Manure, Litter, and Process Wastewater Sampling

Parameter	Units & Speciation (Liquid Materials)	Units & Speciation (Solid Materials)	Laboratory Method	Sampling Frequency	Sample Type
Ammonia-N (NH ₃ -N)	Lbs/1000 gal as N, as received	Lbs/ton as N, as received	SM 4500-NH ₃ G/H-2011	Up to 3 times per year, per source	Composite
Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N)	Lbs/1000 gal as N, as received	Lbs/ton as N, as received	SM 4500-NO ₃ E/F/H-2011	Up to 3 times per year, per source	Composite
Total Phosphorus ^a	Lbs/1000 gal as P ₂ O ₅ , as received	Lbs/ton as P ₂ O ₅ , as received	SM 4500-P E-2011	Up to 3 times per year, per source	Composite
Liner Leak ^b	Yes/No	NA	NA	Weekly	Visual Observation
Volume of Leaked Water	gallons/day	NA	NA	Daily, if leak detected	Measurement

^a If laboratory reports results as elemental phosphorus, multiply the result by 2.29 to convert to the fertilizer form P₂O₅.

^b If leaked water is observed report yes, if not report no.

¹² Bary, A., Cogger, C., Sullivan, D. (2016). *Fertilizing with Manure and Other Organic Amendments*. Pacific Northwest Extension, Washington State University.

¹³ Moore, A., de Haro-Marti, M., Chen, L. (2015). *Sampling Dairy Manure and Compost for Nutrient Analysis*. Pacific Northwest Extension, University of Idaho.

¹⁴ <https://ecology.wa.gov/cafo>

S5.C. Soil Monitoring

1. When to collect and analyze soil samples

The permittee must monitor soil on land application fields. Soil samples must be taken at least twice a year according to requirements in S4.J *Soil Sampling and Nutrient Analysis*.

- Collect soil samples prior to land application and analyze them for the parameters listed in Table 8.
- Collect soil samples after harvest of annual crops and before 3 inches of rainfall accumulate. Analyze them for parameters listed in Table 9.

2. How to collect and analyze soil samples

Samples must be representative of the land application field (composite sample), following the most recent guidance on soil sample handling, preservation, and shipment provided in either Extension Publication PNW 570¹⁵ or EM 8832¹⁶.

Copies of these documents are available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)¹⁷.

Table 8 Pre-Land Application Soil Monitoring

Parameter	Units & Speciation	Sampling Frequency	Depth Increments for Areas with Annual Precipitation of 25 inches or Less	Depth Increments for Areas with Annual Precipitation greater than 25 inches
Ammonia-N (NH ₃ -N)	lbs/acre or ppm as N	Every year	Increment 1: 0 - 12 inches Increment 2: 12- 24 inches	Increment 1: 0 - 12 inches
Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N)	lbs/acre or ppm as N	Every year	Increment 1: 0 - 12 inches Increment 2: 12- 24 inches	Increment 1: 0 - 12 inches

¹⁵ Staben, M. L., et al. (2003). *Monitoring Soil Nutrients Using a Management Unit Approach*. Pacific Northwest Extension.

¹⁶ Sullivan, D., et al. (2021). *Post-Harvest Soil Nitrate Testing for Manured Cropping Systems West of the Cascades*. Pacific Northwest Extension, Oregon State University.

¹⁷ <https://ecology.wa.gov/cafo>

Table 9 Post-Harvest Soil Monitoring

Parameter	Units & Speciation	Sampling Frequency	Depth Increments for Areas with Annual Precipitation of 25 inches or Less	Depth Increments for Areas with Annual Precipitation greater than 25 inches
Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N)	lbs/acre or ppm as N	Every year	Increment 1: 0 -12 inches Increment 2: 12-24 inches	Increment 1: 0 -12 inches
Ammonia-N (NH ₃ -N)	lbs/acre or ppm as N	Every year	Increment 1: 0 -12 inches Increment 2: 12-24 inches	Increment 1: 0 -12 inches
Soil Organic Matter	%	Every 3 years	Increment 1: 0 -12 inches Increment 2: 12-24 inches	Increment 1: 0 -12 inches
Total Phosphorus ^a	ppm	Every 3 years	Increment 1: 0 -12 inches Increment 2: 12-24 inches	Increment 1: 0 -12 inches

^a The Bray-1 extraction method must be used to determine soil phosphorus for soils below pH 7. The Olsen bicarbonate extraction method must be used for soils at or above pH 7.

S5.D. Groundwater Monitoring**1. Medium and Large CAFOs located within a nitrate priority area**

Medium and large CAFOs located within a ***nitrate priority area*** categorized as moderate, moderately high, high, or very high priority must install groundwater monitoring network and conduct monitoring according to the procedures below. A map of the nitrate priority areas is provided in Appendix C.

All production areas and land application fields must be monitored. If the CAFO facility is not co-located, establish separate groundwater monitoring networks for each area. Land application fields with similar management practices and site conditions including but not limited to soil type and hydrogeology, may be grouped together, so long as representative samples can be obtained.

Each groundwater monitoring network must have a sufficient number of wells downgradient of the CAFO facility to ensure a high probability of detecting contamination when it is present. At least one well must be upgradient of the CAFO facility monitored by the network. Groundwater monitoring must be conducted in the uppermost saturated zone.

a. *Develop the Work Plan*

Within 6 months of receiving permit coverage, the Permittee must submit a work plan to Ecology for installing a groundwater quality monitoring network, in accordance with WAC 173-200-080. The work plan must conform to *Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems* (Ecology Publication #93-36) and the *Implementation Guidance for the Groundwater Quality Standards* (Ecology Publication #96-02). The work plan must include well siting, quality control protocols, a sampling plan, and sampling protocols.

b. *Install Groundwater Monitoring Wells*

The Permittee must complete construction of the groundwater monitoring network within ninety (90) days after approval of the work plan by Ecology. The Permittee must construct wells in accordance with Chapter 173-160 WAC. Report to Ecology the tag numbers, latitude and longitude (NAD83/WGS84 datum), and top-of-casing elevations (NAVD88 datum) of each monitoring well.

c. *Conduct Routine Monitoring*

After the groundwater monitoring network is in place, the Permittee must notify Ecology and monitor the parameters in Table 10 according to the approved work plan. Notify Ecology at least 30 days prior to monitoring.

The Permittee must use the analytical methods specified below unless a different method used is sufficiently sensitive and produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136. If the Permittee uses an alternative method, not specified in the

permit and as allowed above, it must report the test method, detection level (DL), and quantification level (QL) in the required report. If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a QL to Ecology with appropriate laboratory documentation.

2. Small CAFOs and Facilities outside of a Nitrate Priority Area

If the results of the nitrate loading analysis (special condition S4.L) or the results of waste storage structure assessment (special condition S7.C) indicates that an adverse impact to groundwater may be occurring, the permittee must evaluate the impacts of its activities on groundwater quality by completing the requirements below:

a. Develop the Work Plan

Within 6 months after receiving the determination from Ecology, the Permittee must submit a work plan to Ecology for a groundwater quality evaluation study at the site specified in the determination, in accordance with WAC 173-200-080. The work plan must conform to *Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems* (Ecology Publication #93-36) and the *Implementation Guidance for the Groundwater Quality Standards* (Ecology Publication #96-02). The work plan must include well siting, quality control protocols, a sampling plan, and sampling protocols.

b. Implement the Work Plan

Upon approval of the work plan by Ecology, the Permittee must conduct a groundwater evaluation study to determine site-specific hydrogeologic conditions.

c. Report the Study Results

After the first full year of monitoring, the Permittee must submit a report summarizing the results of the groundwater evaluation study, interpretations of the data, conclusions, and recommendations. Submit this report with the annual report required in S7.D.

d. Install Additional Groundwater Monitoring Wells

If the groundwater study recommends installation of additional wells, the Permittee must complete construction of the groundwater monitoring network within ninety (90) days after approval of the groundwater evaluation study by Ecology. The Permittee must construct wells in accordance with Chapter 173-160 WAC. Report to Ecology the tag numbers, latitude and longitude (NAD83/WGS84 datum), and top-of-casing elevations (NAVD88 datum) of each monitoring well.

e. Conduct Routine Monitoring

After the recommended groundwater monitoring network is in place, the Permittee must notify Ecology and monitor the parameters in Table 10 according to the approved groundwater evaluation study. Notify Ecology at least 30 days prior to monitoring.

The Permittee must use the analytical methods specified below unless a different method used is sufficiently sensitive and produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136. If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, detection limit (DL), and quantification limit (QL) in the required report. If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix-specific detection limit (MDL) and a QL to Ecology with appropriate laboratory documentation.

3. Submitting work plans and reporting results for all facilities

Work plans and groundwater evaluation study must be submitted to Ecology according to deadlines specified above. Routine monitoring results must be submitted to Ecology with the annual report required in S7.D. Each document must be submitted using WQWebPortal as described in special condition S7.D *Annual Report* and must include the certification statement and signature required by general condition G14.

Table 10 Groundwater monitoring

Parameter	Units & Speciation	Laboratory Method	Sampling Frequency ^a	Sample Type
Measured Depth to Groundwater	Feet (nearest 0.01 ft)	NA	At least quarterly	Field Measurement
pH	Standard Units	NA	At least quarterly	Field Measurement
Conductivity	Micromho/cm	NA	At least quarterly	Field Measurement
Temperature	Degrees C	NA	At least quarterly	Field Measurement
Dissolved Oxygen	mg/L	NA	At least quarterly	Field Measurement
Total Nitrogen (TN)	mg/L as N	NA	At least quarterly	Calculated
Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N)	mg/L as N	SM4500-NO ₃ -E/F/H	At least quarterly	Grab
Total Kjeldahl Nitrogen (TKN)	mg/L as N	SM4500-N _{org} B/C and SM4500NH ₃ -B/C/D/EF/G/H	At least quarterly	Grab

Parameter	Units & Speciation	Laboratory Method	Sampling Frequency ^a	Sample Type
<i>Escherichia Coli</i> (E. coli)	CFU or MPN per 100 mL	SM 9221B, 9221F, 9223B, EPA 1603	At least quarterly	Grab

^a Unless groundwater evaluation study recommends more frequently monitoring

S5.E. Surface Water Monitoring

1. Standard Protocol

If any discharge of pollutants occurs from the production area to surface water or a prohibited discharge occurs from land application areas to surface water, the permittee must:

- Record the date and time the discharge was identified, the date and time the discharge is halted, and an estimate of the volume of the discharge.
- Collect a minimum of one grab sample from the point of overflow or discharge within 30 minutes of detecting the discharge. The sample(s) collected must be representative of the discharge. Analyze the sample(s) for the parameters listed in Table 11.
- Notify the appropriate Ecology regional office in person or by phone, within 24 hours of detecting the discharge.
- Submit the results from the above actions to Ecology using the Water Quality Permitting Portal, unless granted a waiver from electronic reporting according to S7.A *How to Submit Documents to Ecology*.
- If the discharge is unauthorized, follow reporting requirements in special condition S7.E *Reporting Permit Violations*.

2. Protocol when conditions are unsafe

If conditions are not safe for sampling, the permittee must provide documentation of why samples could not be collected and analyzed. For example, the permittee may be unable to collect samples during dangerous weather conditions (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.).

- Record the date and time the discharge was identified, the date and time the discharge is halted, and an estimate of the volume of the discharge.
- Notify the appropriate Ecology regional office by phone, within 24 hours of detecting the discharge.
- Once dangerous conditions have passed, collect a minimum of one sample from the point of overflow or discharge.
- Submit the results from the above actions to Ecology using the Water Quality Permitting Portal, unless granted a waiver from electronic reporting according to S7.A *How to Submit Documents to Ecology*.

- e. If the discharge is unauthorized, follow reporting requirements in special condition S7.E *Reporting Permit Violations*.

3. Ecology Regional Office Contact Information

Central Region at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County

Eastern Region at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County

Northwest Region at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County

Southwest Region at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum County

Table 11 Surface Water Monitoring

Parameter	Units & Speciation	Laboratory Method	Sampling Frequency	Sample Type
<i>Escherichia Coli</i> (E. coli), for discharges to freshwater	CFU or MPN per 100 mL	EPA 1603	1/event	Grab
Enterococci, for discharges to marine water	CFU or MPN per 100 mL	EPA 1600	1/event	Grab
Fecal Coliform Bacteria, for discharges to marine water	CFU or MPN per 100 mL	SM 9222D	1/event	Grab
Total Nitrogen (TN)	mg/L as N	NA	1/event	Calculated
Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N)	mg/L as N	SM4500-NO ₃ -E/F/H	1/event	Grab
Total Kjeldahl Nitrogen (TKN)	mg/L as N	SM4500-N _{org} B/C and SM4500NH ₃ -B/C/D/EF/G/H	1/event	Grab
Total Phosphorus	mg/L	EPA 365.1	1/event	Grab
Volume of discharged water	Gallons/day	NA	Daily, as needed	Measured

S5.F. Laboratory Accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*.

Soils data are process control parameters, which do not require preparation by an accredited laboratory. However, the Permittee must obtain this data from a reputable agricultural test lab that is an active participant in a nationally recognized agricultural laboratory proficiency testing program, such as the North American Proficiency Testing Program (NAPT). You can find more information on the [NAPT website](http://www.naptprogram.org/)¹⁸.

¹⁸ <http://www.naptprogram.org/>

S6. RECORD KEEPING

S6.A. Operations and Maintenance Records

The Permittee must record the outcome of the visual inspections/monitoring required by special condition S5.A *Operations and Maintenance*. A template for this record keeping is available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)¹⁹.

S6.B. Land Application Records

The Permittee must keep the following records of land application for each field where manure, litter, process wastewater, or other organic by-products were applied:

1. Dates of all applications.
2. The field name consistent with the MPPP field map and field specific nutrient budget.
3. Method of land application.
4. Application rate, including commercial/chemical fertilizer, in pounds, gallons, tons, or ft³ per acre.
5. The total nitrogen applied (ammonia-N (NH₃-N), ammonium-N (NH₄-N), nitrate (NO₃-N), and organic nitrogen) in pounds per acre.
6. Total phosphorus applied in pounds per acre.
7. Weather 24 hours before land application.
8. Weather during land application.
9. Weather 24 hours after land application.
10. Total amount of irrigation water applied to each field in acre-feet and fractions thereof.

A template for this record keeping is available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)²⁰.

Upon determination that a high late summer or early fall soil nitrate test is due to crop failure or other unusual environmental conditions, the Permittee must keep records of how the determination was made, including any data, measurements, or best professional judgment by technical assistance providers.

S6.C. Export Records

The Permittee must record the information listed below each time it exports manure, litter, process wastewater, or other organic by-products. A template for this record keeping is available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)²¹.

¹⁹ <https://ecology.wa.gov/cafo>

²⁰ <https://ecology.wa.gov/cafo>

²¹ <https://ecology.wa.gov/cafo>

1. Amount of manure, litter, process wastewater, or other organic by-products exported in gallons for liquid/slurry and tons for solids
2. Name of entity manure was exported to
3. Date export took place

The permittee must provide the most recent manure, litter, process wastewater, or other organic by-product nutrient analysis to the recipient as required by special condition S4.O *Manure Export*.

S6.D. Monitoring Records

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place, method, and time of sampling or measurement
2. The individual who performed the sampling or measurement
3. The dates the analyses were performed
4. The individual who performed the analyses
5. The analytical techniques or methods used
6. The results of all analyses

S6.E. Providing Records

The Permittee must provide a copy of their MPPP, records, or other documents required by this permit to Ecology or WSDA within 14 days of their request.

The Permittee must maintain a copy of their MPPP, records, or other documents required by this permit on-site and make these documents available to Ecology or WSDA during site visits.

Updated MPPP must be submitted to Ecology within the timeframe required in S4.A.5 *Update of the MPPP*.

S6.F. Records Retention

The Permittee must retain records for a minimum of five (5) years. Such information must include copies of all monitoring, reports, and records required by this permit, and records of all data used to complete the application for this permit.

The Permittee must keep records longer in the event of unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S7. REPORTS AND SUBMITTALS

S7.A How to Submit Documents to Ecology

The permittee must use [Ecology's Water Quality Permitting Portal](https://secureaccess.wa.gov/ecy/wqwebportal)²² to submit all documents, data, and submittals required in this permit.

If the Permittee is unable to submit electronically (for example, they do not have access to the internet), they must contact Ecology to request an Electronic Reporting Waiver form and submit the completed form to Ecology at:

Washington State Department of Ecology
Water Quality Program
Attn: CAFO Permit Manager
PO Box 47696
Olympia, WA 98504-7696

All submittals (documents, data, reports, etc.) must be approved and signed by a responsible person in accordance with General Condition G14 (Signatory Requirements).

S7.B. Submittal of MPPP

The Permittee must submit the CAFO's initial MPPP to Ecology with the permit application.

Updated MPPPs must be submitted to Ecology within the timeframe required in S4.A.5 *Update of the MPPP*.

S7.C. Waste Storage Structure Assessment

The permittee must conduct and submit an assessment of the condition of each storage structure used for manure, litter, process wastewater and other organic by-products according to the procedures below.

The Permittee shall continue to address any deficiencies identified in the assessment required in the previous Concentrated Animal Feeding Operation General Permit.

1. Assessment for waste storage ponds with leak detection systems and permanent aboveground tanks

If the waste storage pond has a leak detection system, follow the leak detection plan as written in the MPPP. See special condition S4.C.3 *Maintain Storage Facilities* for plan requirements.

If using a permanent aboveground tank, follow maintenance requirements in special condition S4.C.3 *Maintain Storage Facilities*. Conduct and document visual inspections and repairs as required in special condition S5.A *Operations and Maintenance*.

²² <https://secureaccess.wa.gov/ecy/wqwebportal>

2. Assessment for waste storage ponds without leak detection systems

If a waste storage pond does not have a leak detection system in place, a **qualified expert** must assess the pond for compliance with requirements in special condition S4.C or by completing the Washington NRCS Engineering Technical Note 23 - Assessment Procedure for Existing Waste Storage Ponds. The Technical Note is available on [Ecology's CAFO permit webpage](https://ecology.wa.gov/cafo)²³.

The Permittee must submit the results of the assessment for each waste storage pond without a leak detection system to Ecology within 2 years of permit coverage. The assessment must include the certification statement and signature required by general condition G14.

If the assessment identifies that repairs are needed, the permittee must discontinue use of the waste storage pond and develop a plan for repair. The repair plan must be submitted to Ecology with an updated MPPP within 6 months in accordance with procedures in S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*. The repair plan must include:

- a. A description of how the Permittee will ensure compliance with special condition S4.C.
- b. Timelines of when repairs will be completed.
- c. A certification statement and signature as required by general condition G14.

Ecology may require a work plan and groundwater evaluation study (special condition S5.D *Groundwater Monitoring*) if the assessment determines that:

- a. there is less than two feet of vertical separation between the bottom of the waste storage pond (inside the pond above the liner) and the seasonal high water table, or
- b. there is a reasonable potential to impact groundwater due to the condition of the structure.

Work proposed in the repair plan must be completed within 18 months of the completion of the waste storage pond assessment.

To request a time extension on work proposed in the repair plan, a Permittee shall submit a detailed explanation of why it is making the request (technical basis) to Ecology in accordance with special condition S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*, 120 days prior to the deadline. Ecology will approve or deny the request within 60 days of receipt of a complete request.

²³ <https://ecology.wa.gov/cafo>

3. Assessment for solids storage, dry stacks, and compost piles on impervious surfaces

If the storage area is located on an impervious surface, follow maintenance requirements in special condition S4.C.3 *Maintain Storage Facilities*. Conduct and document visual inspections and repairs as required in special condition S5.A *Operations and Maintenance*.

4. Assessment for solids storage, dry stacks, and compost piles on soil pads

Each solids storage area located on soil pads must be assessed for compliance with requirements in special condition S4.C through a qualified expert or by completing the double-ring infiltrometer test (ASTM D3385-88). The infiltrometer test procedure is available on [Ecology's CAFO Permit webpage](#)²⁴.

The Permittee must submit the results of the assessment for each soil pad to Ecology within 2 years of permit coverage.

If the assessment identifies deficiencies, the permittee must collect soil samples at depth increments of 0-12 inch and 12-24 inches and analyze for parameters in Table 8. The permittee must develop a compliance plan to address the deficiencies. The plan must be submitted with an updated MPPP to Ecology within 6 months in accordance with procedures in S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*. The compliance plan must include:

- a. A description of how the Permittee will ensure compliance with special condition S4.C.2 *Solid Material Storage Facilities*.
- b. Timelines of when work to address the deficiency will be completed.
- c. Results from analyzed soil samples.
- d. A certification statement and signature as required by general condition G14.

Work proposed in the compliance plan must be completed within 18 months of the completion of the solids storage assessment. To request a time extension on work proposed in the compliance plan, a Permittee shall submit a detailed explanation of why it is making the request (technical basis) to Ecology in accordance with special condition S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*, 120 days prior to the deadline. Ecology will approve or deny the request within 60 days of receipt of a complete request.

S7.D. Annual Report

By February 1 each year, the Permittee must submit an annual report using Ecology's Water Quality Permitting Portal – Permit Submittals application, unless Ecology grants the permittee a waiver from electronic reporting according to S7.A *How to Submit documents to Ecology*. Use the form in Appendix B if granted a waiver.

²⁴ <https://ecology.wa.gov/cafo>

The reporting period is the previous calendar year (January 1 to December 31). Permittees must include the following with each annual report:

1. Number of animals and manure, litter, wastewater generated.
2. Discharges from production area or land application fields, if they occurred.
3. Nutrient source content results, analyzed according to S5.B.
4. Field land application information for each field.
5. Soil nutrient results, analyzed according to S5.C.
6. Yearly field-specific nutrient budgets for each field, including double crop or winter crop if applicable, developed according to S4.K.1.
7. The certification statement and signature according to G14.

S7.E. Reporting Permit Violations

In the event the Permittee is unable to comply with any of the permit terms, conditions, or discharge limits, due to any cause, the Permittee must:

1. Immediately take action to minimize or otherwise stop the violation, and correct the problem.
2. Sample and analyzed all discharges to surface water according to procedures in special condition S5.E *Surface Water Monitoring*.
3. Notify the appropriate Ecology regional office in person or by phone, within 24 hours of when the Permittee becomes aware of the noncompliance:

Central Region at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County

Eastern Region at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County

Northwest Region at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County

Southwest Region at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum County

4. Submit a written report to Ecology within 5 days using Ecology's Water Quality Permitting Portal, unless granted a waiver from electronic reporting according to S7.A *How to Submit Documents to Ecology*. The report must include:
 - a. A description of the noncompliance
 - b. A descriptions of the cause of the noncompliance
 - c. The period of noncompliance including exact dates and times

- d. A statement about whether the noncompliance has been corrected, or if it has not been corrected how long the noncompliance is expected to last
 - e. A description of the steps taken, or being taken to correct the noncompliance corrective action taken and/or planned, steps to be taken to prevent a recurrence, results of the re-sampling, and any other pertinent information.
 - f. Sample results required by special condition S5.E *Surface Water Monitoring*.
 - g. The certification statement and signature required by general condition G14.
5. The Permittee must review their MPPP for compliance with the permit and make appropriate updates within 14 days of the noncompliance to address the noncompliance and reflect any necessary changes to the facility. If the MPPP is revised, submit the updated MPPP in accordance with procedures in S4.A.5.b *When Ecology, WSDA, or Permittee assessments require MPPP updates*. The Permittee must also immediately begin the process to fully implement and maintain appropriate source control and/or treatment infrastructure or practices, addressing the deficiencies no later than 45 days from the date of noncompliance. If installation of necessary infrastructure or practices is not feasible within 45 days Ecology may approve additional time when an extension is requested by a Permittee within the initial 45-day period.

Compliance with the requirements of this special condition (special condition S7.E) does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failing to comply.

S7.F. Spills Reporting

The Permittee must report spills of oil or hazardous materials (e.g. pesticides) in accordance with the requirements of RCW 90.56.280 and 173-303-145 WAC by calling the National Response Center 1-800-424-8802, and the Washington Emergency Management Division 1-800-258-5990. Permittees can obtain additional instructions on [Ecology's Report a Spill webpage](https://ecology.wa.gov/Footer/Report-an-environmental-issue/Report-a-spill)²⁵.

S8. APPENDICES

The attached appendices are incorporated by reference into this permit.

APPENDIX A: DEFINITIONS

APPENDIX B: ANNUAL REPORT

APPENDIX C: NITRATE PRIORITY AREAS

²⁵ <https://ecology.wa.gov/Footer/Report-an-environmental-issue/Report-a-spill>

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit shall be consistent with the terms and conditions of this general permit. The discharge of any pollutant more frequently than, or at a concentration in excess of that authorized by this general permit is a violation of the terms and conditions of this general permit.

G2. PROPER OPERATION AND MAINTENANCE

The Permittee shall, at all times, properly operate and maintain all facilities or systems of treatment and control (and related appurtenances) which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by a Permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

G3. RIGHT OF ENTRY

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

1. To enter upon the premises where a discharge is located or where any records shall be kept under the terms and conditions of this permit;
2. To have access to and copy at reasonable times any records that shall be kept under the terms of this permit;
3. To inspect at reasonable times any monitoring equipment or method of monitoring required in this permit;
4. To inspect at reasonable times any collection, treatment, pollution management, or discharge facilities; and
5. To sample at reasonable times any discharge of pollutants.

G4. PERMIT COVERAGE REVOKED

Pursuant with chapter 43.21B RCW and chapter 173-226 WAC, the Director may require any discharger authorized by this permit to apply for and obtain coverage under an individual permit or another more specific and appropriate general permit. Cases where revocation of coverage may be required include, but are not limited to, the following:

1. Violation of any term or condition of this permit.
2. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

3. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.
4. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.
5. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and chapter 173-224 WAC.
6. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable; or Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within ninety (90) days from the time of revocation and is submitted along with a complete individual permit application form.

G5. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of chapter 173-226 WAC. Grounds for modification or revocation and reissuance include, but are not limited to, the following:

1. When a change which occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit;
2. When effluent limitation guidelines or standards are promulgated pursuant to the FWPCA or chapter 90.48 RCW, for the category of dischargers covered under this permit;
3. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved; or
4. When information is obtained which indicates that cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G6. REPORTING A CAUSE FOR MODIFICATION

A Permittee who knows or has reason to believe that any activity has occurred or will occur which would constitute cause for modification or revocation under Condition G5 above, or 40 CFR 122.62 shall report such plans, or such information, to Ecology so that a decision can be made on whether action to modify coverage or revoke coverage under this permit will be required. Ecology may then require submission of a new application for coverage under this, or another general permit, or an application for an individual permit. Submission of a new application does not relieve the Permittee of the duty to comply with all the terms and conditions of the existing permit until the new application for coverage has been approved and corresponding permit has been issued.

G7. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the

regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G8. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this general permit by reference.

G9. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable Federal, State, or local statutes, ordinances, or regulations.

G10. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative orders or permit modification.

G11. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by Ecology. Ecology may revoke this permit coverage or take enforcement, collection, or other actions, if the permit fees established under chapter 173-224 WAC are not paid.

G12. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER A GENERAL PERMIT

Any discharger authorized by this permit may request to be excluded from coverage under this general permit by applying for an individual permit. The discharger shall submit to the Director an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons must fully document how an individual permit will apply to the applicant in a way that the general permit cannot. Ecology may make specific requests for information to support the request. The Director shall either issue an individual permit or deny the request with a statement explaining the reason for the denial. When an individual permit is issued to a discharger otherwise subject to this general permit, the applicability of this general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation. Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G14. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to Ecology shall be signed and certified.

1. All permit applications shall be signed:
 - a. In the case of corporations, by a responsible corporate officer.
 - b. In the case of a partnership, by a general partner of a partnership.
 - c. In the case of sole proprietorship, by the proprietor.
 - d. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.
2. All reports required by this permit and other information requested by Ecology shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
 - a. The authorization is made in writing by a person described above and submitted to Ecology.
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
3. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. Certification. Any person signing a document under this section shall make the following certification:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G15. APPEALS

The terms and conditions of this general permit are subject to appeal. There are two different appeal categories.

1. The permit terms and conditions as they apply to the appropriate class of dischargers are subject to appeal within thirty (30) days of issuance of this general permit in accordance with chapter 43.21(B) RCW and chapter 173-226 WAC; and
2. The applicability of the permit terms and conditions to an individual discharger are subject to appeal in accordance with chapter 43.21(B) RCW within thirty (30) days of the effective date of coverage of that discharger.

An appeal of the coverage of this general permit to an individual discharger is limited to the applicability or non-applicability of this permit to that same discharger. Appeal of this permit coverage of an individual discharger will not affect any other individual dischargers. If the terms and conditions of this general permit are found to be inapplicable to any discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G16. SEVERABILITY

The provisions of this permit are severable, and if any provision of this general permit or application of any provision of this general permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this general permit, shall not be affected thereby.

G17. DUTY TO REAPPLY

The Permittee shall reapply for coverage under this permit at least one hundred and eighty (180) days prior to the specified expiration date of this permit. An expired permit and coverage under the permit continues in force and effect until Ecology issues a new permit (coverage) or until Ecology cancels it. Only those facilities that have reapplied for coverage under this permit are covered under the continued permit.

G18. MONITORING BEYOND PERMIT REQUIREMENTS

If the Permittee performs monitoring to document compliance with this permit beyond that required by this permit, sampling and analysis must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapters N [Parts 400–471] or O [Parts 501–503]).

Ecology may specify alternative methods for parameters without limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

APPENDIX A: DEFINITIONS

25-year, 24-hour Storm Event:

The amount of precipitation from a 24-hour storm event that has the likelihood of occurring once in a 25-year period. The amount of precipitation from a storm event of this type varies by location.

Agricultural Stormwater:

Discharges to surface water from land application fields generated only by precipitation provided that the following are true:

1. The discharge was not from the production area,
2. The discharge was not caused by human activities even if the activity took place during precipitation, and
3. Permittee is in compliance with their CAFO permit (including use of best management practices), where the manure, litter, process wastewater, or other organic by-products have been applied in accordance with site specific yearly field nutrient budget and other relevant permit requirements.

Applicant:

The person or entity applying for permit coverage.

Application for Coverage:

The form developed by Ecology used by a discharger to apply for coverage under a general permit. It is specific to each general permit. Also referred to as a Notice of Intent or NOI.

Application Rate:

The rate in quantity per acre (e.g. gallons/acre, tons/acre) that manure, litter, process waste, process wastewater, other organic by-products, or other nutrients from all sources are applied to a land application field.

Beneficial Use:

All existing and future uses of waters of the state as defined in WAC 173-200-020(4), and the use designations specified in WAC 173-201A-602. All uses have the same priority.

Composite Sample:

A series of grab samples collected over several locations within a field or *management unit* and combined together.

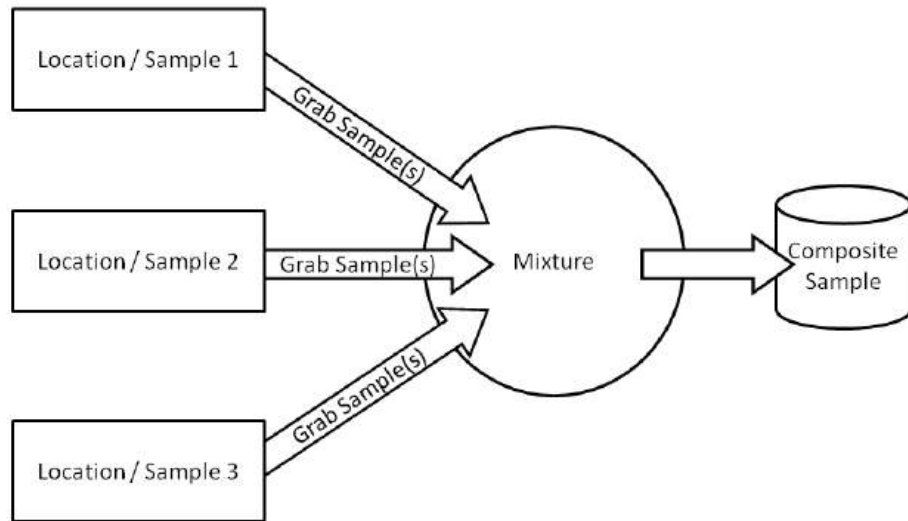


Figure 1 Composite Sample

Control:

Performing, directing, managing, overseeing, supervising, or giving instruction about any action or decision.

Crest:

The highest point of the structural (e.g. embankment) wall of a waste storage pond or other liquid storage structure.

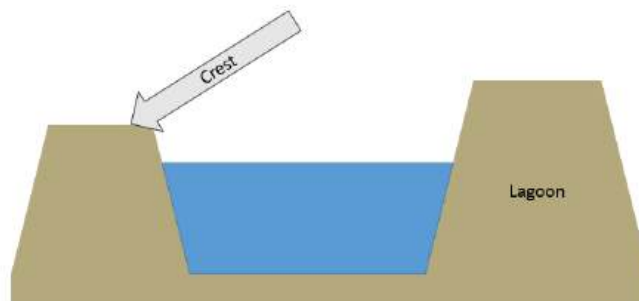


Figure 2 Crest of a waste storage structure

Discharge:

The addition of any pollutant or combination of pollutants to waters of the state.

Discharger:

The owner or operator of any commercial or industrial operation subject to regulation under chapter 90.48 RCW or the federal Clean Water Act due to a discharge.

Drier Climate:

A region in the State of Washington that receives, on average, 25 inches or less of precipitation annually.

Effluent Limitation:

Synonymous with discharge limits. Any restriction on timing, quantities, rates, and concentrations of pollutants discharged into waters of the state.

Export:

The removal of manure, litter, and process wastewater, or other organic by-products from the CAFO's production system to another party that is not under the control of the Permittee.

Feed:

Materials used for animal nutrition or that will be processed and used for animal nutrition that are stored by the CAFO such as hay, silage, grain, vegetable leavings, or other materials used for animal nutrition.

Filter Strip:

A strip of dense permanent vegetative cover such as grass and shrubs which slow land application field run-off and work to filter out nutrients and other contaminants (e.g. sediment, chemicals, bacteria, pathogens).

Freeboard:

The vertical distance from the maximum storage level (including normal storage plus storage volume for a 25-year, 24-hour storm event) of a waste storage pond to the lowest point on the waste storage pond **crest**.

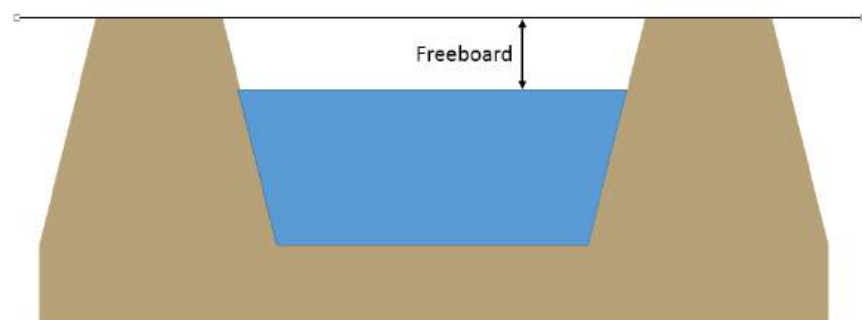


Figure 3 Freeboard

General Permit:

A permit that covers multiple dischargers of a source category within a designated geographical area in lieu of issuing individual site-specific permits to each discharger.

Geomembrane Liner:

A type of storage pond liner material that is a synthetic polymer such as reinforced polypropylene, high density polyethylene (HDPE), or polyvinyl chloride (PVC) and that is usually between 35 and 60 mil thick.

Groundwater:

Water in a saturated zone or stratum beneath the surface of land or below a surface water body. Surficially perched water is groundwater (Douma v. Ecology PCHB 00-019).

Indian Country:

As defined in 18 USC 1151: "Except as otherwise provided in sections 1154 and 1156 of this title, the term "Indian country", as used in this chapter, means (a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation, (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state, and (c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same."

Land Apply/Application:

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

Land Application Field:

An area of land, including *management units*, under the control of the CAFO (excluding the production area) to which manure, litter, process wastewater, or other organic by-products are applied as a fertilizer or soil amendment.

Litter:

Animal bedding, materials used in animal housing such as straw, sand, or shavings on the floor, or spilled feed that has come into contact with manure, other organic by-products, or other contaminants.

Management Unit:

Portions of a field or portions of multiple closely located fields which have the same or very similar soil and crop growth characteristics which allow the areas to be managed as a single land application field.

Manure:

Liquid and solid livestock excrement.

Nitrate priority area:

Area prioritized by Ecology where conditions are vulnerable to nitrate transport to groundwater and wells sampled for nitrate exceed or approach the drinking water maximum contaminant limit of 10 mg/L. Areas are based on factors such as topography, nitrate risk studies, recharge,

land use, geology, soil properties, travel time through the soil profile, nitrate concentrations, and public health exposure. Priority areas are classified as Very High (bin 1), High (bin 2), Moderately High (bin 3), Moderate (bin 4), and Moderate- Urban (bin 5). Areas classified as Low (bin 6) and Insufficient Data (bin 7) have vulnerable conditions, but little to no nitrate results above 5 mg/L.

Notice of Intent (NOI):

A formal application or request for coverage under a general permit pursuant to WAC 173-226-200. See also Application for Coverage.

Notice of Termination (NOT):

A request by the *Permittee* to Ecology to end the Permittee's permit coverage because the facility no longer requires a permit.

Over-Top:

The addition of manure, litter, process wastewater, other organic by-products, or other material (e.g. precipitation) to a waste storage pond until the level of the liquid in the pond rises over the pond crest.

Other Organic By-Product:

Decomposable materials such as compost, biosolids, digestate, crop residues, or other organic sources of nutrients that may be land applied.

Permit:

An authorization, license, or equivalent control document issued by Ecology to implement chapter 90.48 RCW, the federal Clean Water Act, and associated statutes by allowing discharges of pollutants to waters of the state within constraints.

Permittee:

The person or entity that holds a permit coverage allowing specific discharge(s) to waters of the state (surface or ground).

Point Source:

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.

Pollutant:

Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, dirt, sediment, industrial, municipal, and agricultural waste, or any other organic or inorganic matter that shall cause or tend to cause pollution when discharged into water.

Pollution:

Such contamination, or other alteration of the physical, chemical or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate **beneficial uses**, or to livestock, wild animals, birds, fish or other aquatic life.

Process Wastewater:

Any water that is used as part of the operation of a CAFO that has come into contact with manure, litter, feed, **other organic by-products**, or other contaminants on the facility.

Production Area:

The locations making up a CAFO facility that are used for animal confinement, manure, litter, feed, and process wastewater storage, product processing facilities (e.g. milking parlor, egg washing, feed mixing), and other areas used for the storage, handling, treatment, processing, or movement of raw materials, products, or wastes. This includes manure stockpiled on fields.

Qualified Expert:

Individuals who: (1) Have received professional training in waste storage facility design and construction and (2) Are capable of evaluating the conditions of the facility that could impact water quality at the site as required by this permit.

Saturated Soil:

Soil that has water filling 100% of its soil pore volume and that no longer has the capacity to retain additional water within its pore structure.

Storage Period:

The period of time (generally fall to early spring) during which manure, litter, process wastewater and other organic by-products must be stored because they may not be land applied and comply with permit requirements.

Synthetic Liner:

Synonymous with **geomembrane liner**.

T-SUM 200:

A sum of the daily heat units above zero for each day since January 1 until 200 heat units are reached. Heat units are the average of each day's low and high temperatures in degrees Celsius.

Top of the Bank:

The point on the edge of a field past which the land drops quickly down into a drainage ditch, surface water, or depression in the land.

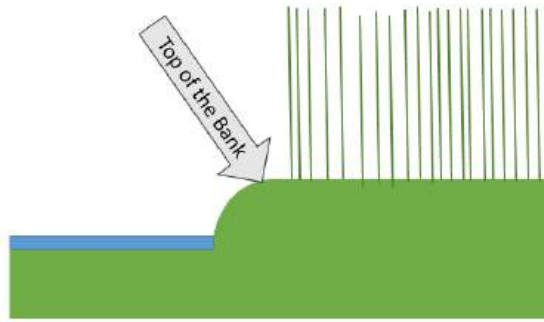


Figure 4 Top of the Bank

Total Maximum Daily Load (TMDL):

A calculation of the maximum amount of a pollutant that a water body can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations include a "margin of safety" to ensure that the water body can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation also accounts for seasonable variation in water quality.

Trust or Restricted Lands:

As defined in 25 USC § 2201(4): "(i) 'trust or restricted lands' means lands, title to which is held by the United States in trust for an Indian tribe or individual, or which is held by an Indian tribe or individual subject to a restriction by the United States against alienation; and (ii) 'trust or restricted interest in land' or 'trust or restricted interest in a parcel of land' means an interest in land, the title to which interest is held in trust by the United States for an Indian tribe or individual, or which is held by an Indian tribe or individual subject to a restriction by the United States against alienation."

Vegetated Treatment Area:

An area of permanent vegetation used to treat contaminated runoff from areas such as feedlots, feed storage, compost areas, solid manure storage areas, barnyards and other livestock holding areas.

Waste Storage Pond:

A structure designed for storage of liquid manure, process wastewater, other organic by-products, or other liquids or slurries. May also be referred to as a temporary storage pond or lagoon.

Water Table:

The level at, and below, which the ground is completely saturated with water.

Waters of the State:

Includes lakes, rivers, ponds, streams, inland waters, underground waters (**groundwater**), salt waters and all other surface waters and watercourses within the jurisdiction of the state of Washington (RCW 90.48.020).

Water Quality Standards:

The current state and federal standards for water quality including, but not limited to:

- Surface Waters of the State of Washington (chapter 173-201A WAC).
- Ground Water Quality Standards (chapter 173-200 WAC).
- Sediment Management Standards (chapter 173-204 WAC).
- Human health based criteria in the National Toxics Rule (40 CFR § 131.36).

Wetter Climate:

A region in the State of Washington that receives, on average, more 25 inches of precipitation annually.



**APPENDIX B: CAFO
GENERAL PERMIT
ANNUAL REPORT
FORM**

Permit No. WAG-_____

Facility Name: _____

Facility County: _____

Use this form to submit your annual report to Ecology. All facilities must submit a signed annual report each year on or before December 31st.

This report is for the activities conducted during calendar year 20_____

Permittee Information

Facility Name

Responsible Person

Email

Phone Number

Operator Information

Operator Name

Email

Phone Number:

Facility Information

Provide the maximum number of each type of animal confined at the facility during the calendar year.

Milking Cow:

Dry Cow:

Calf:

Feedlot Beef:

Chicken - Broiler:

Chicken - Layer:

Swine at least 55 pounds:

Swine smaller than 55 pounds:

Sheep and lambs:

Turkeys:

Ducks:

Other:

How much manure, litter, process waste, process wastewater, and other organic by-products did your facility generate during the past year?

Liquid Manure: Units:

Solid Manure Units:

Poultry Litter: Units:

Process Wastewater: Units:

Digestate: Units:

Other Organic By-products: Units:

How much manure, litter, process waste, process wastewater, and other organic by-products did your facility export during the past year?

Liquid Manure: Units:

Solid Manure Units:

Poultry Litter: Units:

Process Wastewater: Units:

Digestate: Units:

Other Organic By-products: Units:

What is the total number of acres covered in your Manure Pollution Prevention Plan?

What is the total number of acres you applied nutrients to or are in control of for this reporting period?

Discharge Information

During the year, has manure, litter, process waste, or process wastewater discharged from your production area or land application fields? If you are covered by the Combined Permit, do not include discharges of agricultural stormwater here.

☐ NO

☐ YES.

If YES, provide a summary of the approximate date, time, volume and duration of the discharge(s). Summarize your response to the discharge(s) on a separate sheet of paper and attach it with your annual report.

Nutrient Source Content Analysis

Report the results of your manure, litter, and process wastewater analyses as required in special conditions S4.I and S5.B. Results must be reported “as received” or “wet weight basis”. Print additional copies of this page if you have more nutrient sources than space provided.

Nutrient Source Name ²⁶	Sample Collection Date	Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N) concentration	Ammonia-N (NH ₃ -N) concentration	Units for Nitrogen	Total Phosphorus concentration	Units for Phosphorus

²⁶ As documented in your Manure Pollution Prevention Plan

Field Application Information

Fill out this page for each of the fields you applied manure nutrients to fields you control.

Field ID:

Field size, acres:

1st Crop Grown:

1st Crop Yield, include units:

2nd Crop Grown:

2nd Crop Yield, include units:

Field Soil Sample Analysis

Sample Depth	Date sample collected	Nitrate plus Nitrite-N (NO ₃ -N + NO ₂ -N) concentration	Ammonia-N (NH ₃ -N) concentration	Units for nitrogen concentrations	Unit conversion factor for nitrogen ²⁷	Phosphorus (P ₂ O ₅) as P concentration ²⁸	Units for Phosphorus	Unit conversion factor for phosphorus ²⁹	Organic matter content, as percent ³⁰
0-12 inches									
13-24 inches									
25-36 inches									
0-12 inches									
13-24 inches									
25-36 inches									

²⁷ When reporting pounds per acre confirm the conversion factor used by the laboratory. Typically between 3.2 to 4.0 pounds per acre per 1 ppm nitrate-N.

²⁸ Soil Phosphorus analysis required every three years.

²⁹ When reporting pounds per acre confirm the conversion factor used by the laboratory.

³⁰ Organic Matter analysis required every three years.

Nutrient Sources Applied to Field

Fill out this page for each of the fields you applied manure nutrients to fields you control. List all sources of nutrients including commercial fertilizer that were applied to this field.

Field ID:

Field Size:

Date of Application	Nutrient source name ³¹	Total amount of nutrients applied	Units of nutrients applied	Total amount of nitrogen applied	Units of nitrogen applied
Annual Total					

Adaptive Management Risk Level

If the post-harvest soil nitrate test results in a field risk level of high or very high, document the reasons for the result. High risk is soil nitrate concentrations above 31 ppm or 111 pounds per acre. Very high risk is soil nitrate concentrations above 45 ppm or 165 pounds per acre.

³¹ Nutrient Source Name must match the source reported in the Nutrient Source Content Analysis section.

Field Nutrient Budgets

Attach the final field-specific nutrient budgets prepared for each field that received manure nutrients. I have included my field-specific nutrient budgets for the year 20____.

Certification

A person who has signature authority must sign the Application. Signature authority is defined in General Condition 14 as:

- a. In the case of corporations, by a responsible corporate officer.
- b. In the case of a partnership, by a general partner of a partnership.
- c. In the case of sole proprietorship, by the proprietor.

In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

"I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Printed Name: Date:

Signature:

Paper Submittal Instructions

Once the information in above sections is complete and the form is signed by the Legally Responsible Party, mail the form and attachments to:

Washington Department of Ecology

Water Quality Program

Attn: CAFO Permit Administrator

PO Box 47600

Olympia, WA 98504-7600

Keep a copy of the completed form and attached documents for your records.

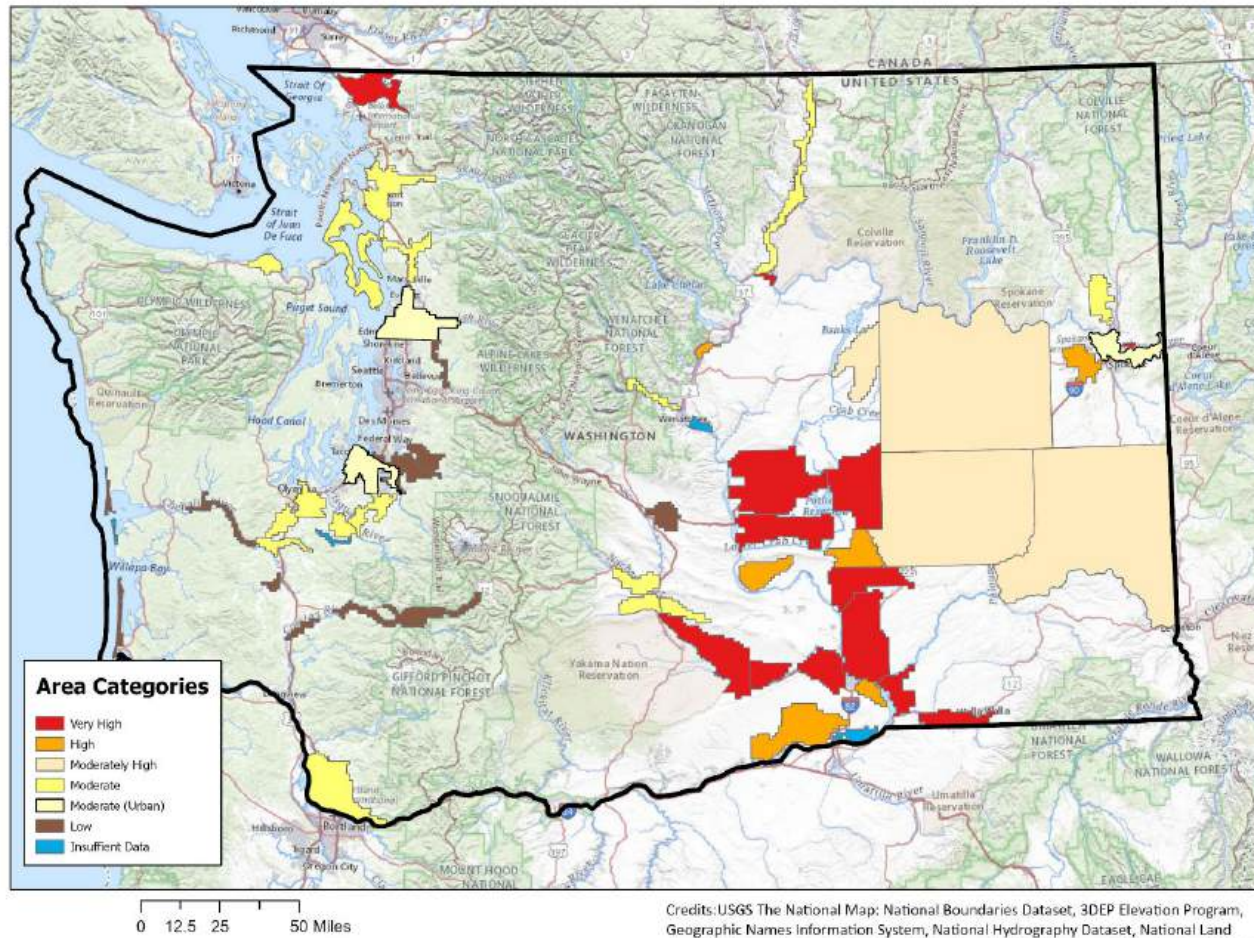
Questions

If you need assistance when filling out this report, please contact your CAFO permit inspector at the Washington Department of Agriculture.

If you're unable to reach your permit inspector, contact the CAFO permit administrator at (360) 407-6600 or cafopermit@ecy.wa.gov.

APPENDIX C: NITRATE PRIORITY AREAS

[View this map online](https://arcg.is/QLKqz)³²



³² <https://arcg.is/QLKqz>

1C – Nutrient Management

Content last updated June 23, 2014

Management Measure

Develop, implement, and periodically update a [nutrient management plan](#) to (1) apply nutrients at rates necessary to achieve realistic crop yields, (2) improve the timing of nutrient application, and (3) use agronomic crop production technology to increase nutrient use efficiency.

Management Practices

The purpose of this management practice is to reduce the nutrient loss from agricultural lands, which occurs through edge-of-field runoff or leaching from the root zone. The most effective way to manage nutrients is to develop a [nutrient management plan \(NMP\) in accordance with USDA NRCS Standard 590](#). NMPs should be updated at least once every 5 years or once per crop rotation period. Records of nutrient use and sources should be maintained for easy reference. Components of an NMP include the following:

- Farm and field maps with identified and labeled: acreage and type of crops, [soil surveys](#), location of any environmental sensitive areas including any [nearby water bodies](#) and [endangered species habitats](#).
- Realistic yield expectations for the crop(s) to be grown based primarily on the producer’s yield history, State Land Grant University yield expectations for the soil series, or USDA NRCS Soils-5 information for the [soil series](#).
- A summary of the nutrient resources available to the producer, which (at a minimum) include (a) soil test results for pH, phosphorus, nitrogen, and potassium; (b) nutrient analysis of manure, sludge, mortality compost (birds, pigs, etc.), or effluent (if applicable); (c) nitrogen contribution to the soil from legumes grown in rotation (if applicable); and (d) other significant nutrient sources (e.g., irrigation water).
- An evaluation of the [field limitations](#) and development of appropriate buffer areas, based on environmental hazards or concerns such as (a) sinkholes, shallow soils over fractured bedrock, and soils with high leaching potential; (b) lands near or draining into surface water; (c) highly erodable soils; and (d) shallow aquifers.
- Use of the limiting nutrient concept to establish a mix of nutrient sources and requirements for the crop based on realistic yield expectations.
- Identification of timing and application methods for nutrients to (a) provide nutrients at rates necessary to achieve realistic yields, (b) reduce losses to the environment, and (c) avoid applications as much as possible to frozen soil and during periods of leaching or runoff.
- Provisions for the proper calibration and operation of nutrient application equipment.
- Provisions to ensure that, when manure from confined animal facilities (excluding CAFOs) is to be used as a soil amendment or is disposed of on land, subsequent irrigation of the land does not leach excess nutrients to surface or ground waters.
- Vegetated Treatment Systems are discussed in [Management Measure 6C](#) of this NPS Encyclopedia.

Programs

- [Biologically Integrated Farming Systems](#) (BIFS) is a program to help growers enhance environmental quality while maintaining yields and profits. BIFS projects use on-farm demonstrations and a collaborative model of outreach and extension involving public-private partnerships.
- California [Certified Crop Advisors](#) (CCA) can help producers grow economically and environmentally sound crops. The California CCA program is a voluntary certification program for individuals who provide advice to growers on crop management and inputs. Their Web site lists certified crop advisors for California. For more information contact the California CCA (Telephone: (916) 928-1625).
- California [Dairy Quality Assurance](#) (CDQA) Program was created to assist dairy producers with navigating and complying with the rules and regulations governing the industry. The CDQA program is a voluntary partnership between dairy producers, government agencies, and academia to address environmental stewardship, animal welfare, and food safety issues. The environmental stewardship module has three components: education, self-assessment, and third-party evaluation, terminating in certification, and focuses on compliance with federal, state, and local water quality regulations. A comprehensive checklist is used as the assessment tool in the certification process.

Information Resources

- California Department of Food and Agriculture’s [Fertilizer Research and Education Program](#) (FREP) was created to advance the environmentally safe and agronomically sound use and handling of fertilizer materials. FREP facilitates and coordinates research and demonstration projects by providing funding and developing and disseminating information. It funds research to develop information on crops, irrigation methods, and nitrate in the soil as well as other environmental issues related to fertilizer use, such as heavy metals.
- Fawcett, R., [A Review of BMPs for Crop Nutrients and Conservation Tillage to Improve Water Quality](#). This paper is published on the Conservation Technology Information Center (CTIC) and provides information on nutrient management.
- Midwest Plan Services, Livestock and Poultry Curriculum: [Module D Land Application and Nutrient Management](#) is a national curriculum developed for U.S. livestock and poultry industry advisors and producers to help them acquire certification and achieve environmentally sustainable production systems.
- USDA Natural Resrouces Conservation Service, [Comprehensive Nutrient Management Plans](#) provides guidance to agricultural producers in developing and writing CNMPs. The site provides visitors with national and state-specific information to complete the manure management, land application, and nutrient management planning required for animal feeding operations. The site includes news, events, case studies, tools, technologies, guidelines and regulations, and links to other pertinent information.
- UC Davis, Pomology Department: [Nitrogen Fertilization Recommendation for Almond](#). This model calculates the nitrogen requirement for almond production based upon the yield history, current conditions, and previous nitrogen applications. This model can be used to calculate both timing and rate of fertilizer application required to maintain optimum yield. Site-specific information is required for accurate projection of nitrogen requirement; hence this model should be applied to each distinct management unit, such as a block or field. The data used in this model were derived from exhaustive tree-nitrogen budget determinations.
- University of California, Davis, Department of Animal Sciences: [Dairy Waste Management](#) offers tools for planning and designing dairy waste management facilities, estimating the nutrient application rate of dairy manure, and assessing the risk to ground and surface water resources.
- University of Purdue, [Manure Management Planner](#) is a Windows-based computer program developed at Purdue University that’s used to create manure management plans for crop and animal feeding operations. The user enters information about the operation’s fields, crops, storage, animals, and application equipment. MMP helps the user allocate manure (where, when and how much) on a monthly basis for the length of the plan (1-10 years). This allocation process helps determine if the current operation has sufficient crop acreage, seasonal land availability, manure storage capacity, and application equipment to manage the manure produced in an environmentally responsible manner. MMP is also useful for identifying changes that may be needed for a non-sustainable operation to become sustainable, and determine what changes may be needed to keep an operation sustainable if the operation expands.
- USDA NRCS, [Nutrient Management](#): this Website contains planning tools, databases on comprehensive nutrient management planning.
- USDA NRCS, [Web Soil Survey](#) provides a mechanism to access our official SSURGO/STATSGO soil survey data. It does not physically store the pre-packaged datasets, but instead generates them in real-time as a request is made from a customer. The Soil Data Mart will only provide access to the current version of data for a soil survey area.
- USEPA [National Agriculture Compliance Center, Crops](#): provides information about environmental requirements specifically relating to the production of many types of agricultural crops, including food, feed, and fiber crops, and specialty crops, such as tobacco, herbs, spices, mushrooms, seed crops, and aquatic plants.

References

USDA. No date. [Electronic Field Office Technical Guide for California](#). U.S. Department of Agriculture, Natural Resource Conservation Service.

USEPA. 2002. Chapter 4: Management Measures. In [National Management Measures for the Control of Nonpoint Pollution from Agriculture](#). U.S. Environmental Protection Agency, Washington, DC.

NPS Encyclopedia Site Map

(Page last updated 7/2/18)

NPS Resources

- [NPS Program Home](#)
- [Education and Outreach Grants & Funding](#)
- [Implementation Programs Plans and Policy](#)
- [Reports Staff Contacts](#)

Water is a precious resource in California, and maintaining its quality is of utmost importance to safeguard the health of the public and the environment.

- Statewide Campaigns

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Flex Alert

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- Quick Links

Board Agendas

Fees

Make a Payment

Grievance Procedure

Help / Business Help

Uniform Grants Guidance
- Resources

OIMA

CEDEN

Data & Databases

Drought Information

FAAST

Language Access Form

Formulario de Acceso al Idioma

My Water Quality

Performance Report

Tribal Affairs

Wastewater Arrearage Payment

Website Index
- Working with the Board

Abbreviations and Acronyms

Board Priorities

Decisions Pending & Opportunities for Public Participation

Employment

Frequently Asked Questions

Grants & Loans

Laws / Regulations

Plans / Policies

Public Records Center

Publications / Forms





DEPARTMENT OF
ECOLOGY
State of Washington

Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution

July 2015
Publication no. 15-10-015

Publication and Contact Information

This report is available on the Department of Ecology's website at <https://fortress.wa.gov/ecy/publications/SummaryPages/1510015.html>

For more information contact:

Washington State Department of Ecology
Water Quality Program
P.O. Box 47600
Olympia, WA 98504-7600

Phone: (360) 407-6600

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o Northwest Regional Office, Bellevue	425-649-7000
o Southwest Regional Office, Olympia	360-407-6300
o Central Regional Office, Yakima	509-575-2490
o Eastern Regional Office, Spokane	509-329-3400

To request ADA accommodation including materials in a format for the visually impaired, call Water Quality Program at Ecology, (360) 407-6600. Persons with impaired hearing may call Washington Relay Service at 711. Persons with speech disability may call TTY at 877-833-6341.

Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution

*by
Ben Rau*

Water Quality Program
Washington State Department of Ecology
Olympia, Washington

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Table of Contents

	<u>Page</u>
Table of Contents	i
List of Figures and Tables.....	v
Figures.....	v
Tables.....	v
Acknowledgements.....	vi
Executive Summary	vii
Chapter 1: Nonpoint Source Pollution in Washington State	1
Land use and Nonpoint Source Pollution	1
What is the quality of Washington State’s water?	1
Water quality assessment	1
Nonpoint pollution in Washington State	2
The impacts of land use practices-summary	3
Chapter 2: Washington State’s Regulatory Framework	7
State water quality laws-regulatory	7
Washington State Water Pollution Control Act	7
Forest Practices Rules.....	8
Dairy Nutrient Management Program (DNMP).....	9
On-Site Sewage Systems.....	10
Additional State Authorities (Regulatory and Non-regulatory).....	12
State Environmental Policy Act	12
Land Use Planning: Growth Management Act, and Shoreline Management Act.....	12
Shellfish Protection Districts.....	14
Salmon Recovery Act, and Salmon Enhancement Program	14
Biosolids	14
Oil and Hazardous Substance Spill Prevention and Response Act	15
Toxics Cleanup, Hazardous Waste, Solid Waste, and Air Quality	15
Hydraulic Project Approval (HPA)	15
Aquatic Invasive Species (AIS) Program.....	15
Secondary Containment Rules (Fertilizer and Pesticide).....	16
Chemigation and Fertigation Technical Assistance Program (CFTAP)	16
Federal Laws (Regulatory and Non-Regulatory).....	17
Clean Water Act	17
Coastal Zone Act Reauthorization Amendments of 1990 (CZARA).....	21
Safe Drinking Water Act	22
Endangered Species Act	23
Federal Farm Bill Programs	24
State Revolving Fund Program	24
Local Ordinances and Regulations	25

Chapter 3: Strategies for Addressing Nonpoint Source Pollution	27
Balancing Restoration and Protection.....	28
Watershed Clean-up Programs	29
Total Maximum Daily Loads and Straight to Implementation	29
Total Maximum Daily Loads (TMDLs).....	29
Straight to Implementation (STI)	32
Focus on Implementation-TMDLs and STIs.....	33
TMDLs and Stormwater	35
Data Tracking, Effectiveness Monitoring, and Adaptive Management	36
Ecology Grant and Loan Programs.....	36
Complaint Response and Inspectors	38
Education and Outreach, and Voluntary Programs.....	39
Partnerships.....	39
Locally Led Water Clean-up Programs	40
Pollution Identification and Correction (PIC) Programs.....	40
Shellfish Protection Districts.....	42
Other Tools to Promote Implementation	43
Draft Water Quality Trading Framework.....	43
Certification and Certainty Programs	44
Continued Implementation of Key Regulatory Programs	45
Forest Practices.....	45
Agricultural.....	52
More information about the program may be found here:	
http://agr.wa.gov/FoodAnimal/Livestock-Nutrient/	54
On-Site Sewage Systems (OSS) Regulation	54
Water Quality Permits	56
State Initiatives.....	57
Governor’s Results Washington.....	57
Washington Shellfish Initiative	57
Puget Sound Action Agenda	58
No Discharge Zone Designation-Puget Sound.....	59
Ocean Acidification/Marine Resources Advisory Council	59
Salmon Recovery in Washington	60
Chemical Action Plan (CAP) Development.....	61
The Voluntary Stewardship Program (VSP)	61
Chapter 4: Water Quality Partnerships	63
Working with Local, State, Tribal and Federal Agencies.....	63
Statewide Coordination.....	63
Agriculture and Water Quality Advisory Committee	63
Water Quality Partnership	64
Financial Assistance Council	65
Landowners, Businesses, and Agricultural Producers.....	65
Agricultural Producer Groups.....	65
Grant Recipients.....	65
Local Governments.....	66
Conservation Districts and State Conservation Commission	67

Local Health Departments and Districts.....	69
Interagency Project Team.....	69
Washington Tribes.....	69
State Agencies.....	70
Federal Agencies.....	72
List of Federal Agencies and Responsibilities	73
Federal Lands-Forestry.....	73
Chapter 5: Financial Incentive Programs.....	77
Coordinated Investment.....	77
Financial Assistance Sources	77
Chapter 6: Recommended Management Measures.....	81
Federal Requirements	81
Existing Guidance	82
Existing Regulatory Programs and Permits.....	82
Stakeholder Involvement	83
Next Steps	83
July 2015-June 2016 Timeline	84
Chapter 7: Monitoring.....	87
Ecology’s Monitoring Strategy.....	87
Water Quality Assessment.....	88
Compiling Existing Sources of Data and Information	88
Data Quality Requirements	88
Data Review, Verification, and Validation	89
Data Analysis Procedures.....	89
Reporting.....	90
Ecology Monitoring Programs.....	91
Water Quality Improvement (WQI) Projects	91
River and Stream Ambient Monitoring.....	92
Marine Water Ambient Monitoring.....	92
Marine Sediment Monitoring	93
Stream Biological Monitoring.....	94
Stream Flow Monitoring	94
Invasive Aquatic Plant Monitoring	95
Beach Environmental Assessment, Communication and Health (BEACH) Prgm.....	95
Freshwater Fish Contaminant Monitoring Program.....	95
Lake/Reservoir Monitoring	96
Groundwater Monitoring.....	96
Intensively Monitored Watersheds.....	97
Water Quality Grants Projects.....	97
Stormwater Work Group	97
Other Monitoring Programs.....	98
U.S. Geological Survey	98
U.S. Forest Service	98
Habitat Conservation Plans	99
Shellfish Growing Area Monitoring.....	99

Salmon Recovery Act.....	100
Strategy to Recover Salmon	100
Aquatic Nuisance Species Management Plan	100
Yakima Ground Water Management Area.....	101
Surface Water Monitoring for Pesticides in Salmon-Bearing Streams	101
Identifying Viable Mitigation for Reducing Malathion Pollutant Loading to Streams	102
Assessing Effectiveness of Pesticide Rule Pertaining to Cranberry Growing Areas	102
Tribal Monitoring.....	102
Local Government Monitoring.....	102
Effectiveness Monitoring.....	102
Effectiveness Monitoring of the Forest Practices Rules.....	103
Quality Assurance.....	105
Data Management	106
Environmental Information Management System (EIM and MyEIM).....	106
303(d)/305(b) Integrated Report Viewer (formerly known as WATS).....	107
Ecology Administrative Grants and Loans Database (EAGL).....	107
Laboratory Information Management System.....	107
The Pacific Northwest Water Quality Data Exchange	107
Coastal Atlas.....	108
TMDL and Nonpoint Source Implementation Tracking Database	108
Chapter 8: Groundwater.....	109
Causes of Nonpoint Pollution in Groundwater.....	110
Regulatory Framework Nonpoint Pollution Control for Groundwater.....	110
Water Pollution Control Act.....	110
Ground WQ Standards	110
Washington State’s Safe Drinking Water Act.....	111
Current Groundwater Pollution Control for Nonpoint Sources.....	111
Washington State Department of Ecology	111
Washington State Department of Agriculture	111
On-Site Sewage System Regulation.....	112
Washington State Department of Health Drinking Water Program	112
Ground Water Management Areas (GWMAs).....	112
Nitrate	113
Nitrate Prioritization Project.....	113
Chapter 9: Goals and Strategies.....	117
Appendices.....	125
Appendix A. Assessment of Nonpoint Pollution in Washington State	125
Appendix B. Letter from Ron Lavigne, Assistant Attorney General	126
Appendix C. Minimum Elements of a Watershed-based Plan	128
Appendix D. Letter from the Department of Health to Ecology concerning shellfish protection	133
Appendix E. The Voluntary Stewardship Program and Clean Water	136
Appendix F. Response to comments received on the public review draft.....	145

List of Figures and Tables

Page

Figures

Figure 1 Forest Practices Adaptive Management Program	48
Figure 2 Ecology's Tiered Monitoring Strategy	88
Figure 3 Public water supply system groundwater sources	109
Figure 4 Groundwater Nitrate Sample Record Max <5 mg/L as N	115
Figure 5 Groundwater Nitrate Sample Record Max >5 mg/L as N	115

Tables

Table 1 Pollutant categories associated with nonpoint pollution from agricultural areas.	3
Table 2 Pollutant categories associated with nonpoint pollution from atmospheric deposition.....	3
Table 3 Pollutant categories associated with nonpoint pollution from forested areas.....	4
Table 4 Pollutant categories associated with nonpoint pollution from hydromodification.	5
Table 5 Pollutant categories associated with nonpoint pollution from marine/boating areas.	6
Table 6 Pollutant categories associated with nonpoint pollution from urban areas.	6
Table 7 Projects-Forest Practice Rules Effectiveness.....	104
Table 8 Goals, Objectives, Strategies and Measurable Milestones	118

Acknowledgements

The author of this plan would like to thank the following people for their contribution to this plan:

- Lawrence Sullivan, Stuart Glasoe and Mary Knackstedt (DOH)
- Ginny Prest (WSDA)
- Mindy Fohn (Kitsap County Public Works) and Stuart Whitford (Kitsap Public Health)
- Marc Engel (DNR)
- Jim Bolger (PSP)
- Jo Henszey (EPA)
- Ron Shultz (WSCC) and Dave Vogel (WACD) for helping organize early feedback from conservation districts
- Washington State Department of Ecology staff
 - Helen Bresler and Melissa Gildersleeve
 - Mark Hicks, Ron Cummings, Stephen Bernath, Alissa Ferrell, Patricia Brommer and Laurie Morgan.
 - Will Kendra, Jessica Archer, Siana Wong and Paul Pickett.
 - Members of the Nonpoint Source Workgroup:
 - Deborah Cornett
 - Derek Rockett
 - Stephanie Zurenko
 - Donovan Gray
 - Andrew Funk
 - Ralph Svrjek
 - Jane Creech
 - Chris Coffin
 - Chad Atkins
 - Martyn Quinn
 - Mike Kuttel, Jr.
 - Mak Kaufman
 - Jessica Kirkpatrick
 - Chris Luerkens
 - Andrew Wargo
 - Marc LaCasse

Executive Summary

This document outlines Washington State's approach to addressing water quality impacts from nonpoint sources (NPS) of pollution. This statewide management plan meets U.S. Environmental Protection Agency (EPA) Clean Water Act requirements, and ensures Washington State's eligibility for Section 319 (federal NPS Program) funding.

The Washington State Department of Ecology (Ecology) is the regulatory agency charged with protecting the quality of Washington State's water. Ecology acts as the lead agency in restoring, maintaining and enhancing water quality collaboratively with citizens, stakeholder groups, tribes, local governments, state agencies, and federal agencies. Ecology's NPS program uses a combination of technical assistance, financial assistance, and regulatory tools to help citizens understand and comply with state and federal water quality laws and regulations.

The passage of the state Water Pollution Control Act and federal Clean Water Act helped Washington State make important progress in cleaning up our rivers, lakes, and coastal waters largely by controlling pollution from factories, sewage plants, and other "point" sources of pollution.

Yet, based on the available water quality data, there remain a significant number of waterways that are not meeting the state Water Quality Standards which protect all beneficial uses.

Runoff from streets, farms, forest lands and other sources continue to pollute our waters. These are considered NPS of pollution, and they represent the largest remaining challenge in achieving compliance with state Water Quality Standards. Both point and NP sources of pollution must be addressed to reverse the trend of impairment and achieve the goals outlined in state and federal law.

This plan aims to protect public health and restore our state's waters by setting clearer goals and standards, and emphasizing the implementation of proven suites of best management practices to prevent pollution.

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Chapter 1: Nonpoint Source Pollution in Washington State

Land use and Nonpoint Source Pollution

Nonpoint source pollutants are introduced into water through:

- Runoff (typically rainfall and snow melt washing pollutants from the land into rivers, streams, lakes, oceans, and underground aquifers).
- Direct deposition of pollutants into state waters.
- Habitat alteration and hydromodification (the alteration of the natural flow of water across a landscape, including channel modification or channelization).
- Atmospheric deposition.

Land use is strongly correlated to nonpoint pollution. Therefore, to manage nonpoint source (NPS) pollution, we must focus on land use activities. The major sources of nonpoint pollution can be divided into the following categories.

Categories	Associated Land Uses
Agriculture	Livestock keeping; crop production; grazing; non-commercial agriculture.
Atmospheric Deposition	Emissions from various sources; wind borne erosion.
Forest Practices	Road construction and maintenance; harvesting; chemical applications.
Habitat Alteration/ Hydromodification	Filling of wetlands and alteration of riparian areas; shoreline development; stream channelization; dikes; dredging; riprap; and dams.
Recreation	Marinas and boats, off-road vehicles.
Urban/Suburban Areas	Stormwater runoff; on-site sewage systems; hazardous materials; construction and maintenance of roads and bridges; residential use of fertilizers and pesticides.

What is the quality of Washington State's water?

Water quality assessment

Ecology's primary means of reporting on the status of water quality is through the development of an integrated water quality monitoring and assessment report, based on EPA's 2002 *Integrated Water Quality Monitoring and Assessment Report Guidance* (November 2001).

Washington State's Water Quality Assessment satisfies Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists, Washington's Integrated Report combines the statewide assessment of all of the state's waters, which is required by Section 305(b), and the list of impaired waters, which is required by Section 303(d).

Ecology's Water Quality(WQ) Program has adopted Policy 1-11 that describes the methods used for assessing information to evaluate attainment of WQ Standards. The policy includes criteria for compiling, analyzing, and integrating data on ambient conditions with project implementation information. The policy describes how the state integrates data from numerous sources, collected for a variety of purposes under a variety of quality control practices.

Washington State's Water Quality Assessment places waterbody segments into one of five categories. All waters in Washington (except those on reservation lands) fall into one of the five categories which describe the status of water, from clean to polluted. *Washington State's Water Quality Assessment* may be found on Ecology's website at:

<http://www.ecy.wa.gov/programs/wq/303d/index.html>

The assessment helps us prioritize the use of state resources more efficiently by focusing on water bodies that need the most work, and to address the problem pollutants that show up most often. It should be noted, however, that the water quality assessment is not a full accounting of the water quality problems in Washington. There are still many water bodies that have not been monitored yet.

Nonpoint pollution in Washington State

To support development of the NPS Plan, Ecology conducted a study of existing information regarding nonpoint source pollution in Washington.¹ The objective of this study was to research and document the current known extent of NPS pollution, evaluate the land uses and human activities that can generate NPS pollution, and look at the linkage between land uses, human activities, and NPS pollution in Washington.

To accomplish this, Ecology evaluated technical reports and other information sources produced since 2005. The study employed several distinct areas of research:

- A review of existing U.S. Environmental Protection Agency guidance.
- A review and summary of recent research on NPS pollution relevant to Washington State.
- Compilation of calculated NPS load reduction targets in 49 Total Maximum Daily Load (TMDL) studies conducted in Washington since 2005.
- An exploratory analysis of TMDL load allocations and associated land uses, using Geographic Information Systems.
- An evaluation of Section 319 grants used for NPS pollution control.
- Four case studies in data-rich watersheds: Walla Walla River, Lower Yakima River, Dungeness River and Bay, and Samish Bay.

Results of these areas of analysis were synthesized to draw conclusions for different categories of nonpoint pollution sources, including agriculture, urban and residential areas, hydromodification, marinas and boating, forests, atmospheric deposition, and natural sources.

¹ To access the full report see Appendix A.

The study found that nonpoint pollution sources are widespread in Washington and cause a variety of water pollution problems. Application of best management practices will help reduce and prevent these pollution impacts.

The impacts of land use practices - summary

Agricultural

Agricultural areas have consistently been cited as a significant source of impairment in freshwaters nation-wide. Documented water quality impacts from agricultural areas include elevated levels of fecal coliform bacteria, suspended sediment, turbidity, pesticides, PCBs, nutrients, and pH, as well as decreased levels of dissolved oxygen, and elevated water temperatures through loss of riparian shade.

Table 1 Pollutant categories associated with nonpoint pollution from agricultural areas.

Pollutant Category	Typical Sources	Impacts
Fecal coliform bacteria	Direct animal access to streams; manure overspray, or runoff; runoff from pastures, grazing areas, application areas, manure piles, or heavy use areas	Human health, shellfish harvest
Suspended sediment/ Turbidity	Erosion from animal access to stream banks, runoff from heavy use areas or cultivated fields, runoff from irrigated farm fields	Aquatic life uses, aesthetics
Pesticides	Direct overspray, runoff from fields	Human health, aquatic life uses
Nutrients/ Dissolved oxygen/pH	Direct animal access to streams, manure or fertilizer overspray or runoff, runoff from pastures, grazing areas, heavy use areas or cultivated fields	Aquatic life uses, aesthetics
Shade/Temperature	Loss of riparian shade due to clearing, suppression of riparian vegetation by grazing animals, degradation of riparian condition from animal access or cultivation in riparian areas	Aquatic life uses

Atmospheric Deposition

Atmospheric deposition of nitrogen, sulfur, mercury, and other toxic compounds such as polychlorinated biphenyls (PCBs) and dioxins enter surface waters via direct fallout or when soils contaminated via atmospheric deposition erode and enter surface waters. Fallout may occur as wet deposition, in which emissions react with water vapor in the air and fall as precipitation (e.g., nitric and sulfuric acids—*acid rain*), or as dry deposition, in which emissions fall in gaseous or particulate form. Emission sources include industrial facilities, vehicle exhaust, and agriculture-related activities, as well as volatilization, or open burning of PCB/dioxin-laden materials. Surface water deposition from atmospheric emissions have been found to occur at local, regional, and global scales.

Table 2 Pollutant categories associated with nonpoint pollution from atmospheric deposition.

Pollutant Category	Typical Sources	Impacts
Nitrogen (ammonia, nitrate), Phosphorus, Sulfur dioxide	Vehicle, agricultural, and industrial emissions, wind-borne erosion	Aquatic life uses
Mercury	Mining, coal burning	Human health, aquatic life uses
PCBs, Dioxin, Furans	Backyard burning of pollutant-laden trash, volatilization from soils or water	Human health, aquatic life uses

Forest Practices

The main pollutants associated with activities in forested areas include temperature, sediment, and nutrients. Nonpoint pollution from toxic chemicals, including heavy metals and pesticides, has also been associated with forest activities.

Table 3 Pollutant categories associated with nonpoint pollution from forested areas

Pollutant Category	Typical Sources	Impacts
Suspended sediment/ Turbidity	Loss of riparian vegetation, concentration of flow from roads, road failures	Aquatic life uses
Temperature	Loss of riparian vegetation	Aquatic life uses
Nutrients/dissolved oxygen	Loss of riparian vegetation, forest fertilization	Aquatic life uses
Toxic chemicals (heavy metals, pesticides)	Sedimentation, aerial forest pesticide applications	Human health, aquatic life uses

The primary means by which timber harvest impacts water quality is through: 1) removal of the trees which provide shade, leaf litter and woody debris, 2) removal of trees and vegetation in sufficient amounts to change the flow of water and nutrients, and 3) compacting and disturbing soils such that excess sediment is delivered to streams with precipitation events.

Poorly located roads, outdated construction practices, and lack of maintenance of forest roads can have a large impact on water quality. Road activities can increase sedimentation through soil compaction and increased runoff from these compacted surfaces.

The loss of shade through removal of streamside canopy is a well-established mechanism leading to elevated stream temperatures. Elevated stream temperatures can contribute to lowered dissolved oxygen levels. Other riparian functions and watershed characteristics, including streambank stability, filtration, and surface water-groundwater connectivity, are affected by forestry and can affect stream temperatures.

The mechanisms and specific risks of water quality impacts from forestry may change with the location in the watershed. Areas in the upper portions of watersheds tend to have steeper, more unstable slopes relative to lower-gradient areas further downstream, and are thus more prone to sediment erosion and debris flows affecting water quality, both locally and downstream. Throughout the watershed forest harvest activities and their associated roads can impact water quality with higher sediment loads when those activities directly discharge to streams or are located too near to streams.

Habitat Alteration/Hydromodification

Hydromodification or habitat alteration, a category found widely in EPA NPS guidance, is comprised of a variety of impacts ranging from large dams to development in riparian zones. Typical forms of hydromodification include:

- Dams and weirs forming reservoirs or ponded areas
- Channelized streams
- Bank armoring and levees
- Bank excavation and removal of riparian vegetation
- Streambank and shoreline erosion

- Removing vegetation and/or large woody debris
- Drain or fill of wetlands
- Irrigation diversions
- Culverts

This category overlaps with many of the other categories since agriculture, urban and residential development, and forestry can affect riparian zones. However, many hydromodification impacts occur directly from channel modification, or from activities on vacant or open space lands. In general, the term “hydromodification” used in this context refers to modifications to the geomorphological channel structure that impair water quality or aquatic habitat. Restoration activities may involve a channel “remodification” to restore ecological function.

The critical aspects of hydromodification are that:

- It can affect any kind of water body – marine, river, stream, lake, or wetland.
- It can be associated with almost any kind of land use or human activity.
- It impacts the aquatic ecosystem physically through loss of habitat and ecosystem function.
- It also impacts the aquatic ecosystem through the discharge of contaminants from construction, building materials, erosion, and the lack of a riparian vegetated buffer to prevent the transport of contaminants from overland flow.

Table 4 Pollutant categories associated with nonpoint pollution from hydromodification.

Pollutant Category	Typical sources	Impacts
Temperature	Loss of riparian canopy, changes in channel morphology, changes in surface water-groundwater interactions	Aquatic life uses
Suspended sediment/ Turbidity	Erosion, alteration of transport and deposition dynamics	Aquatic life uses
Bacteria, Nutrients/ Dissolved oxygen/pH, Pesticides	Loss of the riparian buffer	Aquatic life uses, human health, aesthetics

Recreation

Although generally a less pervasive nonpoint issue compared to agriculture and urban/residential areas, the impacts of NPS pollution from marinas and recreational boating can be present in our coastal areas and lakes.

This is especially true in Puget Sound waters that are poorly flushed and mixed. At the same time, Puget Sound waters contain economically important fish and shellfish areas, marine protected areas, aquatic reserves, and public beaches.

Table 5 Pollutant categories associated with nonpoint pollution from recreation and marine/boating areas.

Pollutant Category	Typical sources	Impacts
Fecal coliform bacteria	Direct sewage discharge	Contact recreation, shellfish harvest
Toxic chemicals (heavy metals, organic toxics)	Anti-fouling paint, solvents, sealers, lubricants	Human health, aquatic life uses
Nutrients from soaps and detergents	Direct sewage discharge, boat cleaning	Aquatic life uses, aesthetics
Petroleum hydrocarbons	Engine fueling and operation, bilge water	Human health, aquatic life uses, aesthetics

Urban and Residential Areas

Urban (including commercial, industrial, and residential) areas and non-urban residential areas have long been recognized as one of the top sources of nonpoint pollution across the United States. A mix of land use and human activities typically contribute to overall nonpoint pollution issues in urbanized watersheds.

The key transport mechanism involved is stormwater runoff from impervious surfaces, although direct dumping and hydromodification also contribute. The most common pollutants associated with nonpoint pollution in urban areas are fecal coliform, toxic chemicals, suspended sediment and turbidity, and nutrients.

Table 6 Pollutant categories associated with nonpoint pollution from urban areas.

Pollutant Category	Typical Sources	Impacts
Fecal coliform bacteria	Onsite sewage systems, pet waste, urban wildlife	Contact recreation, shellfish harvest
Suspended sediment/ Turbidity	Erosion from construction or landscaping, road runoff, road maintenance, bank erosion from increased peak flows	Aquatic life uses, aesthetics
Toxic chemicals (heavy metals, pesticides)	Landscaping chemicals, road runoff, commercial or industrial spills, leaking storage tanks	Human health, aquatic life uses
Nutrients/Dissolved oxygen/pH	Landscaping chemicals, road runoff, commercial or industrial spills, pets, and urban wildlife	Aquatic life uses, aesthetics
Petroleum hydrocarbons	Road runoff, commercial or industrial spills, leaking storage tanks	Aquatic life uses
Temperature	Loss of riparian canopy, changes in channel morphology, changes in surface water-groundwater interactions	Aquatic life uses

Chapter 2: Washington State's Regulatory Framework

This chapter describes Washington State's statutory and regulatory framework for implementing the NPS program. The authority to implement the NPS program is based primarily on the State Water Pollution Control Act and two federal laws—the Clean Water Act (CWA) and Coastal Zone Act Reauthorization Amendments of 1990 (CZARA). Further, three additional state laws provide enforceable mechanisms that address NPS pollution from forest practices, dairies, and on-site-sewage systems. Finally, other relevant state, and local laws are also included to provide a full picture of the legal framework in Washington State.²

State water quality laws-regulatory

In Washington State, the Water Pollution Control Act (Chapter 90.48 RCW) is the principal state law governing water quality. It provides the primary authority to regulate NPS pollution, achieve compliance with the state WQ Standards, and require the implementation of best management practices (BMPs) to address NPS pollution. Other state and local authorities can also provide authority to address NPS pollution. In addition to the Water Pollution Control Act, this section describes three other state laws and associated regulations (the Forest Practices Rules, the Dairy Nutrient Management Act, and On-Site Sewage Systems Regulations) that provide enforcement authority to address nonpoint sources of pollution.

Washington State Water Pollution Control Act

The Washington State Water Pollution Control Act (Chapter 90.48 RCW) is the principal law governing water quality in Washington State. It establishes a comprehensive program to protect water quality and the beneficial uses of water. The goal of the Water Pollution Control Act is to “maintain the highest possible standards to insure the purity of all waters of the state...”³ Further, to achieve this goal the state will “require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state....”⁴ The Water Pollution Control Act applies to surface waters, wetlands and ground water.

Under the Washington State Water Pollution Control Act, Ecology is given the jurisdiction “to control and prevent the pollution of... waters of the state of Washington.”⁵ Pollution is broadly defined in RCW 90.48.020, and includes the contamination or other alteration of the physical, chemical, or biological properties of any waters of the state. Under state law, it does not matter whether the pollution comes from a point or NP sources, all pollution of state waters is subject to Ecology's authority to control and prevent pollution.

² While this chapter discusses most of the relevant authorities in Washington State, it is not intended to be comprehensive of all possible legal authorities that can be used to address nonpoint sources of pollution. In some cases other legal authorities may be better suited to address a specific nonpoint pollution problem.

³ See RCW 90.48.010.

⁴ See RCW 90.48.010.

⁵ See RCW 90.48.030.

The Water Pollution Control Act makes it unlawful for any person to “cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged ... any organic or inorganic matter that shall cause or tend to cause pollution of” waters of the state.⁶ Any person who violates or creates a substantial potential to violate the provisions of Chapter 90.48 RCW is subject to an enforcement order from Ecology pursuant to RCW 90.48.120. Ecology is authorized to “issue such order or directive as it deems appropriate under the circumstances[.]”⁷

In addition to administrative orders, violating Chapter 90.48 RCW may result in injunctions, civil penalties, and notices of violations.⁸ Finally, any “person who conducts a commercial or industrial operation of any type which results in the disposal of solid or liquid waste material into the waters of the state” must obtain a state waste discharge permit before discharging to state waters.⁹ Ecology issues three types of wastewater discharge permits: (1) State Waste Discharge Permit; (2) National Pollutant Discharge Elimination System (NPDES)/State Waste Discharge Permits; and (3) General Permit (may be issued under combined NPDES/State or State-only authority).

It is worth noting that while RCW 90.48.120 gives Ecology the authority to take action in response to NPS pollution, the statute also gives Ecology the authority to take action based on a “substantial potential” to pollute state waters via either a point or nonpoint pollution source. Consequently, Ecology not only has authority to take action following a NPS pollution occurrence (i.e. there was a discharge), but has specific statutory authority to act proactively to prevent NPS pollution from occurring in the first place.

Finally, Ecology’s authority includes the ability to require a nonpoint source polluter to implement specific best management practices (BMPs). Ecology’s authority can be used to prevent nonpoint pollution and require BMPs, as necessary.¹⁰

Forest Practices Rules

The Forest Practices Rules establish protection standards for forest practices activities such as timber harvest, pre-commercial thinning, road construction and maintenance, fertilization, forest chemical application, required reforestation, and specific riparian and wetland protection measures.¹¹ They give direction on how to implement the Forest Practices Act¹² and the Stewardship of Non-industrial Forests and Woodlands.¹³ The rules are designed to protect public resources, such as water quality and fish habitat while maintaining a viable timber industry. They are under constant review through an adaptive management program.

The Forest Practices Board, an independent state agency, adopts Forest Practices Rules. The Department of Ecology needs to concur with proposed rules involving water quality protection prior to adoption by the Forest Practices Board.

⁶ See RCW 90.48.080.

⁷ See RCW 90.48.120.

⁸ See RCW 90.48.037, RCW 90.48.144, RCW 90.48.120, and RCW 90.48.240.

⁹ See RCW 90.48.160.

¹⁰ See Appendix B.

¹¹ See Title 222 WAC.

¹² See Chapter 76.09 RCW.

¹³ See Chapter 73.13 RCW.

The Forest Practice Rules requires trees to be left within streamside areas to shade streams (which keep them cool), to protect stream bank integrity, to capture surface run-off sediment, and to provide the woody debris that builds in-stream salmon habitat. They also establish road construction standards and required road maintenance, provide protection for wetlands, and set restrictions on pesticide use. An approved Forest Practices Application from the state Department of Natural Resources (DNR) is required for any forest practices activities on forestlands in the state meeting certain criteria. DNR is authorized to inspect operations and enforce all rules related to forest practices. Ecology is also authorized to take enforcement action if needed to prevent damage to water quality.

Dairy Nutrient Management Program (DNMP)

The Dairy Nutrient Management Act¹⁴ is administered by the Washington State Department of Agriculture (WSDA). Chapter 90.64 RCW requires all grade “A” licensed dairies under Chapter 15.36 RCW to:

- Register with the DNMP.
- Develop a nutrient management plan (NMP) that describes how manure and process waste water will be managed including collection, storage and utilization. The NMP must be approved within six months of licensing, and certified within twenty-four months of licensing by their local conservation district.
- Prevent discharges to waters of the state.
- Maintain land applications records demonstrating agronomic use of all nutrients.

Chapter 90.64.026 required the Washington State Conservation Commission (WSCC) to develop a document that clearly describes the elements that a dairy nutrient management plan must contain to gain local conservation district approval by November 1, 1998. In addition, WSCC may authorize other methods and technologies than natural resources conservation service if they meet specific standards (see RCW 90.64.026(3)).

The NMP development process is completed by the dairy producer in consultation with a local conservation district, the Natural Resources Conservation Service (NRCS), or a private planner. The NMP development includes a process to assess the number of animals and nutrient inventory, surface and ground water risk(s), manure and process waste water collection, conveyance and storage needs, crop production history, and land application acreage needs. The NMP process identifies the producer’s goals, resource risk(s), and BMPs to protect the resource.

Chapter 16-611 WAC specifies requirements for recordkeeping and the penalty matrixes for recordkeeping and water quality violations.

Chapter 90.64 RCW requires DNMP to implement an inspection program to monitor dairy operations for NMP implementation, recordkeeping violations, and water quality violations (actual or potential). If the water standards (WAC 173-201A) are violated, DNMP has the authority to issue civil penalties. In addition, Chapter 43.05 RCW (Technical Assistance) requires DNMP to identify dairies that could benefit from additional technical assistance. This could be a need for regulatory technical assistance solved by explaining what the laws and rules

¹⁴ Chapter 90.64 RCW.

are, or this could be what is commonly thought of as technical assistance from local conservation districts or private consultants and engineers. Often the local conservation districts are the first stop as they can provide cost share dollars for some projects.

The program is managed in conformance with a Memorandum of Understanding between WSDA and Ecology. Ecology is responsible to EPA for Clean Water Act compliance for animal feeding operations (AFO)s and confined animal feeding operations (CAFOs) and retains the authority under Chapter 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. However, in accordance with the MOU, Ecology recognizes WSDA as the lead on all compliance actions against non-permitted dairies.

On-Site Sewage Systems

Small On-Site Sewage Systems

Small on-site sewage systems (OSS), also known as septic systems, treat domestic sewage from private residences, restaurants, and other small-scale developments. They are used extensively statewide in rural and suburban infill settings.¹⁵ In Washington State, small OSS are regulated by Chapter 246-272A WAC (state OSS rule), Chapter 70.118A RCW (marine recovery area statute), Chapter 43.20 RCW, and Chapter 70.05 RCW. The state OSS rule is adopted by the State Board of Health¹⁶ (SBOH) and administered by the State Department of Health. Local codes must be consistent with, and at least as stringent as the state laws.¹⁷

Chapter 246-272A WAC provides minimum requirements for the location, design, and performance of OSS. Anyone proposing the installation, repair, modification, connection to, or expansion of an OSS, is required to obtain a permit from the local health officer prior to construction.

Local Health Jurisdictions (LHJs) work with local boards of health to adopt and administer the local codes. The LHJs are responsible for permitting all OSS and implementing other significant aspects of the state OSS rule. This includes developing and overseeing management plans (see next section), approving OSS designs, inspecting installations, certifying industry professionals, maintaining system records, and educating homeowners on program requirements and the proper use and care of systems.

OSS owners are responsible for operating, monitoring and maintaining OSS to minimize the risk of failure. Owners are required to have systems pumped when necessary, to avoid damage or improper use of the system, and to ensure the flow of sewage does not exceed the approved design in both quantity and waste strength.

¹⁵ Small on-site sewage systems (OSS) are those sewage systems that have flows of less than 3,500 gallons per day. See Chapter 246-272A WAC. There are about 950,000 OSS in Washington. See

¹⁶ RCW 43.20.050 authorizes the State Board of Health to “adopt rules for the design, construction, installation, operation, and maintenance” of small on-site sewage systems.

¹⁷ The State Department of Health’s On-site Sewage Program reviews local health jurisdiction codes to ensure they are consistent with state regulations.

The State Department of Health may take enforcement action if an LHJ fails to regulate OSS in compliance with state law. The Department of Ecology also has authority to take enforcement actions under the Water Pollution Control Act if there is a discharge to state waters.

On-Site Sewage System-Management Areas

The state OSS and marine recovery area (MRA) laws require LHJs to designate areas where OSSs present added risk to public health or water quality. Areas adjacent to Puget Sound that have pollution problems linked to OSS may be designated as MRAs. Consistent with the state OSS rule, Chapter 70.118A RCW requires LHJs to adopt management plans, and implement enhanced programs in these areas to protect public health and Puget Sound water quality. As part of the enhanced programs in MRAs, LHJs are required to:

- Inventory and inspect all OSS.
- Identify failing systems and ensure they are either repaired or replaced.
- Develop and maintain electronic data systems capable of sharing OSS information with other regulators.

The state OSS rule complements this with the following management plan requirements from WAC 246-272A-0015 for Puget Sound counties:

- Progressively inventory all systems.
- Identify high-risk areas and designate MRAs.
- Develop and tailor operation and maintenance (O&M) requirements to these areas.
- Facilitate education of owners on their O&M responsibilities for all types of systems.
- Remind and encourage system owners to inspect their systems.
- Maintain records of O&M activities.
- Find failing systems, and enforce system owner requirements.
- Assure coordination with local comprehensive plans.
- Assess the capacity of the LHJ to adequately fund the program.

For most Puget Sound counties, requirements are higher and tracked more closely inside designated areas than in other parts of the county. Efforts continue at the State Department of Health and LHJs to strengthen and standardize both baseline and enhanced program requirements.

To see a map that shows counties with management plans, please see:

<http://www.doh.wa.gov/CommunityandEnvironment/WastewaterManagement/OnsiteSewageSystemsOSS/ManagementStrategy/ManagementAreas>

Large On-Site Sewage Systems

Large On-site Sewage Systems (LOSS) convey, store, treat, and provide subsurface soil treatment and disposal of domestic sewage. Their design flow is between 3,500 and 100,000 gallons per day.

LOSS offer an alternative to centralized municipal sewage treatment plants. They can serve about 10 to 370 individual residences, or equivalent flows from schools, churches, campgrounds, recreation vehicle parks, resorts or state park sites, or smaller cities or towns.

The state Department of Health reviews and approves all LOSS project applications. The state LOSS rule is Chapter 246-272B WAC, developed under authority of Chapter 70.118B RCW. The rule took effect July 1, 2011. Among other significant policy changes captured in the rule, it consolidated previously piecemeal regulatory and permitting authority for LOSS at the Department of Health, and assigned responsibility for public health and environmental protection to the agency. The rule is not a SBOH rule.

All existing LOSS are required to obtain and renew annual operating permits from the Department of Health. There are approximately 570 LOSS statewide, and about 290 in the Puget Sound region.

Additional State Authorities (Regulatory and Non-regulatory)

State Environmental Policy Act

Washington's State Environmental Policy Act (SEPA)¹⁸ requires that all state and local agencies consider the likely consequences of agency actions before making decisions that affect the natural and built environment. Among other things, the law requires all state and local governments within the state to:

- "Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment;" and
- Ensure that "...environmental amenities and values will be given appropriate consideration in decision making along with economic and technical considerations...."¹⁹

The policies and goals in SEPA supplement those in existing authorizations of all branches of government of this state, including state agencies, counties, cities, districts, and public corporations. Any governmental action may be conditioned or denied pursuant to SEPA.²⁰

SEPA is intended to ensure that environmental values are considered during decision-making by state and local agencies.

Land Use Planning: Growth Management Act, and Shoreline Management Act

The Shoreline Management Act (SMA)²¹ and, Growth Management Act (GMA)²² are the two primary state statutes related to land use planning. They share some commonalities, but are separate statutes with different purposes, jurisdictions, and requirements.

¹⁸ Chapter 43.21C RCW

¹⁹ RCW 43.21C. 030(2)(a) and (2)(b)

²⁰ RCW 43.21C.060

²¹ Chapter 90.58 RCW, and more information at:

<http://www.ecy.wa.gov/programs/sea/shorelines/smp/handbook/index.html>.

²² Chapters 36.70A and 36.70B RCW.

The overarching goal of the SMA is, "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." Under the SMA, each city and county with "shorelines of the state" must prepare and adopt a Shoreline Master Program (SMP) that is based on state laws and rules, but is tailored to the specific geographic, economic, and environmental needs of the community. The local SMP is essentially a shoreline-specific combined comprehensive plan, zoning ordinance, and development permit system.

The SMA establishes a balance of authority and partnership between local and state government. Towns, cities, and counties are the primary regulators. The state Department of Ecology acts primarily in a support and review capacity. Ecology provides technical assistance to local governments. Ecology also provides funding in the form of grants. Finally, Ecology is also required to review certain kinds of permits (*conditional use* and *variance permits*) for compliance with the law, and must review local shoreline master programs to ensure they also comply.

Local governments may modify (amend) master programs to reflect changing local circumstances, new information, or improved shoreline management approaches. There are two types of amendments: limited and comprehensive. All changes to master programs require public notice. Comprehensive amendments require more extensive public involvement.

SMPs and any amendments are effective only after Ecology approval. In reviewing and approving master programs, Ecology is limited to a decision on whether or not the proposed changes are consistent with the policy and provisions of the SMA and the shoreline master program guidelines.²³

The GMA requires that each Washington city and county establish a public participation program and procedures for amendments, updates, and revisions of comprehensive plans and development regulations.

The GMA requires all jurisdictions in the state to designate and protect critical areas; designate farm lands, forest lands, and other natural resource areas; and determine that there are appropriate public services and facilities for new residential subdivisions. In addition, 29 of the state's 39 counties, and the 218 cities within them, are planning for growth. These jurisdictions develop comprehensive land use plans.

All cities and counties in Washington are required to adopt critical areas regulations by the GMA.²⁴ As defined by the GMA, "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.²⁵

²³ WAC 173-26, Part III.

²⁴ RCW 36.70A.060. More information on the GMA and CAO can be found at: <http://www.commerce.wa.gov/Services/localgovernment/GrowthManagement/Growth-Management-Planning-Topics/Pages/default.aspx>.

²⁵ RCW 36.70A.030(5).

Counties and cities are required to include the best available science in developing policies and development regulations to protect the functions and values of critical areas.²⁶

The Voluntary Stewardship Program (VSP) was passed in 2011 as an amendment to the GMA. Its goals are to protect and enhance critical areas, maintain and improve the long-term viability of agriculture, and reduce the conversion of farmland to other uses. To accomplish these goals the VSP relies primarily on incentives and voluntary stewardship practices. Counties that opt into the VSP are responsible for designating a local watershed group that will develop a watershed plan that describes how critical areas on agricultural lands will be protected and enhanced.

Shellfish Protection Districts

Chapter 90.72 RCW encourages, and in some cases, requires counties to establish shellfish protection districts and programs to curb the loss of productive shellfish beds caused by nonpoint sources of pollution, such as stormwater runoff, failing on-site sewage systems, and runoff from farm animal wastes.

Salmon Recovery Act, and Salmon Enhancement Program

In response to Endangered Species Act listings, Washington State passed the Salmon Recovery Act, Chapter 77.85 RCW. The Act provides for a planning and implementation process that is focused on fish habitat. The Salmon Recovery Funding Board provides grants to local organizations in watersheds to restore and protect salmon habitat.

Regional Fisheries Enhancement Groups (RFEs) are a statewide network of non-profit, community-based, salmon enhancement organizations. Created by the Washington State Legislature in 1990, the RFE program involves citizen volunteers and landowners in the state's salmon recovery efforts.²⁷ The RFE program consists of 14 sanctioned non-profit community-based organizations, with program support provided by the Washington Department of Fish and Wildlife. The long-term vision of the RFE program is that Washington State communities actively care for, and become stewards of, abundant salmon populations for future generations.

Biosolids

Biosolids are the nutrient-rich organic materials resulting from the treatment of sewage sludge (the name for the solid, semisolid or liquid untreated residue generated during the treatment of domestic sewage in a treatment facility). Biosolids facilities in Washington operate under a statewide General Permit for Biosolids Management issued by Ecology.²⁸ This permit covers land application of biosolids and other related processes and aspects of operations related to biosolids.²⁹ The state biosolids program regulates biosolids (including septage) applied to the land, biosolids sold or given away in a bag or other container, biosolids being stored, biosolids transferred from one facility to another, and sewage sludge disposed in a municipal solid waste

²⁶ RCW 36.70A.172.

²⁷ Chapter 77.95 RCW and Chapter 220-140 WAC.

²⁸ Chapter 70.95J RCW and Chapter 173-308 WAC.

²⁹ More information on the biosolids program can be found here:

<http://www.ecy.wa.gov/programs/swfa/biosolids/>; More information on the permit can be found here:
<http://www.ecy.wa.gov/programs/swfa/biosolids/pdf/BiosolidsManagement.pdf>

landfill. The existing general permit expires on August 20, 2015. Ecology is currently in the process of developing a new general permit. There are currently about 200 applicable facilities in the state.

Oil and Hazardous Substance Spill Prevention and Response Act

Oil and hazardous materials spills present a danger to human health and the environment. Ecology is responsible for rapidly responding to, and overseeing the cleanup of oil spills and hazardous material incidents. The law also includes prevention and preparedness requirements, and authorizes Ecology to assess and collect damages and fines for spills.³⁰

Toxics Cleanup, Hazardous Waste, Solid Waste, and Air Quality

Various other laws administered by Ecology can have a nexus with nonpoint pollution. Examples include the Model Toxics Control Act,³¹ Hazardous Waste Management Act,³² Solid Waste Management-Reduction and Recycle Act,³³ and Washington Clean Air Act.³⁴ For additional information on laws and regulations administered by Ecology visit our website: <http://www.ecy.wa.gov/laws-rules/index.html>

Hydraulic Project Approval (HPA)

Anyone planning any construction activity or other work that uses, diverts, obstructs, or changes the natural flow or bed of state waters is required to obtain an environmental permit commonly known as an HPA. Thousands of HPAs are issued each year for activities ranging from work on bulkheads, piers, and docks to culvert replacement.

The Washington Department of Fish and Wildlife administers the HPA program under the state Hydraulic Code,³⁵ which was specifically designed to protect fish life.

All hydraulic projects associated with forest practices activities are administered by the DNR. These projects require an approved Forest Practices Application containing a request for approval of Forest Practices Hydraulic Projects.

Aquatic Invasive Species (AIS) Program

Aquatic invasive species pose an ongoing threat to Washington's environment and economy. The Washington Department of Fish and Wildlife (WDFW) administer the AIS program.³⁶ Penalties for transporting aquatic invasive species in Washington include up to one year in jail and a maximum fine of \$5,000. Additionally, WDFW administers the state's ballast water management laws under Chapter 77.120 RCW. Ballast water management regulations are found at Chapter 220-150 WAC.

³⁰ Chapter 90.56 RCW and Chapter 88.46 RCW & Chapter 173-182 WAC, and Chapter 173-183 WAC.

³¹ Chapter 70.105 D RCW.

³² Chapter 70.105 RCW.

³³ Chapter 70.95 RCW.

³⁴ Chapter 70.94 RCW.

³⁵ Chapter 77.55 RCW and Chapter 220-110 WAC.

³⁶ Chapter 77.135 RCW.

Secondary Containment Rules (Fertilizer and Pesticide)

The Secondary Containment Rules³⁷ are administered by the Washington State Department of Agriculture (WSDA). Fertilizer and pesticide secondary containment rules were implemented to protect ground and surface water. Secondary containment rules are not intended to prevent spills in the event of a catastrophic incident occurring to the primary container. The rules are intended to contain the spill of bulk pesticides or fertilizers in the event the primary bulk container should fail.

Chemigation and Fertigation Technical Assistance Program (CFTAP)

WSDA has regulatory authority involving the application of pesticides³⁸ and fertilizers³⁹ through irrigation systems. The Chemigation and Fertigation Rules apply to any irrigation system that is used to apply a pesticide or plant nutrient in a greenhouse or to a plant nursery, farm, residential or commercial property.

These rules require that chemigation and fertigation systems must have the appropriate safety devices in place and must be properly installed, maintained, and operating to protect human health and the environment. Equipment performance standards, operational procedures, and applicator competencies are protective of existing and future uses of surface water and groundwater quality.

Individuals who chemigate must also adhere to provisions of the Washington Pesticide Control Act⁴⁰ concerning the formulation, distribution, storage, transportation, and disposal of any pesticide; the Washington Pesticide Application Act,⁴¹ involving the use of various pesticides, application recordkeeping, and applicator licensing; the General Pesticide Rules⁴² and the Worker Protection Standards,⁴³ which are co-enforced with the Washington State Department of Labor and Industries. In instances where the water source is a public water system or a domestic water supply, Chemigation and Fertigation Technical Assistance Program (CFTAP) staff collaborate with the Washington State Department of Health, Drinking Water Unit. In counties that have codified the Uniform Plumbing Code to include irrigation wells used in agricultural operations, CFTAP staff advise growers about local permitting requirements and inspection procedures.

³⁷ Chapter 16-201 WAC (Fertilizers) and Chapter 16-229 WAC (Pesticides).

³⁸ WAC 16-202-1000.

³⁹ WAC 16-202-2000.

⁴⁰ Chapter 15.58 RCW.

⁴¹ Chapter 17.21 RCW.

⁴² Chapter 16-288 WAC.

⁴³ Chapter 16-233 WAC.

Federal Laws (Regulatory and Non-Regulatory)

Clean Water Act

The Federal Clean Water Act (CWA)⁴⁴ is the principal federal statute for water quality protection. The CWA's goal is "to restore and maintain the chemical, physical and biological integrity of the Nation's waters."⁴⁵

In Washington State, the Department of Ecology is designated "as the state water pollution control agency for all purposes of the federal clean water act..." and is "authorized to participate fully in the programs of the act as well as to take all action necessary to secure to the state the benefits and to meet the requirements of the act."⁴⁶

Historically, efforts to protect water quality under the CWA focused on the establishment of technology-based limitations on individual discharges into navigable waters from point sources. Point sources are "any discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged," such as any pipe, ditch, channel, or tunnel.⁴⁷ This technology-based approach to addressing point source discharges has had demonstrated success.

Much of the improvement in our waters is attributable to the control of traditional point sources through permits. A majority of the remaining water quality impairments are largely caused by NP sources. While the CWA does not authorize EPA to control NP sources of pollution through a permit system, several sections of the CWA provide a basis for addressing NP sources. In general, the federal CWA addresses nonpoint sources by:

- (1) Supporting the development of state NPS plans and programs.
- (2) Requiring the development of WQ Standards, the identification of impaired waters (including waters impaired by nonpoint sources) and the development of clean-up plans (TMDLs) for those waters.
- (3) Providing financial incentives to states to accomplish those tasks.

This section will cover the key sections of the CWA that address nonpoint pollution.

Section 319-Nonpoint Source Management Programs

In the 1987 CWA Amendments, Congress added Section 319⁴⁸ to the act. Section 319 required states to develop Assessment Reports that described the states' NPS problems, and establish Management Programs to address these problems. The required elements of state management programs are outlined at 33 USC §1329(b)(2). EPA supports implementation of NPS programs by providing funding to states. Ecology is designated as the section 319 lead agency for Washington State's nonpoint program. As the lead agency, Ecology is responsible for the administration of Section 319 pass-through and internal grant funds, the identification and

⁴⁴ 33 U.S.C. §§1251 et seq.

⁴⁵ 33 U.S.C. § 1251(a).

⁴⁶ RCW 90.48.260.

⁴⁷ 33 U.S.C. § 1362(14).

⁴⁸ 33 USC §1329

establishment of priorities for NPS-related water quality problems, and the development of the state's NPS pollution control plan.

According to EPA guidance,⁴⁹ under section 319(b) of the CWA, Washington State's NPS management program must include all of the following components:

(i) An identification of measures (i.e., systems of practices) that will be used to control NPS pollution, focusing on those measures which the state believes will be most effective in achieving and maintaining WQ Standards. These measures may be individually identified or presented in manuals or compendiums, provided that they are specific and are related to the category or subcategory of NPS. They may also be identified as part of a watershed approach towards achieving WQ Standards, whether locally, within a watershed, or statewide.

(ii) An identification of the key programs to achieve implementation of the measures, including, as appropriate, nonregulatory or regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects. The state is free to decide the best approaches for solving NPS problems. These approaches may include one or all of the following:

- Watershed or water quality-based approaches aimed at meeting WQ Standards directly.
- Iterative, technology-based approaches based on best management practices or measures, applied on either a categorical or site-specific basis.
- An appropriate mix of these approaches.

(iii) A description of the processes used to coordinate and, where appropriate, integrate the various programs used to implement NPS pollution controls in the state.

(iv) A schedule with goals, objectives, and annual milestones for implementation at the earliest practicable date; legal authorities to implement the program; available resources; and institutional relationships.

(v) Sources of funding from federal (other than section 319), state, local, and private sources.

(vi) Federal land management programs, development projects, and financial assistance programs.

(vii) A description of monitoring and other evaluation programs that the state will conduct to help determine short- and long-term NPS management program effectiveness.⁵⁰

⁴⁹ See *Section 319 Program Guidance: Key Components of an Effective State Nonpoint Source Management Program* (November 2012).

⁵⁰ Further according to EPA guidance, "In addition, the state incorporates existing baseline requirements established by other applicable federal or state laws to the extent that they are relevant. For example, a coastal state or territory with an approved coastal zone management program incorporates its approved state coastal nonpoint pollution control programs required by section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990, into its NPS management program since CZARA requires implementation through the state's NPS

EPA expects all states to review and, as appropriate, revise their NPS program at least every five years. An updated program allows EPA and states to ensure that resources are efficiently and effectively directed in a manner that will support state's efforts to address water quality issues.

Section 303(d) and 303(c)-Water Quality Standards and Water Clean-up Plans (TMDLs)

WQ Standards are regulations comprised of: 1) a description of the designated use or uses of a water body; 2) the criteria necessary to protect the use or uses; and 3) a statement by the applicable state that the standard will maintain and protect the existing use and the water quality of the water body (antidegradation requirements). Additionally, CWA Section 303(d) requires states to list surface waters not attaining (or not expected to attain) WQ Standards after the application of technology-based effluent limits. States must complete a total maximum daily load (TMDL, water clean-up plan) for all waters on the Section 303(d) list.

In Washington State, the WQ Standards (Chapter 173-201A WAC) are the basis for protecting and regulating the quality of surface waters. The WQ Standards are established to sustain public health and public enjoyment of state waters, and for the propagation and protection of fish, shellfish, and wildlife. A three-part approach was designed to set limits on pollution in Washington State's lakes, rivers, and marine waters in order to protect beneficial uses such as aquatic life, swimming, and fishing. The three-part approach covers:

- Designated uses, such as fishing, swimming, and aquatic life habitat.
- Numeric and narrative water quality criteria limits to protect the uses.
- Policies, such as antidegradation, to protect higher quality waters from being further degraded.

Washington's antidegradation policy is designed to protect waters of a quality that is higher than the state standards. The policy has three tiers.

- **Tier I.** [WAC 173-201A-310](#)
Tier I is used to ensure existing and designated uses are maintained and protected. It does this by focusing on fully applying the water quality criteria and correcting problems using our existing regulatory and TMDL processes. Tier I applies to all waters and all sources of pollution.
- **Tier II.** [WAC 173-201A-320](#)
Tier II is used to ensure that waters of a higher quality than the criteria assigned in the standards are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to new or expanded sources of pollution from specific types of activities directly regulated by Ecology (e.g., NPDES, 401, 404, Forest Practices). Any new or expanding dischargers that would cause a measurable degradation of water quality:
 - a. Must go through a technology review to identify and apply any feasible alternatives to that degradation.

management program. In this manner, the state ensures that this program and other relevant baseline programs are integrated into, and consistent with, Section 319 programs."

- b. Must show that overriding public benefits would occur from allowing the lowering of water quality..
- **Tier III.** [WAC 173-201A-330](#)
Tier III is used when a high-quality water is designated as an “outstanding resource water.” The water quality and uses of these waters must be maintained and protected against all sources of pollution.

A request for designation of Tier III may be made by the Department of Ecology (department). A Tier III designation may also be requested through public nominations that are submitted to the department in writing. Public nominations must include sufficient information to show how the water body meets the appropriate conditions of an outstanding resource water. If the information proposed demonstrates that the waterbody meets the eligibility requirements, the department will schedule a review of the nominated water for designation. The review will include a public process and consultation with recognized tribes in the geographic vicinity of the water. The rules allow two levels of Tier III protection. A qualifying water body may be designated as:

- o Tier III(A), which prohibits any and all future degradation [[WAC 173-201A-330\(5\)\(A\)](#)].
- o Tier III(B), which allows for de minimis (below measurable amounts) degradation from well-controlled activities [[WAC 173-201A-330\(5\)\(B\)](#)].

To fully achieve and maintain compliance with the WQ Standards in Washington, the standards state that the intent of Ecology is to “apply the various implementation and enforcement authorities at its disposal.”⁵¹ The primary means to be used for “controlling municipal, commercial, and industrial waste discharges shall be through the issuance of waste discharge permits, as provided for in RCW 90.48.16, 90.48.162, and 90.48.260.”⁵² Further, “[w]aste discharge permits, whether issued pursuant to the National Pollutant Discharge Elimination System or otherwise, must be conditioned so the discharges authorized will meet the WQ Standards.”⁵³

The standards require activities which contribute nonpoint source pollution to use best management practices (BMPs) to prevent exceedences of water quality criteria.⁵⁴ The Standards define BMPs as “physical, structural, and/or managerial practices approved by the department that, when used singularly or in combination, prevent or reduce pollutant discharges.”⁵⁵ Given that much of nonpoint pollution cannot easily be measured, the Standards express compliance with the law by implementing Ecology approved BMPs.⁵⁶

⁵¹ WAC 173-201A-500

⁵² WAC 173-201A- 510(1) states that “[a]ctivities which generate nonpoint source pollution shall be conducted so as to comply with the water quality standards. The primary means to be used for requiring compliance with the standards shall be through best management practices required in waste discharge permits, rules, orders, and directives issued by the department for activities which generate nonpoint source pollution.”

⁵³ Id. See also, 40 C.F.R. § 130.2(i).

⁵⁴ WAC 173-201A- 510(3)(c)

⁵⁵ WAC 173-201A-020

⁵⁶ WAC 173-201A- 510(3)(a) states that the “primary means to be used for requiring compliance with the standards shall be through best management practices required in waste discharge permits, rules, orders, and directives

Washington's WQ Standards, along with the Washington Water Pollution Control Act, provide Ecology with the tools to fully implement TMDLs, including the requirement that the state provide reasonable assurance that nonpoint sources can be required to meet TMDL load allocations if the wasteload allocations established for point sources depend on those nonpoint reductions being made in the TMDL area.

Section 312-No Discharge Zone

Under Section 312 of the CWA, vessel sewage may be controlled through the establishment of areas in which discharges of sewage from vessels are not allowed. These areas are also known as "no discharge zones."⁵⁷ A No Discharge Zone (NDZ) is a designated body of water where the discharge of sewage (blackwater/toilet waste) from boats, whether treated or not, is prohibited. Under Section 312 of the CWA, the U.S. Coast Guard and the state in which the NDZ has been designated may enforce the NDZ requirements.⁵⁸

Under existing federal regulations, treated sewage may be discharged anywhere in Puget Sound, and untreated sewage may be discharged as long as the boat is more than three miles from shore. If a NDZ is established, no boat, whether a freighter, a cruise ship, or a sailboat, could discharge anywhere within the designated NDZ. All boats and vessels would have to store their sewage until they could safely dispose of it at an onshore or mobile pumpout facility, or hold it until it can be discharged in the open ocean beyond three miles from shore.

Section 320-National Estuary Program

The National Estuary Program (NEP) was established under the 1987 CWA amendments as a program to "restore and maintain the chemical, physical, and biological integrity of the estuary, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish, and wildlife, and recreational activities in the estuary, and assure that the designated uses of the estuary are protected".

The NEP is designed to encourage local communities to take responsibility for managing their own estuaries. Each NEP is made up of representatives from federal, state, and local government agencies responsible for managing the estuary's resources, as well as members of the community such as citizens, business leaders, educators, and researchers. These stakeholders work together to identify problems in the estuary, develop specific actions to address those problems, and create and implement a formal management plan to restore and protect the estuary.

Coastal Zone Act Reauthorization Amendments of 1990 (CZARA)

The Coastal Zone Management Act (CZMA) of 1972⁵⁹ established a national framework for effective management, protection, development, and beneficial use of the coastal zone.

issued by the department for activities which generate nonpoint source pollution." Additionally, WAC 173-201A-020 defines best management practices as "physical, structural, and/or managerial practices approved by [Ecology] that, when used singularly or in combination, prevent or reduce pollutant discharges."

⁵⁷ 33 USC §1322

⁵⁸ 33 USC §1322(k)

⁵⁹ 16 USC §§1451 et seq.

Recognizing that the CZMA did not specifically mention water quality, in 1990 Congress amended CZMA Section 306(d)(16)⁶⁰ and added Section 6217⁶¹ to focus on NPS pollution problems and the protection of coastal waters. Coastal Zone Act Reauthorization Amendments (CZARA) Section 6217 requires state water quality agencies to develop and implement management measures to restore and protect coastal waters from adverse impacts of NPS pollution. States are to implement this requirement through updates to their state nonpoint and coastal zone programs. CZMA Section 306(d)(16)⁶² requires that state nonpoint and CZM programs contain enforceable policies and mechanisms to implement applicable requirements of CZARA Section 6217. To achieve these goals, states were directed to coordinate and integrate their existing CZM and water quality plans and programs, including the states' NPS plans. Washington State has yet to receive CZARA program approval.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA)⁶³ is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards.

The SDWA includes drinking water standards, sampling, treatment, and public notification requirements. The 1996 amendments added new requirements related to annual water quality reports, operator certification requirements, system capacity, and source water assessment and protection. The Washington State Department of Health, through an agreement with EPA, is authorized and responsible for implementing the SDWA in Washington.

Generally, the SDWA applies to water systems with 15 or more connections, or those regularly serving 25 or more people daily, 60 or more days per year. Approximately 4,200 public water systems in Washington are subject to the SDWA.

Sole Source Aquifer (SSA) Protection Program

The Sole Source Aquifer (SSA) Protection Program is authorized by Section 1424(e) of the Safe Drinking Water Act, which states:

"If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for federal assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer."

⁶⁰ 16 USC §1455(d)(16)

⁶¹ 16 USC §1455b

⁶² 16 USC §1455(d)(16)

⁶³ 42 U.S.C. 300 et seq.

EPA defines a sole or principal source aquifer as one which supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. EPA guidelines also stipulate that these areas can have no alternative drinking water source(s) which could physically, legally, and economically supply all those who depend upon the aquifer for drinking water. For convenience, all designated sole or principal source aquifers are usually referred to simply as "sole source aquifers."

If an SSA designation is approved, proposed federal financially-assisted projects which have the potential to contaminate the aquifer are subject to EPA review.⁶⁴ Proposed projects that are funded entirely by state, local, or private concerns are not subject to EPA review. Examples of federally funded projects which have been reviewed by EPA under the SSA protection program include:

- Highway improvements and new road construction.
- Public water supply wells and transmission lines.
- Wastewater treatment facilities.
- Construction projects that involve disposal of storm water.
- Agricultural projects that involve management of animal waste.
- Projects funded through Community Development Block Grants.

Endangered Species Act

The Endangered Species Act provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. The Act:

- Authorizes the designation and listing of species as endangered and threatened.
- Prohibits unauthorized taking, possession, sale, and transport of endangered species.
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds.
- Authorizes establishment of cooperative agreements and grants-in-aid to states that establish and maintain active and adequate programs for endangered and threatened wildlife and plants.
- Authorizes the assessment of civil and criminal penalties for violating the Act or regulations.
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the Act or any regulation issued thereunder.

Section 7 of the Endangered Species Act requires federal agencies to consult with the Fish and Wildlife Service and/or the National Marine Fisheries Service (Services) to ensure that actions the agencies authorize, fund, or carry out are not likely to jeopardize threatened or endangered species or destroy or adversely modify their critical habitat.

⁶⁴ Information on sole source aquifers in Washington State can be found here: <http://yosemite.epa.gov/r10/water.nsf/Sole+Source+Aquifers/SSA>. A map of sole source aquifers in Washington State can be found here: <http://yosemite.epa.gov/r10/water.nsf/sole+source+aquifers/ssamaps>.

Federal Farm Bill Programs

The 2014 Farm Bill was enacted on February 7, 2014. The Farm Bill funds several conservation programs that can benefit agricultural producers and forest landowners along with the environment⁶⁵. Additionally, the 2014 Farm Bill re-linked highly erodible land conservation and wetland conservation with eligibility for premium support paid under the federal crop insurance program. These eligibility criteria should encourage the implementation of better conservation practices. See Chapter 5 for more information on some of the Farm Bill's financial incentive programs.

State Revolving Fund Program

The United States Congress established the Clean Water State Revolving Fund (CWSRF) as part of the Clean Water Act (CWA) Amendments of 1987. The EPA offers states capitalization grants each year according to a formula established in the CWA. The capitalization grants are required to be matched with 20 percent state funds and are added to payments of principal and interest from previous loans. The combined funds are loaned out to eligible public bodies and repaid to the CWSRF with interest. This means that the CWSRF continues to revolve and grow, and more money becomes available to fund water quality projects. Today, the majority of the fund consists of repaid principal and interest.

The CWSRF must be managed in accordance with federal regulations associated with timely use of funds, adherence to specific accounting principles, fund perpetuity, project eligibility, financial capacity assessments of borrowers, implementation of state rules, extensive public outreach and public accountability, and strong coordination of multiple environmental cross-cutters required under the State Environmental Review Process, such as the Endangered Species Act, and state and federal regulations for archeological and cultural resources.

The CWSRF supports a variety of water quality projects, including NPS BMP implementation projects, on-site septic system projects, stormwater projects, and wastewater facility projects.

Additionally, CWSRF has the potential to address a wide range of additional projects. For example, within urbanized areas where sewer service is available, service connections from individual homes and businesses can be a source of NPS pollution. Once the wastewater from homes and businesses reaches the sewer pipes in the public right-of-way, it is collected and treated at the local wastewater treatment facility. However, sewage leaking from the pipe that connects buildings to the public sewer can be a problem. These side sewers, or service laterals, are very near the surface (compared to sewer lines buried in the street) and are susceptible to damage. Tree roots, landscaping, digging, and heavy vehicles can all damage side sewer laterals. Maintenance, repair, and inspection of these privately-owned service laterals is generally the responsibility of the individual property owners. CWSRF could support projects that address problems from side sewers or service laterals.

⁶⁵ More information on the 2014 Farm Bill can be found at:
<http://www.usda.gov/wps/portal/usda/usdahome?navid=farmbill>.

Local Ordinances and Regulations

Local ordinances can supplement federal and state law. While a comprehensive review of local authorities is outside the scope of this section, the most common sources of authority that can be used to address nonpoint pollution sources at the local level are found in local solid waste regulations, illicit discharge ordinances, and animal or pet waste disposal ordinances. Additionally, planning and development codes and regulations can provide authority to address NPS pollution. For example, critical area ordinances can provide protection to critical areas that have a nexus with water quality.

Following are two examples of local regulatory tools that can be used to address nonpoint pollution: Kitsap County Board of Health's Onsite Sewage System and General Sewage Sanitation Regulations and Solid Waste Regulations, and Kitsap County's illicit discharge code.

Example - Kitsap County Public Health:

Kitsap County Board of Health Ordinance 2008-01A, *Onsite Sewage System and General Sewage Sanitation Regulations*, May 1, 2008 and Amended June 7, 2011. Regulatory authority includes nonpoint discharges from failing onsite sewage systems, recreational vehicle dumping, and broken sanitary side sewers.

Section 6. B. Sewage Discharged to Approved or Health Officer-Accepted Systems, Only.

1. All plumbing fixtures in residences, places of business, or other buildings, structures, etc., where sewage is created shall be connected to, and discharge to, an approved public sewer system, large onsite sewage system, onsite sewage system, or other Health Officer-accepted system, only (e.g., temporary holding tanks, portable toilets, RV sewage dumpsites, certified septic tank pumping trucks or facilities, etc.).
2. Sewage shall not be discharged to the surface of the ground, surface water, ground water, cesspools, un-permitted sewage systems, or allowed to backup.

Kitsap County Board of Health Ordinance Number 2010-1, *Solid Waste Regulations*, July 6, 2010. Regulatory authority includes nonpoint sources from animal manure as related to pollution of water. Other typical solid wastes, such as vehicle fluids, paint, and construction are included in other sections.

Section 305 1.(c)

(c) Animal Manure. Animal manure shall not be deposited, or allowed to accumulate, in any ditch, gulch, ravine, river, stream, lake, pond, marine water, or upon the surface of the ground, or on any highway or road right of way, where it may become a nuisance or menace to health, as determined by the Health Officer, through the breeding of flies, harboring of rodents, or pollution of water. Manure shall not be allowed to accumulate in any place where it can pollute any source of drinking water.

Example - Kitsap County:

Kitsap County has an illicit discharge code, as required for the Phase II National Pollutant Discharge Elimination Permit, which specifies the prohibition of non-stormwater discharges into or from the municipal storm sewer system, including pipes and ditches.

Kitsap County Code Title 12.30

12.30.020 *Illicit Discharges*

Illicit discharges to storm water drainage systems are prohibited.

12.30.020 *Illicit Connections and Uses.*

The storm water system of Kitsap County, natural and artificial, may only be used to convey storm water runoff. Violation of this chapter can result in enforcement action being taken as prescribed in Chapter 12.32.

No person shall use this system, directly or indirectly, to dispose of any solid or liquid matter other than storm water. No person shall make or allow any connection to the storm water system which could result in the discharge of polluting matter. Connections to the storm water system from the interiors of structures are prohibited. Connections to the storm water system for any purpose other than to convey storm water or ground water are prohibited and shall be eliminated.

In summary, regulatory authority and enforcement for nonpoint sources can be a combination of efforts by Washington State and local jurisdictions.

Chapter 3: Strategies for Addressing Nonpoint Source Pollution

The Washington State Department of Ecology (Ecology) is the regulatory agency charged with protecting the quality of Washington State's water. Ecology acts as the lead agency in restoring, maintaining, and enhancing water quality collaboratively with citizens, stakeholder groups, tribes, local governments, local governmental entities, state agencies, and federal agencies. Ecology's NPS program uses a combination of public education, technical assistance, financial assistance and regulatory tools to help citizens understand and comply with state and federal water quality laws and regulations that protect water quality.

The NPS plan aims to protect public health and restore our state's waters by setting clear goals and objectives. Ecology's strategy to address NPS pollution focuses on cleaning up impaired watersheds, completing watershed evaluations to identify NPS pollution issues, and implementing suites of best management practices (BMPs) to address identified pollution sources and ensure compliance with the WQ Standards.

Ecology will apply the following key principles in the implementation of this nonpoint strategy:

- Communicate clear standards and compliance expectations.
- Implement BMPs that ensure compliance with state WQ Standards and state law.
- Implement watershed-based plans/strategies designed to meet WQ Standards.
- Identify and correct nonpoint pollution sources in impaired watersheds.
- Be proactive in addressing pollution problems (i.e. incentives/education and outreach).
- Escalate to enforcement when education, outreach, and technical assistance fail.
- Be accountable by collecting data on watershed evaluations and tracking BMP implementation.
- Target effectiveness monitoring where implementation of BMPs has occurred.
- Promote adaptive management.
- Develop and/or strengthen partnerships to achieve water quality goals.

The primary tools that Ecology will use to guide and promote the implementation of this strategy are:

1. Water Clean-Up Plans - TMDLs, which are plans for restoring impaired waters, as required by the federal Clean Water Act.
2. Straight to Implementation (STI) projects, which implement BMPS to achieve compliance with state water quality law using Ecology's state nonpoint authority.
3. Grant and loan programs.
4. Complaint Response and Inspectors.
5. Education and outreach, and voluntary programs.
6. Partnerships.

Ecology will also support locally led programs that are designed to identify nonpoint pollution sources and cleanup those sources of pollution. For example, locally led Pollution Identification

and Correction (PIC) programs have been developed around the Puget Sound. Also, Shellfish Protection Districts provide a framework for locally led programs to address areas where pollution is impacting shellfish resources.

When an opportunity exists we will support the development and use of other tools to address NPS pollution. Current examples include:

- Water Quality Trading.
- Certification/Certainty Programs.

Ecology will continue to support the implementation of the following key regulatory programs:

- State's Forest Practice Rules.
- Dairy Nutrient Management Program.
- Local regulation of on-site sewage systems
- NPDES/State Waste Discharge Permit program.

Finally, Ecology will coordinate our nonpoint program with key state initiatives connected to water quality:

- Results Washington.
- Governor's Shellfish Initiative.
- Puget Sound Action Agenda.
- No discharge zone designation for Puget Sound.
- Ocean acidification/Washington Marine Resources Advisory Council.
- Washington's efforts to recover salmon species.

The state has many programs designed to address some segment of the nonpoint problem. However, these efforts are generally not coordinated and are not necessarily designed to achieve compliance with state water quality law. The ideal is to have all of the agencies managing these disparate programs working together to create a single unified program that links all of these efforts into a more cost-effective program to address nonpoint pollution and achieve compliance with the WQ Standards. While we have a long way to go to achieve that ideal, Ecology will continue to work with partner agencies to better align programs and coordinate activities to address nonpoint problems and achieve compliance with the water quality standards.

Details of each of these implementation areas follow.

Balancing Restoration and Protection

Solving the state's water quality problems requires correcting existing problems as well as preventing future degradation. With limited resources, Ecology's first priority is to correct known water quality impairments from nonpoint source pollution. Our second priority is to support projects that protect threatened and high quality waters from present and future nonpoint source pollution impacts. Ecology will follow the WQ Standards' antidegradation policy when supporting projects that protect threatened and high quality waters.

Watershed Clean-up Programs

Total Maximum Daily Loads and Straight to Implementation

Ecology's primary strategy for addressing nonpoint pollution is implementing watershed clean-up projects. There are two related approaches that Ecology uses to clean up impaired water bodies: Total Maximum Daily Load (TMDL) and Straight to Implementation (STI) projects. Additionally, Ecology supports locally led programs to clean-up impaired water bodies such as; Pollution Identification Correction (PIC) programs, and Shellfish Protection District efforts discussed later in this chapter.

Both TMDL and STI projects utilize a combination of education and outreach, technical assistance, financial incentives, and enforcement to meet the requirements of the WQ Standards, and promote compliance with water quality laws.

Total Maximum Daily Loads (TMDLs)

As required by Section 303 of the federal Clean Water Act, Ecology develops TMDLs for water bodies on the state's list of impaired waters. TMDLs are a regulatory tool that sets the maximum quantity (or "load") of a pollutant that may be added to a water body from all sources, including natural background sources, at levels necessary to attain and maintain the applicable narrative and numerical water quality standards. It must take into consideration seasonal variations in water quality conditions, and must include a margin of safety to account for any lack of knowledge concerning the relationship between effluent limitations and water quality.

There are two types of loads that are allocated by TMDLs: wasteload allocations (WLAs) that include the portion of the TMDL allocated to existing and future point sources with NPDES permits; and load allocations (LAs) that include the portion of the TMDL allocated to existing and future nonpoint pollution sources and natural background sources.

The TMDL Process in Washington State

Washington State's TMDL process starts by choosing where TMDLs will be developed. Once a TMDL area is finalized, Ecology typically conducts field monitoring and computer modeling of watershed conditions. A TMDL study identifies pollution sources within a watershed and determines what needs to change so that pollution is reduced or eliminated.

Pollution sources are broken down into two categories. The first is *nonpoint pollution*, where the source runs directly off the land into the water. The allowable discharge from all the nonpoint sources is called the *load allocation*. The second category is *point source pollution*, which typically flows out of a pipe and is regulated by a NPDES permit. The allowable discharge from a permitted point source is called a *wasteload allocation*. The TMDL then sets out the actions required for each point source and land use in the project area to ensure TMDL allocations are met.

In short, our TMDL approach:

- Assigns load allocations to specified nonpoint pollution sources.

- Assigns wasteload allocations to point sources which may require more protective NPDES permit limits.
- Designates suites of BMPs for various land-use categories.
- Details the technical data, analyses, and actions needed to attain standards and return waters to good health.

Each TMDL project is unique, but there are essential elements common to all. As long as these elements are included, the TMDL project should result in a water quality improvement plan that is complete, acceptable to the public, and approvable by EPA. These elements include:

- *An initial study of water quality problems.* This includes a monitoring study identifying the sources and amounts of pollutants causing the water quality problem, and a technical analysis to determine how much pollution sources must be reduced to protect the water.
- *Public involvement.* Public involvement, along with coordination with tribal governments and consideration of environmental justice issues (as appropriate), is important at all key decision steps of the process.
- *Loading capacity for the pollutant.* This is the sum total of all of the pollutant loading the waterbody can absorb without violating WQ Standards.
- *Load allocations (LAs) for nonpoint sources.* The LA quantifies how much of the pollutant(s) can be discharged from nonpoint sources, along with the other sources, and have the water body still meet WQ Standards.
- *Wasteload allocations (WLAs) for point sources.* The WLA quantifies how much of the pollutant(s) can be discharged from point sources, along with other sources, and have the water body still meet WQ Standards.
- *A margin of safety.* An allowance so that surface WQ Standards will be met under the worst conditions likely to be experienced.
- *A reserve capacity.* This factor estimates the effect of population growth and future land uses on pollutant WLAs and LAs so they will continue to be adequate in the future.
- *Consideration of seasonal variation of flows and contaminant concentrations.* This ensures that WQ Standards are met during all seasons of the year.
- *An implementation plan.* A detailed plan to prevent, reduce, or clean up excess pollution.
- *A follow-up monitoring plan.* To demonstrate the success of pollution controls contained in the implementation plan or the need for additional action.
- *Reasonable assurance.* For TMDLs that allocate pollutant loads to both point and nonpoint sources, the state must demonstrate reasonable assurance that the LAs will be achieved and WQ Standards will be attained. The purpose of reasonable assurance is to ensure that the WLAs and LAs established in the TMDL are not based on overly generous assumptions regarding the amount of nonpoint source pollutant reductions that will occur.
- *An administrative record.*
- *An estimate* of when the waterbody will meet WQ Standards.

TMDLs and Nonpoint Source Pollution

Ecology relies on TMDL implementation plans to ensure that we accomplish the reductions needed from nonpoint pollution sources to meet the LA required by the TMDL. Our goal is to secure the load reductions required of nonpoint sources through voluntary implementation and the use of education and outreach, technical assistance, and financial assistance. However, enforcement authority under state law provides a regulatory backstop. This regulatory backstop is necessary because there must be *reasonable assurance* that the abatement strategies for

nonpoint sources will actually take place. If nonpoint sources are not addressed, federal law shifts reduction requirements to point source dischargers.

History of TMDLs in Washington State

Starting in 1998, Ecology was placed on a schedule to produce 1,566 TMDLs in 15 years as the result of a citizens' suit filed against EPA. For the first few years, TMDL production met the schedule. However, as time went on, TMDL development became more complicated and controversial for several reasons.

- Instead of focusing on individual segments and individual pollutants when developing TMDLs, Ecology began to focus on entire watersheds and multiple pollutants. Focusing on multiple pollutants for an entire water body provided the opportunity for the same set of actions being able to address an array of related pollutants. Although focusing on multiple pollutants and the entire watershed gained more for the same set of actions, these TMDLs required more data, more analyses, and more time to complete.
- As it became necessary to set more and more stringent wasteload allocations in TMDLs, point source dischargers concerned about the costs of installing advanced treatment technologies began debating Ecology's technical work supporting TMDLs. Additional and more detailed modeling was required to predict outcomes of TMDL implementation and support TMDL wasteload allocations.

When the TMDL settlement agreement completion date passed in 2013, significant work remained to produce the required 1,566 TMDLs.

Additionally, implementing the load allocations in TMDLs has been an increasing challenge, because it has been more controversial as we identify solutions to address the problem. This is in spite of the fact that compared to the technology and investments required of point source industries to meet wasteload allocations, the remedial measures necessary to meet load allocations are usually simple, straight forward, practical, low-tech and inexpensive.

Slow-paced implementation of the load allocation component in TMDLs puts at risk the state's ability to provide reasonable assurance that load allocations will be met. This would have serious consequences for point sources. If Ecology is unable to require nonpoint sources to meet the load allocations in TMDLs, then the loads assigned to nonpoint sources must be assigned to the point sources and required by the point sources' NPDES permits. This is not Ecology's preferred option. We would rather assign pollutant loads to the sources discharging them and then use our nonpoint authority to require the nonpoint sources to meet their load allocations.

Aligning Ecology's Nonpoint and TMDL Programs

As Ecology moves forward, we will deploy our resources in a more systematic manner by aligning our TMDL and NPS programs. Ecology has already taken several important steps to more closely align our TMDL and NPS programs to better leverage an array of staff expertise and to orient programmatic efforts toward cleaning up impaired watersheds. For example, all TMDLs include an implementation plan that contains the required elements of a watershed based plan.

Moving forward, we intend to continue improving implementation plans to designate the specific actions necessary to comply with TMDL load allocations. Additionally, while Ecology will continue to work with and rely on partners to implement load allocation requirements, Ecology will utilize watershed evaluations to identify sites with nonpoint pollution issues and secure the implementation of BMPs that ensure compliance with the WQ Standards and state law. The watershed evaluation process is used most often in agricultural lands, and it has been vetted through the Ecology director's Agriculture and Water Quality Committee as an approach that the group understands and supports. Once problem sites are identified, Ecology will first work with partners in the watershed to implement those suites of BMPs that will address the identified pollution problems. If implementation stalls, for instance because of recalcitrant landowners, Ecology will utilize enforcement tools as necessary and appropriate.

Straight to Implementation (STI)

Straight to Implementation (STI) is a strategy that uses Ecology's nonpoint authority and state resources to clean up a watershed. In watersheds in which the sources of nonpoint pollution are known and the suites of BMPs necessary to control those sources have been identified by Ecology, we simply begin working directly with landowners to implement those BMPs.

In general, Ecology identifies watersheds that are good candidates for STI using the following criteria:

- Are the pollution problems in the watershed caused primarily by nonpoint sources?
- Are there a limited number of land uses in the watershed?
- Do we understand which land uses are causing pollution problems?
- Do we have suites of known effective BMPs that will solve the pollution problems caused by land uses in the watershed?

If the answer to any of these questions is no, then a TMDL is most likely a better tool.

As with implementing TMDLs, Ecology's emphasis is on a collaborative approach to addressing pollution problems. Once Ecology has identified the specific suites of BMPs that will achieve compliance, it will use education programs and outreach to landowners and potential implementation partners to inform citizens about the necessary BMPs. Ecology will first use technical assistance and incentives to secure the proactive implementation of BMPs to address nonpoint sources of pollution. However, Ecology also identifies and utilizes all available federal, state, and local enforceable authorities to secure implementation if the technical and financial assistance fails to address nonpoint sources of pollution. This is a similar approach to that used by local Pollution Identification and Correction programs outlined later in the report.

While a STI project is being implemented, Ecology monitors the rate of implementation and, when possible, performs water quality monitoring to ensure that the water body is actually getting cleaner.

If STI is successful, the impaired water bodies will be cleaned up and move from Category 5 (impaired water body) to Category 1 (clean water body) of the Water Quality Assessment without the need to develop a TMDL. While a STI project is being implemented, the affected water bodies will remain in Category 5. If they do not move to Category 1 by the end of the project, Ecology will develop a TMDL.

STI projects are intended to implement nonpoint source controls as quickly as possible. When we use STI, compliance with the WQ Standards is to be achieved in no more than 10 years after the start of STI work in the watershed. The only exception to this time requirement is for parameters such as temperature, which might take longer because of the time it takes for trees to grow and achieve site potential shade. However, even in this case, all implementation actions necessary to achieve compliance must be completed within 10 years.

STI is more appropriate for watersheds with few pollution inputs, and rural watersheds with few contributors tend to make the best candidates for this methodology. STI projects are guided by an internal staff work plan that includes EPA's required elements of a watershed based plan, which makes project implemented in support of STIs eligible for Section 319 grants.

Focus on Implementation - TMDLs and STIs

Ecology uses watershed evaluations to support STI and TMDL implementation efforts by identifying specific nonpoint pollution problems and prioritizing sites to be contacted for technical and financial assistance. While watershed evaluations can be used to identify and address multiple types of nonpoint source pollution, Ecology primarily uses them to address agricultural nonpoint pollution sources because there is no specific statewide regulatory oversight/permit program designed to meet WQ Standards for this sector.⁶⁶

Watershed Evaluations

During watershed evaluations, Ecology assesses site-specific conditions to determine if water quality problems exist. While water quality monitoring may be used to help document pollution in the water body and/or stormwater flowing into surface water,⁶⁷ Ecology relies on visual site conditions as the primary evidence for identifying nonpoint source pollution problems. An evaluation of site conditions is supported by numerous scientific studies that clearly link site conditions to pollutant discharges. It is also important to use site conditions because unlike many point sources, nonpoint pollution does not discharge continuously. Instead, nonpoint source pollution discharges are intermittent; pollution is moved to state waters through run-off events, atmospheric deposition, direct deposition and irrigation. It is not possible to be on a site every time there is a discharge. Evaluating site conditions provides a more constant and reliable tool for identifying most nonpoint source pollution issues.

In general, when evaluating a site for nonpoint pollution problems Ecology considers the following questions:

- Are there sources of nonpoint pollution present?
- Is surface water present at the site or in proximity to the site? Are there groundwater concerns?
- Are there pathways for pollution to get to state waters?

⁶⁶ As covered below the other major sources of nonpoint source pollution are addressed through permit or other regulatory programs: urban/suburban development and stormwater is addressed through permits and requirements in TMDLs, forestry is addressed through the state Forest Practices Rules, and on-site sewage systems are regulated through local ordinances and regulations. Additionally, dairies are regulated through the Dairy Nutrient Management Program and are also not addressed by Ecology through watershed evaluations.

⁶⁷ See Chapter 7 for more information on Ecology's monitoring efforts.

- Is there evidence that pollutants have left the site and entered state waters?
- Are management practices in place for identified sources of nonpoint pollution to prevent the delivery of pollution to state waters?

After a site is identified as having a nonpoint source pollution problem, Ecology then promotes the use of technical and financial assistance to correct the problem. If technical and financial assistance fail to address the pollution issue, Ecology may utilize enforcement tools to secure compliance.

Watershed Evaluation Process:

- Coordination with partners (local conservation districts, local government, health districts, producer groups, tribes, environmental groups, etc.).
- Secure resources—Technical and financial assistance.
- Complete watershed outreach with partners.
- Complete watershed surveys and site prioritization.
- Contact producers or landowners.
- Complete site visits and/or inspections.
- Work cooperatively to implement recommended BMPs to address identified problems.
- Complete follow-up outreach.
- Use of enforcement tools if technical and financial assistance tools fail.

The watershed evaluation process provides accurate and specific information about pollution problems in a watershed. A statewide system of suites of BMPs that could be used for different land uses would likely be as effective at addressing pollution problems.

Implementing Key Changes Recommended by the Agriculture and Water Quality Advisory Committee

Ecology strives to continually improve the way it performs its work. As part of this process, in 2014 the Director of Ecology convened the Agriculture and Water Quality Advisory Committee⁶⁸ to give us input on our water quality work on agricultural lands. One of the areas where Ecology received input is on ways to improve our watershed evaluation process when using it in agricultural areas. The group made several recommendations, which Ecology is implementing.

- Increasing education and outreach efforts in watersheds where we work, communicating with willing conservation districts, and engaging with producer groups when conducting education and outreach in watersheds.
- When contacting producers our letters will include specific information on the pollution problem observed at the site, a clear timeline for producers to contact Ecology, and an offer for the producer to access the documentation related to their operation and an offer for Ecology staff to make a site visit.

⁶⁸ For more information on the Agriculture and Water Quality Advisory Committee see Chapter 4.

- Ecology will send letters as close as possible to when we observe the site, with the goal of sending letters to prioritized sites within sixty days of observing the site. Letters will provide producers thirty days to contact Ecology and/or set up a site visit. After the thirty days, Ecology will send second letters to producers who fail to contact Ecology and/or set up a site visit.
- If we can verify that land is being leased, Ecology will send the first communication to the lessee.

These changes were made to promote better upfront communication, better engage producer groups, increase clarity around nonpoint pollution problems and promote consistency between regions of our state.

TMDLs and Stormwater

Stormwater pollution from new and existing development and roads is a significant contributor of pollution to state waters. However, due to their coverage under the National Pollution Discharge Elimination System (NPDES)/State Waste Discharge permit program, many stormwater sources of pollution have shifted from our NPS program to our point source pollution/permit program. These include:

- New Development (geographically limited)
- Construction Site Erosion and Sediment Control
- Construction Site Chemical Control
- Existing Development (geographically limited)
- Road, Highway and Bridge Construction Projects
- Road, Highway and Bridge Construction Site Chemical Control
- Road, Highway and Bridge Operation and Maintenance (geographically limited)
- Road, Highway and Bridge Runoff Systems (geographically limited)

Where there is a legal requirement to obtain a permit the NPS program does not address or cover that source. However, stormwater sources that are not required to obtain a permit remain a nonpoint source of pollution. Ecology's primary strategy to address those sources is to utilize TMDLs.

For TMDLs that cover watersheds that contain Municipal Separate Storm Sewer Systems (MS4s) that are not legally required to obtain an NPDES permit, Ecology will:

1. Design the TMDL study to clearly identify whether or not the MS4 causes or contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the state.
2. Establish, to the extent possible, specific load or wasteload allocations to areas of MS4s where they are identified as a potential source of impairment.
3. If the MS4 is deemed a significant and/or contributing source of the water quality impairment Ecology will, at a minimum, specify and include by reference in the TMDL the management practices in Ecology's most recently issued Stormwater Manuals as the minimum required BMPs necessary to achieve compliance with the TMDL allocations.

4. If the TMDL contains information relevant to the determination of whether the MS4s meet the criteria for coverage as specified in *Ecology's Municipal Stormwater Permit Criteria for Designating Phase II Bubble Cities*, the TMDL will be used to support the designation of the jurisdiction as needing to discharge under a new or existing MS4 permit issued by Ecology pursuant to CWA Section 402(p)(2)(E) and 40 C.F.R. § 122.26(a)(9)(i)(C) and (D).

Data Tracking, Effectiveness Monitoring, and Adaptive Management

Tracking implementation data is important for accountability, transparency, effectiveness monitoring and adaptive management. At a minimum, Ecology will track the following implementation data for TMDL and STI projects:

- The location of nonpoint source problems identified by Ecology during watershed evaluations.
- Sites that Ecology has contacted after the evaluations.
- The BMPs that were implemented in the watershed and their location.

A specific description of the BMPs that are implemented at a site is the most important information to track in order to support effectiveness monitoring efforts and promote accountability and transparency. For BMPs implemented with funds from an Ecology grant, specific information is collected on our BMP approval form. For other BMPs implemented in support of a TMDL or STI project, Ecology will collect data consistent with the BMP approval form. Additionally, we will work with partners to promote the collection of consistent implementation data, and share that data with partners and the public.

Finally, to support implementation tracking, Ecology is working to develop a TMDL and Nonpoint database.

Ecology Grant and Loan Programs

Ecology's Water Quality Program administers four major funding programs that provide grants and low-interest loans: The Centennial Clean Water Fund, The State Revolving Fund, Section 319 grants, and Stormwater Financial Assistance Program. These funding programs are for projects to protect and improve water quality in Washington State. Applicants use one integrated financial assistance application to apply for funds to address both point and nonpoint source water pollution. Ecology reviews, rates, and ranks applications and then distributes funds to the highest priority projects.

Each of the funding programs, based on fund source, has different eligibility requirements and limitations and may have specific set-asides or funding priorities. All projects are rated and ranked on a standard set of criteria. Scoring criteria cover:

- Scope of Work - The Scope of Work represents a complete and concise description of the project tasks and outcomes, including deliverables and timelines, and the project directly and measurably addresses a water quality problem.

- Task and Project Budget - The cost estimate process is reasonable, and the project budget represents a good value for the work and water quality benefits achieved. For nonpoint source activity projects requesting grant funding, the applicant identifies adequate matching funds.
- Water Quality and Public Health Improvements - Consideration of the severity of the water quality problem, whether the project will achieve substantial water quality and public health benefits, how project success can be measured, and how the project will provide long-term water quality benefits.
- Coordination with State and Federal Priorities - TMDL or STI implementation, other state or federal water quality requirements, the Puget Sound Partnership Action Agenda or current approved plan or program specifically designed to address water quality problems such as a watershed-based plan containing EPA's required elements.⁶⁹ Also, consideration is given to how well the applicant and the project address greenhouse emission reductions in accordance with RCW 70.235.070.
- Project Team - Applicant defines team members' roles and responsibilities. Additionally, scoring considers team members' past experience, and whether the staffing commitment is well described.
- Project Development, Local Support, and Past Performance—A comprehensive decision-making process was used to arrive at the proposed project, and plans for long-term project success and sustainability were considered during project development. Additionally, scoring considers the level of local support and commitment for the project, and the applicant's past performance on other water quality projects, including Ecology funded projects.
- Readiness to Proceed - Project elements are in place for the project to proceed and documentation is provided.

Successful proposals will demonstrate how the project solves or addresses a water quality problem and how the applicant will document that benefit. Projects must have a well-defined scope of work that has goals, objectives, timelines, and measurable outcomes in addition to an accurate and reasonable budget. Proposals are also prioritized based on their readiness to proceed through documentation that items are in place to begin as soon as funds may be offered.

The funds for nonpoint source pollution help to provide an incentive to support the achievement of clean water objectives and meet the WQ Standards. Eligible activities covered by these nonpoint source funds include implementation of one or more of a limited set of effective BMPs, education and stewardship programs, pollution identification and correction, water quality monitoring, and watershed planning. Ecology prioritizes nonpoint projects that implement eligible BMPs such as livestock exclusion fencing, agricultural waste management, restoring riparian vegetation, irrigation system improvements, stream habitat restoration, control of invasive species, bank stabilization projects, and promoting practices that decrease soil erosion such as direct seed.

To ensure that effective BMPs are implemented, Ecology funds only a small set of BMPs that we have determined will achieve compliance with state law if implemented, operated, and maintained correctly. The program funding guidelines are reviewed and updated annually to

⁶⁹ See Appendix C.

ensure that funded projects meet WQ Standards and to decide whether additional known effective BMPs should be made eligible for funding. Eligibility requirements apply statewide to all proposed projects. The guidelines for state fiscal year 2016 are found at <https://fortress.wa.gov/ecy/publications/publications/1410045.pdf>. The funding guidelines also include statutory requirements, the administrative rule defining uses and limitations of funds, and program and agency policy that guide our programs.

Additionally, Ecology recognizes the need to measure outputs and outcomes, as well as, BMP costs to improve accountability and better target future clean water investments. To better track BMP implementation Ecology started collecting more specific implementation data through a BMP approval form. The form includes specific BMP metrics that must be reported by the grantee, and the requirement to submit a site plan that clearly identifies the location of BMPs that will be implemented by the project. Ecology will work with other funding programs to collect consistent data to measure the effectiveness of funded projects.

In addition to our combined funding program, other grant programs can help with implementation. More detailed information on other funding programs is provided in Chapter 5. Important sources of financial assistance come from local conservation districts, Natural Resource Conservation Service, the State Conservation Commission, Salmon Recovery Funding Board, and EPA. Ecology will look to support our partners' grant programs and pursue opportunities for coordinated investment.

In state fiscal year 2015, Ecology implemented a new online grant and loan management system called Ecology Administration of Grants and Loans (EAGL). This implementation followed an agency wide Lean effort to standardize agency grant and loan procedures for all programs to be used in the system. Lean is a management concept that has been adopted as part of the governor's Results Washington performance management system. It promotes improvement in work processes and results by evaluating factors such as how each worker goes about a task, how the separate tasks function as a system, how those tasks are arranged to arrive at a final product, and what happens between tasks. Because of system improvements adopted through the Lean process, applicants now apply for and manage their funded projects in EAGL throughout the grant and loan life cycle.

Complaint Response and Inspectors

Ecology's complaint response system provides a tool to address reported nonpoint pollution problems through technical assistance, education, referrals, or in limited circumstances, escalating enforcement. All of Ecology's regional offices have staff dedicated to responding to nonpoint source pollution complaints.

Ecology complaint response staff and field inspectors are the first line of Ecology employees that a nonpoint discharger will interact with after a discharge is reported. These staff are responsible for verifying complaints, conducting field visits or inspections, providing technical assistance, highlighting financial assistance opportunities, and referring landowners (if need be) to local conservation districts or other resources for additional support.

Ultimately, Ecology is responsible for ensuring that individuals comply with state law, and that the BMPs implemented at a site are sufficient to address the identified water quality problem.

Finally, nonpoint inspectors can also support the implementation of TMDLs and STIs, local programs (PIC and Shellfish Protection), and other programs with a nexus to water quality.

Education and Outreach, and Voluntary Programs

Public outreach and education are an important part of the state's NPS program. Developing education and outreach programs that increase the public's understanding of nonpoint source pollution, the technical and financial assistance resources available to address nonpoint pollution, and how the public can be involved in preventing pollution before it happens, are fundamental to the success of our nonpoint strategy. Our education and outreach efforts take advantage of a variety of delivery mechanisms.

Ecology will continue to work with partners including producer groups, tribes, state and federal agencies, local governments, conservation districts, environmental organizations, and other stakeholder organizations in a collaborative effort to maximize participation and increase stakeholder adoption of practices that protect and enhance water quality. These collaborative efforts take advantage of the skills and knowledge of partner organizations to complement education and outreach expertise at Ecology.

Ecology will also support locally led voluntary programs that address nonpoint sources of pollution and promote compliance with the WQ Standards. This includes programs designed specifically to address nonpoint pollution, as well as programs that focus on broader natural resource goals that have a nexus with water quality including salmon recovery programs, voluntary stewardship programs, irrigation efficiencies, and floodplains by design projects.

Partnerships

Ecology works collaboratively with other key state and local entities to coordinate the implementation of NPS control measures. In some cases a partner agency or local government is the lead regulatory agency. In other cases they are the on-the-ground implementers of nonpoint pollution control activities. The importance of partnerships to addressing nonpoint pollution sources cannot be overstated. Whether it is implementing TMDL or STI projects, administering our grants and loans program, responding to complaints, or developing education and outreach programs, partners are fundamental to successfully implementing our nonpoint program.

Additionally, we recognize the importance of existing locally led efforts (both voluntary and regulatory) to reduce nonpoint pollution. We will look for ways to help strengthen and augment existing programs that address and prevent the harmful effects of nonpoint pollution. Further, we will look to support programs that bring together farmers, landowners, communities and local organizations to address nonpoint pollution.

Chapter 4 provides a detailed description of current and future partnership efforts.

Locally Led Water Clean-up Programs

Pollution Identification and Correction (PIC) Programs

Pollution Identification and Correction (PIC) programs identify and address pathogen and nutrient pollution from a variety of nonpoint sources, including on-site sewage systems, farm animals, pets, sewage from boats, and stormwater runoff. The corrective actions taken by local agencies or tribes may include outreach and education, technical assistance, incentives for best management practices, and enforcement.

To promote PIC programs, the state Departments of Health and Ecology have offered short term federally-funded grants to county governments, local health jurisdictions, and tribal governments adjacent to Puget Sound to establish or enhance PIC programs.⁷⁰ The goal of these grants is to launch new, and improve existing PIC programs that can eventually be sustainable in the long term by integrating planning across local water quality programs, interests, and concerns.

An effective program will have the following components:

- The ability to reduce or eliminate pathogen and nutrient pollution caused by on-site sewage systems, farm animal waste, pet waste, boat sewage, and stormwater. The capacity to address diverse sources may be accomplished through partnerships.
- An on-going assessment and monitoring program to identify and prioritize problem areas for correction. A monitoring program should include both targeted monitoring to identify pollution sources and monitoring to assess effectiveness of control efforts to ensure that waters stay clean. Assessments from other programs can be used to identify and prioritize water quality problems, for instance the Washington State Water Quality Assessment.
- Corrective action work which includes outreach and education, technical assistance, and incentives, such as cost share for the installation of best management practices. The program includes enforcement as a backstop when other methods don't fix the problem.
- A sustainable funding source.

While PIC programs are administered at the local level, Ecology will continue to take an active role in supporting these programs because our nonpoint strategy shares the objectives of identifying and addressing water pollution issues. Additionally, Ecology provides the regulatory enforcement backstop for counties to help implement the agriculture-related components of their programs.⁷¹ Specifically, as EPA pushed for National Estuary Program (NEP) funding to be focused on local PIC programs, there was an acknowledgement that it would take some local programs time to have a complete and sustainable program similar to Kitsap County's program. Ecology was asked to provide enforcement backup until those local programs developed their own comprehensive enforcement programs that address all sources of nonpoint pollution.

⁷⁰ EPA is providing the funding for these grants through the National Estuary Program grant program. They are currently available from November 2011 through September 2014.

⁷¹ See Appendix D.

Example: Kitsap County's Clean Water Kitsap Program

Kitsap County's Clean Water Kitsap Program is a comprehensive, interagency partnership to address local issues related to stormwater management, nonpoint source pollution, and water quality. County leaders created the program in 1993 to protect public health and natural resources, meet state and federal requirements, minimize costs, and provide stable, ongoing funding to address nonpoint source pollution.

This partnership is led by Kitsap County Public Works Stormwater Division. Stormwater management fees fund the Stormwater Division and, through interlocal agreements, also fund selected programs at Kitsap Public Health District, Kitsap Conservation District, Washington State University Kitsap Extension, and the Kitsap County Department of Community Development.

Through this interagency model, the partners work collaboratively to accomplish many programs and projects for the ultimate goal of clean water. The following descriptions are some programs that are uniquely relevant to the State NPS Plan.

Water Pollution Identification & Correction (PIC) at Kitsap Public Health District

Kitsap's PIC program is nationally recognized for its innovation and effectiveness. Their mission is to protect the public from waterborne illness and other water quality related hazards. Water that is polluted with fecal bacteria is the primary concern. Kitsap defines their job as ensuring that surface waters are safe and sanitary so you don't get sick when you swim in them or eat the shellfish. Their work includes:

- Collecting water samples
- Investigating fecal bacteria sources of water pollution
- Taking steps to correct problems

How it Works

Kitsap uses standard procedures for doing PIC work, as outlined in:

- [Pollution Identification and Correction Protocol Manual 2012](#)
- [Pollution Identification and Correction Guidance Document 2014](#) (written with the Washington State Departments of Health and Ecology).

Looking For Trends

Kitsap starts with the big picture by monitoring long-term water quality trends for Kitsap County's marine (salt) waters, lakes and streams (known as surface waters). All Kitsap streams run into the Puget Sound or Hood Canal, so if the streams are polluted, they can impact marine waters. The streams are relatively small, so signs of pollution appear early and damage occurs more quickly.

Early Warnings

Surface water quality gives an early warning that development, land uses, and other human activities are beginning to harm the public's health, shellfish resources, and the environment.

The primary sources of pollution are:

- Failing septic and sewer systems
- Faulty storm water systems
- Pet and livestock waste
- Runoff from farms.

Correcting Pollution Problems: Strength of the Clean Water Kitsap Partnership

Each year Kitsap's PIC team uses their monitoring data to prioritize a list of the waterways that are the most polluted. Working through this list, they investigate to find the source of the pollution. When they locate the source, they work with property owners to eliminate it. When sources are from failing septic systems or other sewage issues, Kitsap Public Health spearheads the education, enforcement, and technical assistance to work through the correction process.

When the source is animal waste from a farm, the Kitsap Conservation District is available for non-regulatory technical assistance while the owner has the option of a voluntary compliance process to address the documented water quality problem. When the source is a faulty stormwater system, Kitsap Public Works will perform smoke and dye testing to find and confirm an illicit connection to the storm drain system and follow up with the established escalating enforcement strategy required in the stormwater NPDES Permit.

Water Quality Reports

Public communication about the state of the public's local water bodies is an important part of the PIC Program. Kitsap's PIC team publishes annual [reports](#) about the relative fecal coliform levels in streams, bays and lakes, their ongoing efforts to improve water quality, and the current priority list of polluted areas. The Kitsap PIC has demonstrated success at cleaning up polluted waters. On the 2015 WQ Assessment, seven polluted segments covered by the PIC program were moved into Category1—meets WQ Standards.

Shellfish Protection Districts

RCW 90.72 authorizes counties to establish shellfish protection districts to include areas in which nonpoint pollution threatens the water quality upon which the continuation or restoration of shellfish farming or harvesting is dependent. The shellfish protection program should be designed to address the pollution sources that affect shellfish, including, but not limited to requiring the elimination or decrease of contaminants in storm water runoff, establishing monitoring, inspection, and repair elements to ensure that on-site sewage systems are adequately maintained and working properly, assuring that animal grazing and manure management practices are consistent with best management practices, and establishing educational and public involvement programs to inform citizens on the causes of the threatening nonpoint pollution and what they can do to decrease the amount of such pollution.

The State Department of Health routinely samples water around commercial and recreational shellfish growing areas to make sure it meets health standards. If water quality fails to meet those standards, they restrict or close that area to shellfish harvest. This is called a classification downgrade.

When a shellfish area's classification is downgraded due to poor water quality, the county authority must create a shellfish protection district (SPD) and implement a program to find and correct the pollution source(s) that are causing water quality to decline (see [RCW 90.72.045](#)). Shellfish protection districts have proven to be very effective in reversing pollution of

Washington's saltwater beaches, preventing new pollution sources, and reopening shellfish areas to harvest.

More information on Shellfish Protection Districts can be found at:

<http://www.doh.wa.gov/CommunityandEnvironment/Shellfish/GrowingAreaRestoration/ShellfishProtectionDistrictsLibrary>

Other Tools to Promote Implementation

In addition to the ongoing nonpoint efforts outlined previously, Ecology continues to pursue and support other tools and strategies to address nonpoint source pollution.

Draft Water Quality Trading Framework

Ecology's Water Quality Program developed a water quality trading framework⁷² to guide the development of trading programs in watersheds in which the point sources determine that they will need trading to meet TMDL wasteload allocations and the subsequent NPDES permit limits. Water quality trading has the specific goal of helping point source dischargers meet permit limits through the purchase of pollution reduction credits from a source of the same pollutant that is able to reduce pollution at a lower cost than the point source. This narrow definition of trading is the only one supported by EPA's trading guidance, which Washington must follow.

EPA's trading policy recommends:

- Timely public access to information on trades.
- Public participation during program development and implementation.
- Mechanisms to monitor progress, evaluate program effectiveness, and revise the program as necessary.
- Legal mechanisms to facilitate trading.
- Clearly defined units of trade.
- Methods to quantify credits and address uncertainty.
- Compliance and enforcement provisions.
- Accountability for all trades. Assurance that NPDES permit holders meet their permit limits.

Ecology supports the concept of pollution trading markets that:

- Meet the requirements and objectives of Washington's WQ Standards and the federal Clean Water Act.
- Promote cost-effective water quality protection and restoration.
- Result in water quality trades that are verifiable and fully enforceable.
- Ensure credits generated by a nonpoint source from the installation of best management practices must be beyond those required to meet the most stringent load allocation applicable to that nonpoint source.

⁷² See <http://www.ecy.wa.gov/programs/wq/swqs/progs.html> and <http://www.ecy.wa.gov/biblio/1110027.html>.

- Measure or calculate nonpoint source credits and trading ratios from the same baseline used in the TMDL and consistent with the assumptions used to develop the load allocation.

Ecology considers the most logical pollutants for trading are phosphorus, nitrogen, other oxygen-related pollutants, and sediment. We will consider trades involving temperature, although the lengthy time lag to produce shade may prohibit temperature trades in many watersheds.

Certification and Certainty Programs

Certification programs take a market-based approach to address environmental problems. They can verify to retailers and consumers that a product has been produced using environmentally sustainable management practices. Ecology supports the concept of certification programs that include a focus on protecting water quality from nonpoint sources of pollution and support the key principles of Ecology's nonpoint source pollution strategy. Additionally, when organizations develop certification programs in consultation with Ecology, we can provide regulatory certainty to participating landowners, businesses, and agricultural producers who participate in the program.

A current example is the Farmed Smart Certification. The Farmed Smart Certification is a sustainable farm certification program developed by the Pacific Northwest Direct Seed Association (PNDSA) and a conservation farming technical stakeholder committee, comprised of conservation producers, managers from conservation districts, Ecology, and researchers with NRCS and Washington State University. The certification criteria were developed using best management practices from multiple environmental and conservation entities including NRCS and Ecology. The certification program was vetted by SureHarvest, a third party certification company and several regional commodity marketing companies with positive feedback that this is a market-ready program.

The Farmed Smart certification objectives include:

- Define a set of conservation standards that will provide a clear understanding of economic and environmental benefits of direct seeding.
- Certify producers that are utilizing sustainable practices.
- Educate and develop environmental markets for certified sustainable products and producers.

Further, the Farmed Smart certification has six initiatives that will be evaluated and proven in order to become certified:

- *Improving Water Quality* – through less soil disturbance, less soil erosion, precision placement of fertilizers and implementing buffer strips along water sources.
- *Improving Air Quality* – by keeping crop residue on the field to avoid wind erosion, and reducing fuel emissions from equipment.
- *Improving Soil Quality* – by reducing the amount of tillage which increases organic matter, earthworm activity, and yield potential.
- *Improving Wildlife habitat* – by providing food and cover for wildlife and fish habitats.

- *Conserving Energy and Reducing Carbon Footprint* – through planting in 1 – 2 passes allowing a significant reduction in fossil fuel usage and sequestering carbon in the soil.
- *Improving Economic Viability and Sustainability* – Reducing input costs of fuel, labor, and chemicals through precision agriculture and direct seeding practices ensures the family farm can continue to produce a safe food supply for the growing population.

Continued Implementation of Key Regulatory Programs

Forest Practices

Washington's streams benefit from a well-regulated Forest Practices Program. In Washington, forest practices are mandated under law to meet the state WQ Standards, and are implemented using forestry prescriptions developed and refined through a science-based adaptive management system. In response to the strength and focus of the current regulatory system, the Department of Ecology in cooperation with the United States Environmental Protection Agency established the Clean Water Act Assurances. To the extent that the current rules continue to be tested and refined as appropriate by a well-funded adaptive management program, the rules will be relied upon to ensure streams in the forested environment meet the state WQ Standards.

History of the Current Forest Practices Rules

The Forests & Fish Report

Leading up to the current Forest Practices Rules was the Forests and Fish Report (FFR). This document, issued in 1999, was the result of the collaboration of stakeholders including tribes, forest landowners, local governments, environmental groups, and state and federal resource agencies. These diverse stakeholders outlined ways to protect water quality and aquatic and riparian-dependent species on non-Federal forestlands in Washington.

The FFR identified four goals:

1. Provide compliance with the federal Endangered Species Act for aquatic and riparian-dependent species on state and private forestlands.
2. Restore and maintain riparian habitat to support a harvestable supply of fish.
3. Meet the requirements of the Clean Water Act for water quality.
4. Keep the Washington timber industry economically viable.

The Salmon Recovery Act of 1999

Following the release of the Forests and Fish Report was passage and enactment of the state's Salmon Recovery Act of 1999 (sometimes called the 'Forests and Fish Law'). This act directed the adoption of the goals of the Forests and Fish Report into the State Forest Practices Rules. Those rules are guided by the state's Forest Practices Board, and set standards for timber harvests, pre-commercial thinning, road construction, and other forest practices on over 10 million acres of state and private forestland.

The Forest Practices Habitat Conservation Plan

The Washington State Forest Practices Habitat Conservation Plan (HCP) is a direct result of the Forests and Fish Report. The HCP was approved in 2006 by the U.S. Fish and Wildlife Service and NOAA's Marine Fisheries Service. Covering 60,000 miles of stream habitat across 9.3 million acres of private and state forestlands, this 50-year agreement protects the habitat of aquatic species, supports economically viable and healthy forests, and creates regulatory stability for landowners.

The Forest Practices Act

The Washington State Legislature found that the 1999 Salmon Recovery Act and the resulting Forests and Fish Rules "...taken as a whole, constitute a comprehensive and coordinated program to provide substantial and sufficient contributions to salmon recovery and water quality enhancement in areas impacted by forest practices..." (RCW 77.85.180(2)). It also recognized that federal and state agencies, tribes, county representatives, and private timberland owners have spent considerable effort and time to develop the Forests and Fish Report (RCW 76.09.055), and authorized the development of Forest Practices Rules based on the analyses and conclusions of the Forests and Fish Report (FFR). The rules include the development of an adaptive management program to:

... make adjustments as quickly as possible to forest practices that are not achieving the resource objectives ... (and) shall incorporate the best available science and information, include protocols and standards, regular monitoring, a scientific and peer review process, and provide recommendations to the board on proposed changes to forest practices rules to meet timber industry viability and salmon recovery. (RCW 76.09.370(7))

These provisions for the forest practices Adaptive Management Program are designed to meet the goals and objectives for water quality and fish habitat within the jurisdiction of the Forest Practices Program.

The state Forest Practices Act (Chapter 76.09 RCW) and the Stewardship of Non-industrial Forests and Woodlands (Chapter 76.13 RCW) set up the foundation for management by the state and private landowners in Washington. Landowners must either follow the prescriptions established in the state Forest Practices Rules (Chapter 222 WAC), or follow prescriptions established in federal Habitat Conservation Plans established for their specific lands. There are currently eight other HCPs that cover some of the state and private forest lands.

The Forest Practices Rules

The Forest Practices Rules in Washington are detailed and comprehensive. The rules cover a wide range of issues associated with forest harvesting, roads, and unstable slopes. The specific prescriptions are dependent on site factors such as the size of streams and the type and size of wetlands, as well as the productivity of the soils and the method of harvest (e.g. clear cutting vs. thinning, ground based vs. cable yarding). As such, the rules are too complicated to restate here. However, some generalized elements related to water quality protection are worth noting. These include leaving streamside forested buffers that range from 90 - 200 feet wide along each side of fish-bearing streams west of the Cascade Mountains and 75-130 feet wide buffers on the east side of the mountains (the dry side). Fifty-foot wide buffers typically protect most of the flowing reaches of the non-fish-bearing waters on the westside, with an allowance for more variable width buffers on the eastside to mimic historic forest fire cycles.

All new forest roads must be constructed to the rule standards and Road Maintenance and Abandonment Plans exist statewide to replace barriers to fish passage and bring roads into compliance with current road standards. Based on current rates of improvement, most ownerships will meet the initial target date of 2016 for bringing all of their roads up to current standards, with only a small number of ownerships formally granted a 5 year extension due to economic hardship incurred during the economic recession that began in 2008.

The enhancements made to the forest practices rules in response to the 1999 Forests and Fish Report targeted the protection five key riparian functions: shade, stream bank stability, woody debris availability and recruitment, sediment filtering, and nutrients and leaf litter fall. This occurs through the combined results of maintaining mature forested stands along streams, rivers, and wetland impoundments; by disconnecting road runoff from natural drainages to the fullest extent feasible; and identifying and protecting potentially unstable slopes which if otherwise were allowed to fail could contribute deleterious amounts of sediment to waterways.

It is important to note that the Forest Practices Board may not adopt or amend any rule that would affect water quality without the agreement of the Director of Ecology.

Framework for Administering the Forest Practices Rules

Overview of the Adaptive Management Program

The Adaptive Management program was created to provide science-based recommendations and technical information to assist the Forest Practices Board in determining if and when it is necessary or advisable to adjust rules and guidance for aquatic resources to achieve the resource goals and objectives of the Forests and Fish Report.

The Forest Practices Adaptive Management Program is a multi-caucus program that includes representatives from state departments (including Fish and Wildlife, Ecology, and Natural Resources), federal agencies (particularly National Marine Fisheries Service, U.S. Fish and Wildlife Service, and Environmental Protection Agency), forest landowners, county governments, the environmental community, and tribal governments. Representatives of these caucuses participate on two key Adaptive Management Program committees established by the Forest Practices Board: the Timber, Fish and Wildlife Policy Committee (Policy) and the Cooperative Monitoring, Evaluation, and Research Committee (CMER).

The Policy Committee makes recommendations to the Board for decision. CMER reviews existing science and contributes original research to the program. This science function is designed to produce unbiased technical information for consideration by the Policy Committee and the Board, as illustrated by the interactive structure of the Adaptive Management Program in the following diagram. The Department of Natural Resources (DNR) operationally implements the Forest Practices Program. The Department of Ecology, the Department of Fish and Wildlife, and many of the state's Tribes are active cooperators with DNR in implementing key provisions of the state's Forest Practices Rules in the field.

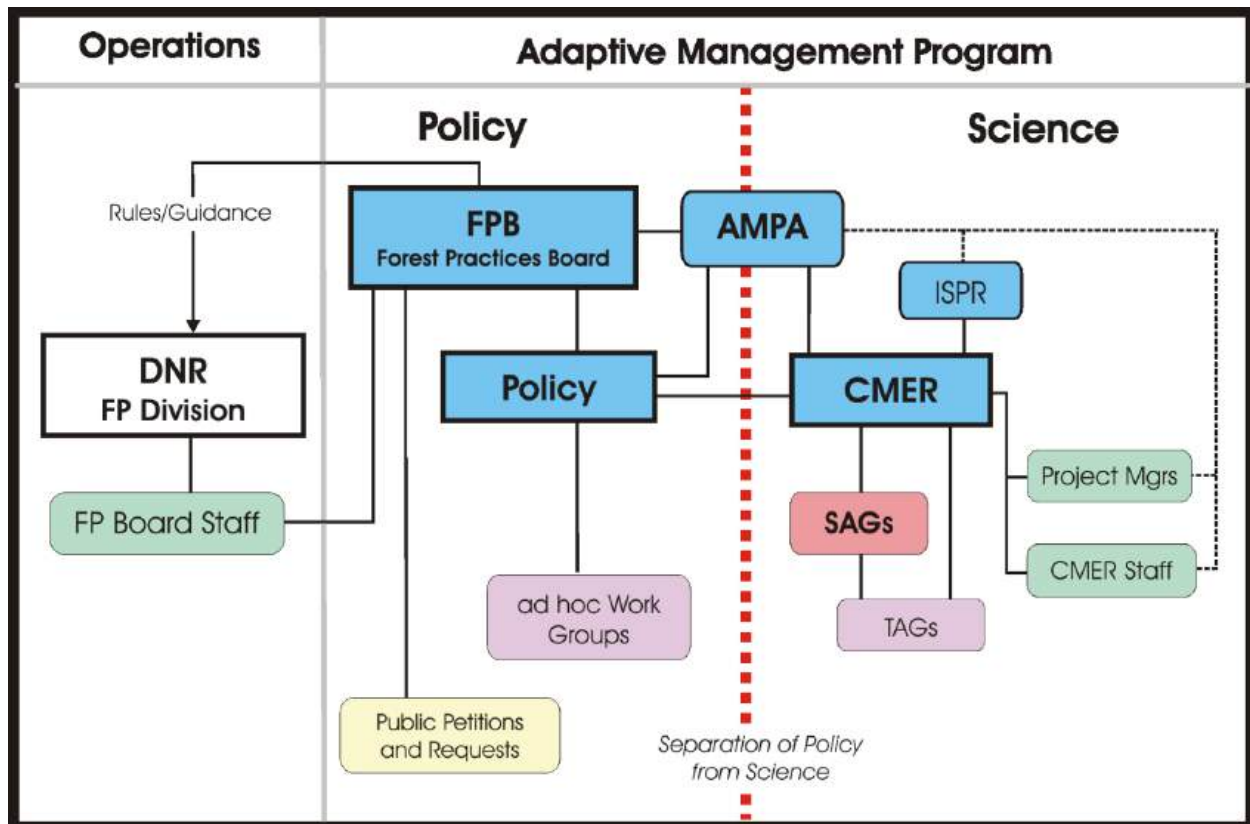


Figure 1 Forest Practices Adaptive Management Program

Forest Practices Board (Board)

The Board has approval authority over proposed CMER projects, annual work plans, and expenditures. It establishes resource objectives to inform and guide the activities of the program and sets priorities for action. If consensus or an otherwise acceptable conclusion is not reached in Policy, the Board makes the final determination. The Board also:

- Directs the program to complete work according to the CMER master project schedule.
- Determines whether the program is in substantial compliance with the CMER master project schedule.
- Notifies the National Marine Fisheries Service and the US Fish and Wildlife Service if the program is not in substantial compliance with the CMER master project schedule.
- Approves nominations for CMER committee members.
- Ensures that fiscal and performance audits of the Adaptive Management Program are conducted.
- Forwards to the Adaptive Management Program all proposals affecting aquatic resources for new rules and board manual content.
- Approves proposed updates to Schedules L-1 and L-2 of the Forests and Fish Report, “Key Questions, Resource Objectives, and Performance Targets for Adaptive Management.”

Timber, Fish and Wildlife Policy Committee (Policy Committee)

The Policy Committee is a consensus- based policy forum to support the Adaptive Management Program. The Policy Committee consists of members selected by and representing the following State of Washington Timber, Fish, and Wildlife (TFW) caucuses:

- Industrial private timber owners.
- Nonindustrial (small) private timber owners.
- Environmental community.
- Western Washington tribal governments.
- Eastern Washington tribal governments.
- County governments.
- Department of Natural Resources.
- Departments of Fish and Wildlife and Ecology.
- Federal agencies (National Oceanic & Atmospheric Administration Fisheries, US Fish and Wildlife Service, and US Environmental Protection Agency).

The function of the Policy Committee is to develop solutions to issues that arise in the Forest Practices Program. These issues may be raised by science reports on rule or program effectiveness, or policy questions on implementation of forest practices. Solutions may include the preparation of rule amendments and/or guidance recommendations.

The Policy Committee also assists the Board by providing guidance to CMER and recommendations on adaptive management issues. The Policy Committee reviews and makes recommendations on the key questions, resource objectives, and performance targets, and recommends CMER program priorities for CMER work plans containing specific research projects to the Board. In cooperation with CMER, the Policy Committee reports to the Board the status of the CMER master project schedule prioritizing CMER research and monitoring projects, and provides an update of the CMER master project schedule at least every four years.

The Cooperative Monitoring Evaluation and Research Committee (CMER)

The purpose of CMER is to advance the science needed to support adaptive management. For the Adaptive Management Program, best available science is considered to be relevant science from all credible sources including peer-reviewed government and university research, other published studies, and CMER research products. Applicable historic information, privately produced technical reports, and unpublished data may have value and are considered as long as they can be assessed for accuracy and credibility. CMER is responsible for understanding available scientific information that is applicable to the questions at hand, selecting the best and most relevant information, and synthesizing it into reports for the Policy Committee and the Board.

CMER is composed of scientific representatives of TFW participating caucuses who are expected to maintain an objective scientific perspective. CMER operates on the basis of consensus. Because CMER is charged with producing credible, peer-reviewed technical reports based on best available science, participating caucuses are encouraged to nominate research scientists with research and publication experience.

The CMER work plan provides a long-term integrated strategy for how CMER supports the Adaptive Management Program. The work plan identifies six objectives towards this goal:

1. State critical research and monitoring questions that are pertinent to evaluating rule, guidance, and DNR products (i.e., rule tools) effectiveness.
2. Organize these questions into coherent program groupings.
3. Assess feasibility, resource risk, and scientific uncertainty addressed by each program.

4. Develop an integrated strategy for accomplishing the work.
5. Rank programs/projects for implementation.
6. Develop budget estimates and timelines.

The Clean Water Act Assurances

Overview

Under Washington State law (Chapters 90.48 RCW & 76.09 RCW) Forest Practices Rules are to be developed so as to achieve compliance with the state WQ Standards and the federal Clean Water Act (CWA). Ecology has been designated as the state water pollution control agency for all purposes of the CWA, and has been directed to take all action necessary to meet the requirements of that Act. The original Clean Water Act assurances (CWA assurances) granted by Ecology in 1999 as part of the Forests and Fish Report (FFR) were reviewed after June 30, 2009. The assurances established that the state's Forest Practices Rules and programs, as updated through a formal adaptive management program, would be used as the primary mechanism for bringing and maintaining forested watersheds into compliance with the state WQ Standards.

The foundation for granting the CWA assurances was the belief that the Forest Practices Rules were a substantial step forward in environmental protection, and when implemented would provide the quickest and most efficient means for achieving environmental goals and compliance with the state's WQ Standards. Developing CWA mandated TMDLs to serve as regulatory water cleanup tools for forested watersheds was therefore viewed as a low priority, and the CWA assurances established that Ecology would rely on the FFR-based forest practices program for an initial ten-year period. It was assumed in 1999 that research and monitoring would occur to demonstrate that implementing the Forest Practices Rules would improve water quality and eventually bring forested waters into full compliance with the state's surface WQ Standards and thereby also satisfy the conditions under Section 303 of the federal CWA. The value of offering formal assurances is that they provide landowners and agencies with a predictable and consistent regulatory system, and in doing so provide an additional motivation for stakeholders to participate in the adaptive management program.

In July of 2009, Ecology completed a re-examination on progress in meeting the conditions for providing the CWA Assurances ([2009 Clean Water Act Assurances Review of Washington's Forest Practices Program](#)). At that time, Ecology determined the forest practices program had not achieved the level of information needed to verify that water quality in the forested environment will meet WQ Standards, or to verify that the conditions for offering the assurances in 1999 had been satisfied. In spite of these shortcomings, Ecology believed the forest practices program still offered a viable and compelling management strategy for achieving water quality goals in the forested environment. As such, Ecology concluded that continuation of CWA assurances would be warranted if specific actions were taken to improve the program's performance.

Taken in total, the forest practices program provides a substantial framework for bringing the Forest Practices Rules and activities into full compliance with the WQ Standards. Ecology concluded it remained in the best interests of water quality, and was most consistent with legislative intent, to work with the other participants to make needed improvements to the existing program. Ecology therefore conditionally extended the CWA assurances with the intent

to stimulate needed improvements to the forest practices and adaptive management programs. Ecology, in consultation with key stakeholders, established specific corrective milestones. The extension of the assurances remains conditioned on meeting these research and administrative milestones by the specific target dates described. These milestones serve as a corrective action plan necessary to retain the assurances into the foreseeable future.

The key result of the corrective milestones was to more directly prioritize water quality-based operational and science issues and concerns. But even before the assurances review had been completed, steps were already being taken to proactively address some of the corrective milestones associated with operational issues, compliance monitoring, and assessing progress under Road Maintenance, Abandonment, and Planning (RMAP) rules.

Compliance with the corrective milestones is intended to demonstrate sufficient progress to satisfy the CWA assurances and the adaptive management provisions of the state WQ Standards (WAC 173-201A-510(3)). Because extending the assurances was based on meeting the specific research and administrative milestones by the specific dates listed, failure to meet any milestone would be considered a basis for potentially withdrawing the assurances at that time.

The 2009 corrective milestones included 21 operational or administrative milestones, and phase-specific milestones covering 20 research projects examining prescription effectiveness questions. Between 2009 and the 2015 Ecology has made changes in the milestones in response to new information, natural disasters, and the global economic recession. While the initial list in 2009 is different from that today, neither the number nor the complexity of the milestones has been reduced in scale, and the priority research remains focused on water quality protection issues. As of this time, only a few operational and administrative milestones remain incomplete, and most of the priority water quality research is either in field implementation or in the study design phase.

Currently the CMER research program invests about 3.2 million dollars per year in examination of the effectiveness of the Forest Practices Rules. To be successful in meeting these milestones and consequently retaining the CWA assurances, the caucus principals will need to continue to work together to ensure continued funding and support for the actions needed to meet the specific milestones. Based on ongoing progress and the continued commitment by key stakeholders, Ecology fully expects these steps to be successful. More information about CMER's work may be found here:

<http://www.dnr.wa.gov/AboutDNR/BoardsCouncils/CMER/Pages/Home.aspx>

Small Forest Landowners - Alternate Rules

The state legislature enacted special rules for some landowners. Small forest landowners are defined as entities that harvest less than 2 million board feet per year on average. The vast majority of these small forest landowners own less than 20 contiguous acres. These smaller landowners were provided with rules that allow for greater harvests near streams and they are only required to correct problems on their roads at the time the associated land is harvested. The Legislature established the Small Forest Landowner Office to be housed in the Washington State Department of Natural Resources to help landowners and to proactively improve environmental

conditions on their lands through the use of targeted financial, technical, and regulatory opportunities, as well as education.

Small landowners are provided with limited cost share funding and technical assistance to fix road crossing fish barriers on their properties, and limited additional appropriations to help compensate them for leaving trees along streams to protect water quality and other public resources in recognition of the disproportionate impact the Forest Practices Rules when established, were estimated to have on small forest landowners.

With the exception of those rules established directly by the legislature, all the programs provided to small forest landowners were initially designed with the intention of meeting the goals of the federal Clean Water Act and the state WQ Standards, and are scheduled to be tested through science based adaptive management. While no programs exist to directly examine the effectiveness of the rules established for small forest landowners, research designed to evaluate the rules applied to larger landowners will have value in providing feedback to the state legislature and the state Forest Practices Board on the effectiveness of the small forest landowner rules as well.

Agricultural

Ecology and Agriculture

As detailed elsewhere in this Chapter, Ecology will continue to use its nonpoint source authority to address pollution problems on agricultural lands, and to develop additional strategies that might help us accomplish the goal of achieving clean water in Washington. As the state water quality agency, Ecology will continue to work on better defining what compliance with state water quality law means and to provide that feedback to landowners so they can make informed decisions.

Dairy Nutrient Management Program-Washington State Department of Agriculture (WSDA)

The Dairy Nutrient Management Program (DNMP) currently has 3.5 dedicated staff for inspection activities. DNMP utilizes several tools to work with dairy, CAFO permitted livestock, and non-dairy operations including:

- DNMP conducts routine inspections at all dairy and permitted CAFO operations approximately every 22 months, and a wet-weather inspection every five years to identify actual or potential violations of water quality and recordkeeping requirements.
- DNMP conducts focused inspections, such as fall and spring lagoon assessment to ensure adequate storage is available and being operated and managed appropriately and to monitor agronomic applications.
- DNMP partners with other agencies (Ecology, Health, local agencies) to identify and correct actual or potential violations from non-dairy livestock operations in watersheds with documented water quality issues, such as Samish, Portage Bay, and the Lower Yakima Valley.
- DNMP established a compliance pathway to provide clarity for dairy producers and encourage compliance with water quality laws through the use of regulatory technical assistance, warning letters, notices of correction and, when necessary, civil penalties. RCW 43.05 (Technical Assistance) requires WSDA to provide technical assistance before issuing a civil penalty for violations.

- DNMP is working with local conservation districts to provide training and tools to help producers meet recordkeeping requirements.

DNMP is working with state and local agencies to identify gaps in authorities and strategies to fill those gaps such as:

- Requesting additional funding to provide additional inspections and training to livestock producers.
- Evaluate and update WAC 16-611 to include additional recordkeeping requirements to ensure land applications of nutrients are not exceeding the agronomic needs of crops.
- Evaluating and identifying regulatory gaps in RCW 90.64 to address significant potential to pollute issues.

Challenges and Gaps in the Current Program Identified by WSDA

The following are challenges and gaps in the current program identified by WSDA. During the term of this plan we will work collaboratively and find opportunities to address these gaps and challenges. WSDA had identified the following gaps:

Program Requirements - Regulatory agency does not control specific program requirements so can't directly respond to evolving water quality or industry issues.

- Conservation Commission sets minimum elements of dairy plans based on NRCS standards.
 - Elements not updated since 1998, no requirement to incorporate updated standards.
- Conservation Districts approve and certify plans as meeting minimum elements.
- Operators not required to meet plan timelines if district does not have resources.

Enforcement Authority - The state lacks the enforcement authority and penalties for dairies that do not get plans updated or properly implement their plans, which limits water quality enforcement effectiveness.

- Plan Updates: Dairies have no effective requirement to update a plan when there are changes to dairy operations.
 - Updates are only required if the plan contributes to a discharge to waters of the state; generally, management decisions, not the plan, are the primary contribution to discharges.
 - No agency has authority to require the update.
 - No penalty is established for failing to update a plan.
- Plan Implementation: Dairies have no requirement to follow an approved and certified plan.
 - No penalty for failure to follow the plan except for when proper records have not been kept to show agronomic applications or discharge occurs (2010 legislation).
 - Plan development relies on practice standards that are intended as guidelines, subject to interpretation and are updated periodically.
- Water Quality Enforcement: State has limited enforcement authority except where dairy actions cause a discharge or create a potential to pollute.

- WSDA can issue a Notice of Correction based on creating a potential to pollute.
 - WSDA may issue a penalty if:
 - There is a water quality standard violation.
 - Records are not kept to show agronomic applications. Actual over-application is not subject to penalty unless a discharge is documented.
- Violations/Penalties: The Dairy Nutrient Management Act narrowly defines what a violation is and establishes specific penalties for violations.
 - Violating water quality standards —civil penalty up to \$10,000 per day.
 - Failure to obtain an approved and certified initial plan—a civil penalty of \$100 per month past due date with \$5000 max penalty (RCW 90.64.030).
 - Records violation added in 2009—penalty established in 2010 for up to \$5,000 per violation and maximum of \$5,000 in one year.

More information about the program may be found here:

<http://agr.wa.gov/FoodAnimal/Livestock-Nutrient/>

On-Site Sewage Systems (OSS) Regulation

There are about 950,000 small on-site sewage systems (OSS) in Washington. Failing on-site sewage systems can pose a threat to shellfish resources, impact groundwater, and cause nutrient enrichment of receiving waters.

In Washington, on-site sewage systems are regulated by Chapter 246-272A of the Washington Administrative Code, “On-site Sewage System.” This rule is adopted by the State Board of Health, developed and administered by the state Department of Health, and primarily implemented by local health jurisdictions for small systems with flows less than 3,500 gallons per day.

The regulations prohibit the discharge of sewage to surface waters and provide a permitting system for on-site sewage systems. Conditions for permits and system design requirements are set in state and local code, including minimum land area, horizontal setback and other site characteristics, soil and treatment standards, and more. Circumstances are described which require connection to a public sewer system. On-site sewage system designers must be licensed by the state Department of Licensing, and installers and pumpers must be certified by local health jurisdictions. Local health jurisdictions are authorized to inspect on-site systems under construction as part of the permitting process.

As noted previously, local health jurisdictions implement front-line provisions of Chapter 246-272A WAC and have authority to promulgate more stringent regulations (RCW 70.118.050). Enforcement of rules related to onsite sewage systems is authorized in Chapter 70.05 RCW.

The state Department of Health has back-up enforcement authority under RCW 43.0.130, “Powers and duties of the Secretary of Health.” The Department of Ecology also has the authority to take enforcement action under the Water Pollution Control Act.

To ensure that local programs are consistent with the state rule, the state Department of Health must approve local health codes. If a local government does not follow the state rule, the Department of Health works with the local health officer and local board of health to bring the local code into compliance with the state rule. If necessary, the Secretary of Health may exercise enforcement authority if a local health jurisdiction fails to enforce the state public health rules.

The Department of Health uses a technical advisory group made up of government and industry representatives to provide advice on technical wastewater issues and guidelines governing the design and use of public domain and proprietary on-site sewage treatment and distribution technologies approved for use in the state.

The state recognizes that proper operation and maintenance of on-site systems is essential to ensure they function properly. Chapter 246-272A WAC describes the operation, monitoring, and maintenance responsibilities of system owners and the local health jurisdictions. System owners are responsible for properly operating their systems, periodically evaluating them, and pumping when necessary to avoid problems and to ensure ongoing performance. The Department of Health and local health jurisdictions provide technical support, oversight services, and information on proper operation and maintenance (O&M) to homeowners. One example of an information source on the Department of health website:

<http://www.doh.wa.gov/CommunityandEnvironment/WastewaterManagement/OnsiteSewageSystemsOSS/HomeownerEducation>

Local health jurisdictions are responsible for developing and implementing management plans describing their methods and financial capacity to educate and remind system owners of their O&M responsibilities. The state rule and chapter 70.118A RCW on marine recovery areas, establishes more rigorous requirements for the 12 Puget Sound counties. The Department of Health has produced numerous guidance documents and administers a small amount of state grant funding (about \$1.2 million biennially) to support implementation of these management plans. The local plans and programs are all uniquely designed and implemented, and involve such activities as inventorying systems, tracking system status and inspection/maintenance activities, facilitating and enforcing work on failures, and educating system owners. Funding for the local management programs is limited and uneven. The department is working closely with the local health jurisdictions and other interests to establish dedicated sustainable funding for these programs.

In implementing the plans, local health jurisdictions generally focus their oversight on more complex systems that require regular O&M and in areas where site risks are greatest, such as marine recovery areas and other sensitive areas.

To supplement this regulatory framework, the Washington Department of Ecology (Ecology) has loaned significant money from the Water Pollution Control State Revolving Fund (SRF) to local governments to set up low-interest loan programs to repair or replace failing on-site sewage systems. The following is an overview of the funding program:

- Water Pollution Control State Revolving Fund loans can be used by counties and cities to, in turn, loan money to land owners to repair or replace their failing systems.

- Centennial Clean Water Program grant funds can help defray some of the operating costs and lending risks for these programs. Counties and cities can use the grant funds to cover operating costs for the program, provide small grants to property owners, and to establish a loan loss reserve account to cover their obligations if a property owner defaults on a loan.

To capture greater economies of scale, Ecology is working with the Department of Health and counties to establish and capitalize a regional scale loan program that would complement or potentially replace many county-based loan programs in the state's coastal counties. Once established, this program could scale up to cover additional parts of the state.

Shellfish restoration projects provide an important opportunity to address on-site sewage systems. When a shellfish bed is downgraded, the state works with the local government and other interests to develop and carry out a restoration strategy, which typically includes work to find and fix failing on-site systems. The local jurisdiction must also create a shellfish protection district to implement long-term solutions to the problems, including on-site septic measures such as inspections, corrections, education, and operation and maintenance. Local watershed plans must include nonpoint pollution control strategies for addressing on-site septic systems which can include voluntary, educational, and regulatory programs. The good news is that stronger local septic management programs are helping to effectively protect shellfish beds and preempt reactive work in many areas.

When a TMDL or a ground water study indicates that further restrictions must be placed on on-site systems, Ecology may impose those restrictions.

Additives to and loadings from onsite sewage systems have been addressed by restrictions at the retail level:

- Chapter 70.118 RCW prohibits the use of Chemical additives in onsite sewage systems unless certified by the state Department of Health.
- Chapter 70.95L RCW bans the retail sale of laundry and dishwashing detergents which contain 0.5 percent or more phosphorus by weight.

Complementing the management and regulation of small on-site sewage systems, the Department of Health directly regulates and permits large on-site sewage systems with flows between 3,500 and 100,000 gallons per day. There are approximately 570 LOSS statewide, roughly half of which are located in the Puget Sound region. The Department of Health provides oversight to approve plans and inspects newly constructed systems, issues and renews permits annually for all systems, and tracks annual operation and maintenance reports to monitor system performance and operational activities.

Water Quality Permits

Ecology will work to ensure that the nonpoint program is well-integrated with our regulation of point source pollution. Specifically, Ecology will focus on connections between the nonpoint and TMDL programs, and the regulation of stormwater and confined animal feeding operations.

State Initiatives

Several important initiatives are underway that our nonpoint program supports. Ecology can support these efforts through our TMDL and STI implementation efforts, grant and loan programs, technical expertise and research support, and by providing a regulatory backstop.

Governor's Results Washington

Governor Inslee believes we can do more to ensure a faster, smarter and more accountable state government — a government focused on key goals that will help strengthen our economy, improve our schools, and make Washington an ideal place to live and do business.

By setting clear goals and continually tracking results, the state will be better equipped to engage its employees, partners, and the public in building a healthier, better-educated and more prosperous Washington. Indeed, the Governor is delivering on his inaugural address promise that “We will provide efficiency, effectiveness and transparency.”

In 2014 the state launched Results Washington, a new system combining the best aspects of Government Management Accountability and Performance (GMAP) with a significantly expanded Lean initiative that involves all state agencies. Results Washington will use the latest technology to routinely gather, review, and display performance data which will make it easier for citizens to see for themselves how well state government and its many partners are delivering services and meeting key performance goals.

The Results Washington Measure that most clearly aligns with the objectives of the NPS plan is under the category of Healthy Fish and Wildlife. Under this category the state has committed to the following:

2.1 Increase improved shellfish classification acreage in Puget Sound from net increase of 3,038 acres from 2007-13 to net increase of 8,614 acres by 2016.

2.1.a. Increase percentage of inspections that are current for on-site sewage systems in marine recovery areas and other specially designated areas from 37% to 50% by 2016.

2.1.b. Increase the number of implemented agricultural BMPs to improve water quality in shellfish areas in Puget Sound, Grays Harbor, and Pacific counties from 345 in 2008 to 750 by 2016.

More information on Results Washington can be found at:

<http://www.results.wa.gov/>

Washington Shellfish Initiative

The Washington Shellfish Initiative is an agreement among federal and state governments, tribes, and the shellfish industry to restore and expand Washington's shellfish resources, to promote clean-water industries and create family-wage jobs.

To restore and expand shellfish resources, Washington must renew its protection, restoration and enhancement efforts. These efforts will pay off in increased recreation, additional clean water jobs, and a healthier Puget Sound and coastal marine waters. The Puget Sound Partnership has targeted a net increase from 2007 to 2020 of 10,800 harvestable shellfish acres, which includes 7,000 acres where harvest is currently prohibited in Puget Sound.

Shellfish Initiative:

1. Create a Public/Private Partnership for Shellfish Aquaculture
2. Promote Native Shellfish Restoration and Recreational Shellfish Harvest
3. Ensure Clean Water to Protect and Enhance Shellfish Beds

More information on the Washington Shellfish Initiative can be found at:

<http://www.psp.wa.gov/shellfish.php>

Puget Sound Action Agenda

The Puget Sound Action Agenda is a shared regional road-map for prioritizing Puget Sound recovery and protection actions to ensure resources are invested effectively and efficiently. The 2014/2015 Action Agenda⁷³ identifies key ongoing programs, local priorities for different areas of Puget Sound (which participate through Local Integrating Organizations [LIOs]) and 290 specific actions intended to be implemented over a two-year period. These actions advance the region's efforts towards shared recovery targets. Approximately half of these actions are regional in scope; the other half are locally developed and focused. Each of nine existing LIOs developed and contributed these actions, demonstrating significant local commitment to this recovery effort.

The 2014/15 Puget Sound Action Agenda addresses nonpoint source pollution at multiple levels in the document (strategies, sub-strategies, actions and targets) and by addressing a number of relevant topics such as stormwater runoff, on-site sewage system runoff, runoff from timber harvest, and agricultural runoff. There are targets ranging from reducing specific types of nonpoint pollution (e.g., from on-site sewage systems) to protecting natural resources and local economies by reducing resulting harms from nonpoint pollution. For more information about the targets (the "Vital Signs") see: <http://www.psp.wa.gov/vitalsigns/index.php>.

The current Action Agenda emphasizes three areas of priority, referred to as the Strategic Initiatives, as follows:

1. *Prevent pollution from urban stormwater runoff.* Polluted runoff from roads, roofs, parking lots, and other paved areas is the biggest threat to Puget Sound's water quality. Although many tools and technologies exist for reducing stormwater pollution, much broader use of them needs to be made for the scale of impact that is necessary for Puget Sound.
2. *Protect and restore habitat.* The rate of habitat destruction still outpaces recovery efforts, a fact that must be reversed. Restoring damaged shorelines and protecting salmon habitat along the many rivers and streams that flow into Puget Sound is necessary to save salmon (as a keystone species) and honor tribal treaty rights.

⁷³ http://www.psp.wa.gov/2014_action_agenda_download.php

3. *Restore and re-open shellfish beds.* Shellfish harvesting is a major Puget Sound industry, and a tribal treaty right. Both are threatened by pollution that has closed more than 7,000 acres of Puget Sound beaches. Shellfish health begins on land, through reduction of pollution from rural and agricultural lands and maintenance and repair of failing septic tanks.

State statute requires an update of the Action Agenda every two years. Accordingly, the Puget Sound Partnership will conduct an update in the course of this year, working closely with all partners, including state and federal agencies, the LIOs, and the tribes.

No Discharge Zone Designation-Puget Sound

A No Discharge Zone (NDZ) is a designated body of water where the discharge of sewage (blackwater/toilet waste) from boats, whether treated or not, is prohibited. There are currently 90 NDZs in 26 states. Washington State has no designated NDZs. Consistent with the plan to restore Puget Sound, Ecology is considering a NDZ for all or parts of Puget Sound.

A state can petition EPA for NDZ status under the Clean Water Act under three approaches: 1) the water body requires greater protection and has adequate pumpout facilities; 2) protection and enhancement of a water body requires establishment of a NDZ – do not have to show pumpout capacity; or 3) there is a drinking water intake. In order to assure feasibility of a NDZ, Ecology is verifying that adequate pumpout facilities exist.

Over the last three years Ecology has been conducting a detailed evaluation process which has included gathering data on Puget Sound vessels, pumpout facilities, the conditions of Puget Sound, marine sanitary device performance, boater surveys, research on other states with NDZs, an evaluation of implementation, and outreach to stakeholders. Ecology sent out a draft petition for public comment in 2014 and received more than 26,000 public comments, with the vast majority supporting the draft petition. Ecology provided a response to the comments.

In response to the comments, Ecology is:

- Continuing to meet with stakeholders on concerns.
- Working on adding additional pumpout facilities for certain commercial vessels.
- Conducting an analysis of water and pollution movement in areas of Puget Sound.
- Conducting an analysis of cost impacts to certain commercial vessels.

A potential final petition to EPA will be submitted, at the earliest, in the fall of 2015.

When Ecology submits a final petition to EPA, EPA reviews it and if it is accepted, it will be published in the Federal Register for formal comment prior to a final determination by EPA.

More information on this topic can be found at:

<http://www.ecy.wa.gov/programs/wq/nonpoint/CleanBoating/nodischargezone.html>

Ocean Acidification/Marine Resources Advisory Council

The 2013 Legislature enacted Engrossed Senate Bill 5603 Section 4 creating the Washington Marine Resources Advisory Council, within the Office of the Governor. The Marine Resources Advisory Council's membership includes legislative, executive, and elected officials,

nongovernmental organizations, and the private sector. The Governor invited representatives from academic institutions and federal agencies to participate.

The Marine Resources Advisory Council has the following powers and duties:

1. To maintain a sustainable coordinated focus on ocean acidification.
2. To advise and work with the Washington Ocean Acidification Center on the effects and sources of ocean acidification.
3. To deliver recommendations to the Governor and Legislature on ocean acidification.
4. To seek public and private funding resources to support the Advisory Council's recommendations.
5. To assist in conducting public education activities regarding ocean acidification.

The Marine Resources Advisory Council will be informed by the extensive work of the Washington Blue Ribbon Panel on Ocean Acidification. The Council has identified reducing local land-based contributions to ocean acidification as one of its key areas for early action. Specifically, their strategy looks to implement effective nutrient reduction programs in locations where these pollutants are causing or contributing to multiple water quality problems.

More information can be found at:

<http://www.ecy.wa.gov/water/marine/oceanacidification.html>

Salmon Recovery in Washington

To recover salmon, Washington is trying to protect the wild salmon that remain and help them increase their numbers by restoring where they live.

The network of individuals dedicated to restoring salmon starts with people in communities and includes watershed groups, regional organizations, state and federal agencies, city and county governments, tribes, conservation districts, nonprofit groups, as well as the legislature, Governor, and Congress.

Regional Organizations - To coordinate the work of recovery planning and implementation, seven regional organizations formed, and recovery plans in each of those regions have been accepted by the federal government and are being implemented.

Lead Entities - Lead entities are watershed-based organizations authorized by the Legislature in 1998 (Revised Code of Washington 77.85.050 - 77.85.070) to develop habitat restoration and protection strategies, and look for projects to meet those strategies.

Project Applicants - Project applicants develop habitat restoration and protection projects based on regional recovery plans or strategies developed by lead entities. Project applicants typically are regional fisheries enhancement groups, local governments, tribes, state agencies, community groups, land trusts, and others. They apply for grants from the Salmon Recovery Funding Board and others to pay for projects to protect or restore salmon and bull trout habitat.

More information on Salmon Recovery in Washington can be found at:

http://www.rco.wa.gov/salmon_recovery/index.shtml

and <http://www.stateofsalmon.wa.gov/>

Chemical Action Plan (CAP) Development

Toxic chemicals pollute stormwater, streams and lakes in Washington. Exposure to these chemicals affects people's health and the health of the environment. Ecology will continue to use our TMDL and STI approaches to address impairments caused by toxics. In addition, Ecology will look for additional tools outside the Clean Water Act to address toxics. For example, we will continue to support the development of chemical action plans (CAP).

A CAP is a comprehensive plan to identify, characterize and evaluate all uses and releases of a specific persistent, bioaccumulative toxic (PBT), a group of PBTs or metals of concern. A CAP is a plan, not legislation or a rule. It recommends actions to protect human health and the environment. Some of the recommendations may lead to new legislation or rules. These would go through the normal legislative or rulemaking process.

The CAPs can serve as a list of BMPs for our TMDLs in identifying actions to get particular toxic out of the water.

The PBT Initiative focuses on one toxic substance at a time. Ecology develops each CAP in collaboration with other agencies and experts representing various business, agricultural and advocacy sectors.

More information can be found at:

<http://www.ecy.wa.gov/programs/swfa/pbt/caps.html>

The Voluntary Stewardship Program (VSP)

The VSP is a relatively new program implemented by the Washington State Conservation Commission. The VSP was passed in 2011 as an amendment to the Growth Management Act (GMA). Its goals are to protect and enhance critical areas, maintain and improve the long-term viability of agriculture, and reduce the conversion of farmland to other uses. To accomplish these goals, the VSP relies primarily on incentives and voluntary stewardship practices. Counties that opt into the VSP are responsible for designating a local watershed group to develop a watershed plan that describes how critical areas on agricultural lands will be protected and enhanced.

Counties opting into this program are eligible for funding for the development of watershed work plans to set goals and benchmarks for protection and enhancement of wetlands and other critical areas on agricultural lands. At this time, only two counties (Thurston and Chelan) have received funding to develop watershed work plans. If additional funding is not received, counties that have opted into the program and not received funding will need to develop regulations addressing agriculture and critical areas.

Improved compliance with state and federal clean water law was a critical part of the Ruckelshaus agreement that led to the creation of the VSP. While this "regulatory backstop"—which was to take the form of better enforcement of clean water law *separate* from the VSP—was not included in the VSP statutory language, it was seen as a critical element by those involved with the Ruckelshaus

process. The expectation that state and federal clean water laws will serve as a regulatory backstop is documented in correspondence to legislative leadership, the implementation budget for the law, and other sources.

Finally, even though they have different purposes and standards, both clean water laws and the VSP should provide protection to the riparian corridor. This provides an opportunity for the two programs to take advantage of each other to achieve shared goals and intended outcomes. An effective VSP program could complement the protection and pollution reduction goals of federal and state clean water laws by helping to implement the best management practices needed to meet the water quality standards and clean water laws.

More information can be found at:

<http://scc.wa.gov/voluntary-stewardship/>

More information on the relationship between VSP and clean water laws can be found in Appendix E”

Chapter 4: Water Quality Partnerships

Working with Local, State, Tribal, and Federal Agencies

It is important that Ecology's NPS Program take a lead role in coordinating interagency efforts related to the NPS Plan. It is the responsibility of the NPS Program to reach out to its partner organizations, support them in their efforts related to NPS pollution, and coordinate with them to ensure that mutual goals are met.

Developing and strengthening partnerships is a continuous process. Efforts to address nonpoint source pollution are most effective when local partners engage in getting implementation on the ground. Further, the scope of the nonpoint source pollution issue and the effect it has on NPDES permittees in the state necessitates multiple agencies and entities working to address pollution problems.

Ecology works collaboratively with key local and state entities to coordinate the implementation of NPS control measures in high priority watersheds. While recognizing the importance of statewide coordination, Ecology also emphasizes the need to coordinate with partners at the local level. Regional offices lead local coordination efforts through multiple avenues.

Statewide Coordination

State Advisory groups that Ecology uses to coordinate with stakeholders:

- Agriculture and Water Quality Advisory Committee.
- Water Quality Partnership.
- Water Quality Financial Assistance Council.

Agriculture and Water Quality Advisory Committee

In 2014, Ecology Director Maia Bellon created the Agriculture and Water Quality Advisory Committee. The committee includes a broad array of agricultural interests. The goal of the committee is to improve working relationships, and ensure both water quality protection and a healthy agricultural industry.

The committee discusses issues and provides advice and guidance associated with the work Ecology does to prevent agricultural pollution, including issues related to the implementation of our nonpoint program. The purpose is to provide an open forum for producers and stakeholders to meet our staff, learn about our work, and provide guidance as we tackle the challenge of ensuring water quality protection and a healthy agricultural community.

The Committee meets quarterly, and alternates meeting locations between the west and east sides of the state. The public can attend the meetings. More information on the committee, previous meetings, and future meetings can be found at:

<http://www.ecy.wa.gov/programs/wq/nonpoint/Agriculture/AgWQACmtg.html>

Representation-Invitations were sent to the following organizations:

Producers

- Cattle Producers of Washington
- Hop Growers of Washington
- Pacific Coast Shellfish Growers Association
- Pacific NW Direct Seed Association
- Poultry Growers Association
- Washington Association of Conservation Districts
- Washington Association of Wine Grape Growers
- Washington Cattleman's Association
- Washington Cattle Feeders Association
- Washington Hay Growers Association
- Washington State Dairy Federation
- Washington State Farm Bureau
- Washington State Water Resources Association
- Washington Horticulture Association
- Washington Tilth Producers
- Washington Potato Commission and
- Washington Wheat Growers

Environmental Organizations

- Center for Environmental Law & Policy
- Puget Sound Waterkeepers
- The Nature Conservancy and
- Washington Environmental Council

Tribal

- Columbia River Inter-Tribal Fish Commission
- Northwest Indian Fisheries Commission

Water Quality Partnership

The Water Quality Partnership is the standing stakeholder group for the Ecology's Water Quality Program. The goal of the Water Quality Partnership is to:

- Help the Water Quality Program maintain a dialogue with key interests about our work.
- Give key interests regular access to decision makers in the Water Quality Program.

The Water Quality Partnership meets quarterly at the Ecology headquarters building. Stakeholders that attend the Water Quality Partnership meetings include representatives from agricultural producer groups, tribes, environmental groups, state and federal agencies, businesses, and local government.

Financial Assistance Council

The Water Quality Financial Assistance Council (Council) provides Ecology with advice and guidance for the effective and efficient administration of its state and federal grant and loan programs. The Council is not mandated in state law, but was formed by Ecology to help ensure that the process of administering state and federal grants and loans is transparent and is supported by Ecology's clients and stakeholders. The Council is comprised of representatives from cities, counties, tribes, conservation districts, special purpose districts, environmental groups, and state and federal agencies.

Landowners, Businesses, and Agricultural Producers

Private landowners in both urban and rural areas, business owners, and agricultural producers are the most important partners in protecting water quality. Ultimately, they are the ones responsible for implementing BMPs that address nonpoint sources of pollution. Garnering their support and participation provides one of the best ways to make direct changes to protect water quality in the watersheds where they live.

In many areas of the state, Ecology staff have created strong and productive relationships with landowners. This is usually through a person to person approach, in which the Ecology staff works directly with a landowner to offer technical assistance to solve a nonpoint pollution problem. When there is a conservation district willing to work with Ecology, the landowner contact is often made by Ecology and the conservation district together. This approach has resulted in the implementation of BMPs in several watersheds in the east side of the state and grant projects on the ground.

In addition to this landowner by landowner approach, the Agriculture and Water Quality Committee proposed that Ecology do more outreach to inform citizens and producer groups in the area about what is needed to address water quality problems before it starts work in a watershed. Ecology has begun to implement this recommendation. Ecology will continue to look for ways to better communicate and partner directly with landowners, businesses and producers.

Agricultural Producer Groups

Based on feedback from the Agriculture and Water Quality Advisory Committee, Ecology is committed to better utilizing and engaging producer groups as partners in conducting education and outreach in watersheds where we are working to address nonpoint pollution problems. Producer groups can help provide a more direct line to producers, and their forums (conventions, newsletters, and meetings) to communicate our nonpoint goals and strategies.

Grant Recipients

One of our primary strategies to implement the NPS program is our grant program. Our grant recipients are the on-the-ground organizations that implement BMPs, provide technical

assistance, and work with landowners and producers to address pollution problems. One of Washington's strengths is the wide range of recipients that have received grants. Past recipients have included conservation districts, salmon enhancement groups, tribes, cities, counties, health districts, environmental groups, land conservancies, reclamation districts, universities, and groups supporting specific watersheds.

Ecology's funding guidelines allow funds to be used only for a limited number of BMPs that Ecology determined will achieve compliance with state water quality law. The BMPs must be implemented as suites of BMPs, for instance, we will not provide funds for off-stream watering or for a winter feeding area unless cattle exclusion from a stream is also installed. The wide range of grant recipients who have used funds for these BMPs now understand what Ecology has determined is required to achieve compliance with the water quality standards.

Local Governments

The three basic forms of local government in Washington are:

- Counties
- Cities
- Special purpose districts

The 39 counties of Washington were established by acts of the legislature, and are considered subdivisions of state government. Basically, the county was designed to serve as an administrative unit of the state in rural areas. The same holds true for cities and special purpose districts. As subdivisions of state government, all three are called upon to implement state legislative mandates.

Prior to 1960, several types of districts were formed to deal with an array of issues, which sometimes include environmental protection:

- Conservation districts
- Health districts
- Water districts
- Sewer districts
- Public utility districts
- Weed control districts

Since 1960, many new types of special purpose districts have been authorized by the legislature, especially with regard to environmental protection. These environmentally-oriented districts include:

- Groundwater protection districts
- Lake protection districts
- Shellfish protection districts
- Solid waste management districts
- Stormwater utility districts

Many state laws are implemented by local governments, with state agencies in an oversight and/or support role. With regard to the environment, local governments and special districts have primary authority or major implementation efforts in:

- Solid waste management.
- Growth management and land use.
- Stream restoration and rehabilitation.
- Sewage systems, both on- and off-site.
- Road construction and maintenance.
- Shorelands management.
- Stormwater management.
- Drinking water protection.
- Used oil and household toxics.
- Irrigation water and return flows.

Local governments and special purpose districts are the on-the-ground implementers of many nonpoint pollution control activities. Ecology relies heavily on the continued commitment of energy and resources by these entities. Additionally, local governments can often play an important role in monitoring and correcting nonpoint source pollution. Ecology is committed to assisting local governments with monitoring and enforcement.

State agencies can also assist with financial assistance to local governments through the various funding programs they administer. Ecology supports the goals of the nonpoint program by funding local projects and programs designed to achieve the WQ Standards and support the implementation of watershed based plans.

Conservation Districts and State Conservation Commission

Conservation districts are county-based, non-regulatory governmental entities that assist in meeting local resource needs with technical assistance and financial resources. These districts report to the Washington State Conservation Commission (WSCC) and help landowners with on-the-ground conservation projects that enable them to be good stewards of their property. Each conservation district is directed by a board of supervisors: three elected locally, two of which must be landowners or operators of a farm. This ensures a local perspective on projects to protect both working lands and ecological functions.

WSCC is the coordinating state agency for all 45 conservation districts in Washington State. WSCC was established in 1939 as a nonregulatory state agency providing assistance to conservation districts across the state. WSCC has no regulatory function, but works primarily through education and through facilitating dialogue between land owners, land managers, local stakeholders, and state and federal agencies on critical natural resource conservation issues.

Incentive-based programs at the WSCC provide funding and technical assistance for the protection of water quality and other important resources. Programs implemented by the WSCC include the Conservation Reserve Enhancement Program, which provides rental payment to landowners to lease riparian habitat for protection from agricultural activities. The WSCC also administers a Water Quality grant program.

The Voluntary Stewardship Program is a relatively new program implemented by the WSCC. It's an alternative planning process that uses incentives instead of regulations to promote the protection of critical areas on agricultural lands. Counties opting in to this program are eligible for funding for the development of watershed work plans to set goals and benchmarks for protection and enhancement of wetlands and other critical areas on agricultural lands. At this time, only two counties (Thurston and Chelan) have received funding to develop watershed work plans. If additional funding is not received, counties that have opted into the program and not received funding will need to develop regulations addressing agriculture and critical areas.

Districts offer a range of voluntary services including assistance with erosion control, habitat restoration, manure management, wildfire prevention/mitigation, stormwater management, forest plans, irrigation efficiency, noxious weed control, fish barrier removals, livestock stream crossings, and more.⁷⁴

Beyond grant programs, districts are a key partner in the delivery of technical and financial assistance to private landowners and producers. Further, districts play a critical role in landowner and producer outreach and engagement, and help create support for water quality goals in their communities.

Many districts are active participants in the development and implementation of TMDLs. Districts represent one of the major recipients of federal 319 grant funds, and many conduct monitoring projects to determine effectiveness of completed projects.

Although not all districts work with Ecology, those that accept Ecology grants to implement BMPs follow our funding guideline that allow the use of only a few specific suites of BMPs that Ecology determined will achieve compliance with state water quality law.

Through grants and other opportunities, Ecology partners with districts working on soil erosion, stream protection and restoration, and livestock projects. In addition, Ecology supports districts working on direct-seed projects and the Farmed Smart certification program, along with other efforts that support the implementation of the goals of the NPS plan. Some districts have also expanded their services to include implementing stormwater BMPs and Ecology sees this as an emerging opportunity. Ecology will continue to look for the right opportunities to partner on stormwater projects, low impact development, and green infrastructure strategies/initiatives.

Districts are a key partner in our watershed evaluation process. Districts have helped with education and outreach efforts, partnered on site visits, and have been a primary resource for technical and financial assistance. Ecology will continue to partner with districts during watershed evaluations, and look to tailor how we work with individual districts to meet their local needs. Across all districts we will work on increasing communication around what we are seeing and about the best fixes to assist districts in being able to better serve landowners.

Finally, Ecology will work to respond to feedback from districts that highlighted the need for Ecology to be clear about the BMPs needed to protect water quality. With that guidance they

⁷⁴ For more information on the services provided by conservation districts as well as the financial and technical assistance programs they administer please see: <http://scc.wa.gov/about-the-districts/>.

can reduce risk for the landowners they work with. Additionally, they expressed their desire to provide flexibility, and recognize that there can be multiple ways of achieving equivalent water quality results. We will also work to respond to feedback that our strategies and programs need to be cost effective and balance environmental goals, available funding, cost benefits, return on investment, and landowner participation.

Local Health Departments and Districts

Washington has 31 county health departments, three multi-county health districts, and two city-county health departments. We refer to them as local health jurisdictions. They are local government agencies that carry out a wide variety of programs to promote health, help prevent disease, and build healthy communities. Related to nonpoint source pollution, they regulate on-site sewage systems (see Chapter 3), and can fill key roles in PIC programs.

Interagency Project Team

The Interagency Project Team (Team) consists of staff from the surface water departments of Clark, King, Kitsap, Pierce, Snohomish and Thurston counties and staff from the Washington State Department of Transportation (WSDOT). The Team formed to improve implementation of the Clean Water Act (CWA) Section 303(d) and total maximum daily load (TMDL) programs in Washington State. They developed a report and set of recommendations which they sent to Ecology in 2014. The recommendations focused on improving the Water Quality Assessment and Total Maximum Daily Load Programs in Washington State, inclusive of the nonpoint program. Their recommendations related to nonpoint pollution included:

- Recommendation 2: Implement existing regulatory authority related to unpermitted and nonpoint sources— Utilize existing legal authority (WAC 173-201-510 and RCW 90.48.080) to control unpermitted and nonpoint sources and ensure that LAs and WLAs are equitable.
- Recommendation 9: Develop consistent TMDL implementation expectations.

Both of these recommendations are consistent with actions Ecology believes are necessary if we are to address nonpoint pollution in Washington.

Washington Tribes

Washington is home to 29 federally recognized and seven non-federally recognized Native American tribes.⁷⁵ Traditional fishing areas for tribes encompass essentially all of Washington.

Tribal representatives participate in the development and implementation of TMDLs, and are also recipients of federal 319 grant funds. They provide technical expertise on natural resource issues and are an important partner in implementing the state's nonpoint program.

Tribal resources, including shellfish and salmonids, continue to be negatively impacted by nonpoint source pollution. Many rivers and streams in the state exceed temperature standards.

⁷⁵ Governor's Office of Indian Affairs, 2015. March 2015 access to web link: Tribal Map at the following link: http://www.goia.wa.gov/tribal_gov/documents/WAStateTribalMap.pdf and Governors Office of Indian Affairs at: <http://www.goia.wa.gov/>. Governor's Salmon Recovery Office. 1999. Summary Statewide Strategy to Recovery

High water temperatures threaten the health and survival of salmon. Likewise, nonpoint source pollution in the form of sediment and nutrient inputs threaten the health and survival of salmon. Pathogen pollution from a variety of nonpoint sources, including on-site sewage systems, farm animals, pets, sewage from boats, and stormwater runoff can cause shellfish bed closures.

Ecology recognizes the importance of salmon and shellfish resources to the tribes and will utilize the following regulations, policies and guidance to implement the NPS plan:

- Clear guidance related to BMPs necessary for all nonpoint sources to achieve compliance with all WQ Standards.
- Enforceable mechanisms in place to ensure compliance with the WQ Standards.
- Transparency and accountability for collecting sufficient implementation data to determine whether programs are achieving compliance with WQ Standards.
- Ecology will work collaboratively to address improper manure management and application that affect tribal fishing areas and shellfish beds. At a minimum we will look to work on the following issues:
 - Need for manure sources to be analyzed for nutrient content prior to application, and include an accurate accounting of N-P-K rates.
 - Manure application timing that optimizes nutrient uptake by plants and eliminates runoff or leaching.
 - Manure application occurring in the right location, including adequate setbacks from surface waters, drainage, and other locations that are likely to result in transport away from the root zone.
 - Manure being applied in correct amounts, i.e., agronomic rates, such that the nutrients applied will be utilized by target crops, and excess nutrients will not accumulate in or on soils and be subject to runoff or leaching.
 - Manure storage and location and the potential for leaching to groundwater via unlined lagoons, overtopping due to insufficient storage capacity, or subject to breaches and leaks.
- Implementation of temperature standards and addressing thermal loading.
- Address hydromodification issues including the following sources: agricultural ditching, dredging and maintenance of degraded streamside and instream conditions; transportation projects, stream crossings, and culverts; flood control projects; and land development.
- Sediment loading issues.
- Water quality and water withdrawal issues and their nexus with water quality.
- The need for a consistent outreach program that can uniformly convey to the public the practices needed to achieve compliance with the WQ Standards.

Additionally, Ecology will work to gain approval for the state's CZARA program.

State Agencies

State agencies play a key role in implementing authorities that can help in preventing and controlling NPS pollution. No single state agency has all the tools to solve nonpoint source pollution problems. The state natural resource agencies in the following outline have some type of program or resources that can support the implementation of the NPS plan. The primary authorities of state agencies are outlined in Chapter 2. Ecology recognizes the need to share

resources, coordinate efforts and programs, and send consistent messages on what is needed to meet WQ Standards and the goals of the NPS plan.

State agencies include:

- Washington State Department of Health (DOH) – The mission of the DOH is to protect and improve the health of people in Washington State. Its programs and services help prevent illness and injury, promote healthy places to live and work, provide education to help people make good health decisions and ensure the state is prepared for emergencies. DOH and local health districts regulate on-site sewage systems.
- Puget Sound Partnership (PSP) - PSP serves as the backbone agency for Puget Sound recovery. The PSP coordinates the efforts of tribes, scientists, businesses, and non-profit groups to set priorities, implement a regional recovery plan, and ensure accountability for results.
- Washington State Recreation and Conservation Office (RCO) - RCO is a state agency that manages grant programs to create outdoor recreation opportunities, protect the best of the state's wildlife habitat and farmland, and help return salmon from near extinction. The Salmon Recovery Fund managed by RCO provides financial assistance to a wide variety of projects that address nonpoint sources of pollution.
- Washington State Conservation Commission (WSCC) - The WSCC is the coordinating state agency for all 45 [conservation districts](#) in Washington State. Together, the WSCC and conservation districts provide incentive-based programs that make it easier and more affordable for private landowners to implement conservation on their property (see previous section on Conservation Districts and State Conservation Commission for more information on these entities).
- Washington State Department of Agriculture (WSDA) - is headquartered in Olympia, with employees in every county in the state. Their staff carries out a broad spectrum of activities that support the producers, distributors, and consumers of Washington's food and agricultural products. WSDA manages the Dairy Nutrient Management program.
- Washington State Department of Natural Resources (DNR) - In partnership with citizens and governments, the Washington State DNR provides innovative leadership and expertise to ensure environmental protection, public safety, perpetual funding for schools and communities, and a rich quality of life. DNR is the primary implementer of the state Forest Practices Rules.
- Washington State Department of Fish and Wildlife (WDFW) - The mission of WDFW is to preserve, protect and perpetuate fish, wildlife and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities.
- Washington State Department of Commerce (Commerce) - Grow and improve jobs in Washington State by championing thriving communities, a prosperous economy, and sustainable infrastructure. Commerce oversees the state Growth Management Act.
- Washington State University (WSU) - WSU Extension is the front door to the University. Extension builds the capacity of individual, organization, businesses and communities, empowering them to find solutions for local issues and to improve their quality of life. The WSU Puyallup Research and Extension Center is the home of the Stormwater Center, which serves as a clearinghouse for stormwater technology, information, and permittee assistance.

- Washington State Department of Transportation (DOT)--The Washington State Department of Transportation is the steward of a multimodal transportation system and responsible for ensuring that people and goods move safely and efficiently. Many of the roads, highways and bridges managed by DOT are covered by stormwater permits.
- Washington State Parks and Recreation Commission - The Washington State Parks and Recreation Commission cares for Washington's most treasured lands, waters, and historic places. State parks connect all Washingtonians to their diverse natural and cultural heritage and provide memorable recreational and educational experiences that enhance their lives.
- University of Washington SeaGrant (WSG) - Washington Sea Grant (WSG) identifies, addresses, and funds important marine issues, shares its expertise with coastal businesses and communities, provides tools for the management of ocean and coastal resources, and engages the public in protecting and sustainably using those resources.

Federal Agencies

There are many federal agencies in Washington that operate with different mandates and responsibilities. This is, in large part, due to the diversity and complexity of Washington's natural environment.

For example, the strategic location of the Puget Sound region makes it an ideal home for several military installations such as Joint Base Lewis-McChord, Puget Sound Naval Shipyard, Bangor submarine base, and Whidbey Island Naval Air Station. The Puget Sound region is surrounded by U.S. Forest Service (USFS) lands and the Olympic National Park.

The Palouse region of eastern Washington is the home of some of the most productive nonirrigated agricultural lands found anywhere in the United States. These lands are in close proximity to the Snake River and Columbia River. Interested federal agencies are the Natural Resource Conservation Service (NRCS), Farm Service Agency (FSA), The Bureau of Reclamation (BOR), Bonneville Power Administration (BPA), and the Army Corps of Engineers (COE).

The Yakima Valley is another good example of federal agency presence. Not only are NRCS and FSA actively engaged with agricultural activities, the BOR, the COE, and the BPA all have responsible roles and mandates. In addition, the US Army's Yakima Firing Range is one of the largest military bases in the United States.

These are a few examples of the roles federal agencies play in using and managing land in the state. Federal agencies are the second largest group of landowners in the state (next to private individuals), and a major source of funding for cost share and restoration efforts.

If Ecology identifies federal lands and activities that are not managed consistently with state nonpoint program objectives, we will work with EPA and those federal agencies to resolve issues at the federal agency level.

List of Federal Agencies and Responsibilities

Many federal agencies in Washington either contribute to nonpoint source pollution, or help control nonpoint source pollution through their water quality programs – or both.

- Army Corps of Engineers (COE) - is responsible for maintenance of harbors and navigable waterways and wetlands management. COE operates and maintains many large dams along the Columbia and Snake Rivers.
- Bonneville Power Administration (BPA)-controls numerous dams along the Columbia and Snake Rivers.
- Bureau of Land Management (BLM) - has relatively small holdings within the state on which grazing activities occur.
- Bureau of Reclamation (BOR) - owns and manages hundreds of miles of irrigation canals in eastern Washington, and some hydroelectric dams.
- Department of Energy (DOE) - manages the Hanford Reservation.
- Department of Defense (DOD) - has several bases in Washington, due to the strategic location of the state and its access to the Pacific Rim.
- Environmental Protection Agency (EPA) administers the Clean Water Act. It also partners with NOAA's National Ocean Service to administer the Coastal Nonpoint Program under CZARA.
- Federal Highway Administration (FHA) - has hundreds of miles of highways in Washington.
- Fish and Wildlife Service (FWS) - is responsible for habitat conditions related to the health and well-being of fish and wildlife. FWS works to protect ESA-listed resident fish such as bull trout and cutthroat trout.
- U. S. Geological Survey (USGS) - routinely monitors both surface and ground water through its National Water Quality Assessment Program.
- Natural Resource Conservation Service (NRCS) - develops conservation practices for its *Field Office Technical Guides*, and provides financial and technical assistance to landowners to implement the practices that a landowner chooses.
- National Park Service (NPS) - owns thousands of acres of parkland, including Mount Rainier National Park, Olympic National Park, and North Cascades National Park.
- National Oceanic and Atmospheric Administration (NOAA) - The National Marine Fisheries Service oversees the status of endangered species and the National Ocean Service partners with EPA to administer the Coastal Nonpoint Program under CZARA.
- US Forest Service (USFS) - manages about 20% of the land area in the state.

Federal Lands - Forestry

Federal agencies are required to conduct their activities so as to be at least as protective as the complementary state programs. Thus in Washington, federal agencies must design their programs in a manner that will comply with the state WQ Standards. They need not use the same forestry prescriptions as those required by the state Forest Practices Rules, but the results

need to achieve the same regulatory objective of meeting the state WQ Standards. Ecology will continue to work with federal agencies to ensure their actions are designed to be as protective as what is required by state rules, and that they comply with the WQ Standards.

Although there are numerous federal agencies that affect forest management in Washington, it is primarily the USDA Forest Service that affects water quality attainment through forest management activities.

United States Department of Agriculture-Forest Service

The US Department of Agriculture (USDA) - Forest Service manages its lands under federal land and resource conservation plans and strategies such as those established under the Northwest Forest Plan. Ecology entered into a Memorandum of Agreement (MOA) with the USDA Forest Service, Region 6 in 2000. The purpose of the MOA is to clarify roles and Ecology's expectations so that the Forest Service would achieve compliance with state WQ Standards. Ecology hopes to continue to strengthen its formal working relationship with the US Forest Service to ensure the WQ Standards are met on these key federal lands.

The MOA contains a specific requirement that roads on Forest Service lands would be brought up to current state standards by 2015. Approximately five years into the MOA, however, the Forest Service recognized it would not be able to comply with the road requirements at current funding levels.

There are 22,000 miles of USDA Forest Service roads in Washington. Deteriorating, unmaintained, and poorly located forest roads add sediment-laden runoff into streams, changing stream flow dynamics and harming dwindling runs of threatened and endangered salmon that need cold, clear water to thrive and reproduce. Sediment decreases drinking water quality and increases the need for expensive community water filtration systems. Two-thirds of the runoff from problem roads drains into an already ailing Puget Sound. Unlike private and state forests, there has been no program designed to aggressively identify and correct road problems on federal forest lands. Ecology working in partnership with other key stakeholders in Washington has helped the Forest Service receive congressional funding to help address its growing backlog of road projects as part of the Legacy Roads and Trails program. This funding, while helpful, has not kept pace with the growing backlog of needed road repairs. While addressing road problems is being done only as the limited appropriation funds permit, all National Forests are now working to have updated road analysis plans in place by October 2015.

Other Federal Landowners

Bonneville Power Administration (BPA) and Bureau of Land Management (BLM) (only about 10,000 acres) are the two federal agencies besides the USDA Forest Service with noteworthy presence in Washington's forested watersheds. Similar to the USDA Forest Service, the BLM may establish roads and harvest timber so long as the prescriptions applied result in compliance with the state WQ Standards.

The BPA primarily harvests timber within and adjacent to power transmission line rights of way. BPA rights of way situated adjacent to streams are often targeted for heavy use by recreational off-road vehicle users. This can result in significant localized damage to stream beds and excessive sedimentation. The responsibility of federal agencies to manage their lands in compliance with state regulations is unfortunately not always matched with the necessary

commitment of resources to accomplish that objective. Ecology currently has no written agreement with either of these agencies on managing their lands for water quality.

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Chapter 5: Financial Incentive Programs

Both state and federal funding programs are available to landowners, businesses, and agricultural producers which can support the goals of the nonpoint program. Ecology will work with partners to coordinate funding and promote consistency with the goals of the state NPS plan. Additionally, Ecology will work to coordinate the collection of consistent and detailed implementation data to better understand the effectiveness of financial incentive programs.

Coordinated Investment

Ecology will look to support coordinated investment strategies that help meet the goals of the NPS plan. Specifically, Ecology will look to support coordinated investments that target projects that implement TDMLs and STIs, while also solving multiple environmental problems in a more efficient way. Where possible we will work to leverage multiple sources of funding and fund projects that meet water quality, salmon and shellfish goals. Further, we will look to support efforts that include multiple parcels in a watershed and maximize opportunities to secure continuous BMP implementation over longer stretches of streams and rivers.

Key coordinated investment principles include:

- Focusing on the implementation of BMPs and projects that ensure compliance with state WQ Standards at the parcel level.
- Supporting projects communicating clear standards and compliance expectations.
- Supporting the implementation of TMDLs and STIs.
- Supporting projects that provide multiple environmental benefits—water quality, salmon and shellfish goals.
- Focusing on outcomes and accountability through collecting specific BMP implementation data.
- Maximizing opportunities to secure continuous BMP implementation over longer stretches of streams and rivers.

In March 2015, Ecology formalized creation of a Coordinated Strategic Investment Group made up of Ecology managers. The purpose of the group is to coordinate agency investments that support salmon recovery, habitat restoration, and toxics cleanup. The idea is that the agency can use funds from different sources to create integrated investment packages that will advance watershed-based ecosystem improvement and recovery.

Financial Assistance Sources

Here is a summary of key sources of financial assistance available in Washington State:

Ecology Water Quality Combined Financial Assistance Program

Department of Ecology runs an annual competitive water quality funding cycle program that includes funding from the state Centennial Clean Water program, federal Section 319 nonpoint grant program, State Revolving Fund loan program, and the state Stormwater Financial Assistance grant program. Centennial Grants are state funds that provide grants for water quality infrastructure and nonpoint source pollution projects. Eligible nonpoint projects include:

livestock fencing, off-stream water development, stream crossings, riparian plantings, and subsidization of on-site sewage repair and replacement local loan programs. There is also limited funding available for education and outreach.

In addition, the federal EPA provides Section 319 grant funds to Washington State. The Section 319 program offers funds for nonpoint source pollution control projects similar to the state Centennial program. These two funding sources are combined with the Clean Water State Revolving Fund loan program and stormwater grant program into a single combined financial assistance funding cycle. The Revolving Fund loan program can also fund nonpoint source projects. The Stormwater Financial Assistance Program provides funds to reduce impacts of non-point source stormwater runoff from existing development. Projects may integrate green infrastructure solutions.

Conservation Reserve Enhancement Program (CREP)

CREP provides funding to farmers and ranchers to help protect stream corridors and conserve priority salmon stocks. Landowners enroll land located along water bodies to create buffer zones. These buffers are planted with native trees and shrubs to cool stream temperatures and filter polluted run-off. Participants are reimbursed for 100% of the costs to establish the buffer. They also receive an annual rental payment per acre enrolled based on NRCS soil rental rates. CREP is funded by the USDA Farm Service Agency and the state of Washington. The state portion is managed by the Conservation Commission.

Continuous Conservation Reserve Program (Continuous CRP)

The Continuous CRP program is similar to CREP. It provides cost-share to producers to implement riparian buffers on agricultural land. Continuous CRP program pays 90% cost-share for fencing, livestock water, and tree planting, and has a rental payment per acre over the 10-15 year contract. The main difference between CREP and Continuous CRP is that CREP is primarily available on streams where threatened runs of salmon or steelhead are currently present or part of their historic range.

Bonneville Power Administration (BPA)

BPA funds salmon recovery projects. The funding is appropriated through a process developed by the Northwest Power and Conservation Council (NWCC). Over 60 subbasins exist within the Columbia basin and each has developed a subbasin plan to help guide salmon recovery and wildlife habitat protection. Millions of dollars are made available every year to address priority projects throughout the Columbia Basin.

Environmental Quality Incentive Program (EQIP)

The Environmental Quality Incentives Program (EQIP) is designed to promote agricultural production, forest management, and environmental quality. Through EQIP, NRCS provides financial assistance to eligible farmers and ranchers to address soil, water, and air quality, wildlife habitat, surface and groundwater conservation, energy conservation, and related natural resource concerns. The program requires the development of lists showing practices eligible for payment, allowed payment rates, criteria used to rank applications, and a description of the program and the application process. This is a locally driven process where “local work groups” made up of local governments, agencies, and agricultural producers identify specific annual priorities for funding.

Salmon Recovery Funds

In 1999, the Washington State Legislature created the Salmon Recovery Funding Board. The board provides grants to protect or restore salmon habitat and assist related activities. Since 1999, the board has awarded more than \$477 million in grants to more than 1,700 projects in 31 of the state's 39 counties. The Salmon Recovery funds are offered through an annual competitive process. The funds can be utilized for many types of fish passage and habitat improvements including projects that can help to protect water quality.

Ecology Direct Implementation Funds (DIF)

The Department of Ecology may identify a small amount of the federal Section 319 funds it receives to implement a TMDL or install nonpoint pollution control BMPs in support of an STI project. These are small grants that focus on specific implementation actions. The projects are sponsored by Ecology staff to achieve a specific water quality objective. Often, these projects involve funding riparian protection and planting.

Ecology Coastal Protection (Terry Husseman) grants

The Coastal Protection (Terry Husseman) grants are small grants (less than \$50,000) available for specific on-the-ground actions. The coastal protection account was created to utilize money collected via water quality penalties for water quality protection. Availability of funds varies.

Floodplains by Design

The Department of Ecology's Floodplains by Design program is intended to reduce flood risk to communities while also improving natural ecosystem functions and improving habitat. The program seeks to combine efforts for flood reduction and salmon and habitat recovery, while also protecting working lands like agriculture, forestry, and shellfish production. It relies on broad stakeholder support to promote approaches that are beneficial to all involved parties.

State Conservation Commission grants

The WSCC has historically made funds available for projects proposed by conservation districts. Additionally, the WSCC has provided salmon and shellfish grants for projects proposed by conservation districts.

Regional Conservation Partnership Program

The Regional Conservation Partnership Program (RCPP) fund is part of the 2014 Farm Bill. It promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. The Columbia River Basin is one of eight priority watersheds that will receive 35% of the annual funding available through the program. Projects that address multi-state issues are also prioritized. The fund is competitive and uses the rules of existing NRCS programs (EQIP, CSP, ACEP and HFRP).

National Estuary Program Funds

The EPA provides federal funding to support efforts to protect and restore Puget Sound. Most of the funds are used for financial assistance to state, local and Tribal governments for their efforts to implement the [Puget Sound Action Agenda](#). EPA passes these grants through state agencies.

Family Forest Fish Passage Program

The Family Forest Fish Passage Program (FFFPP) provides state cost share money to private forestland owners for replacing culverts and other stream crossing structures that keep trout, salmon, and other fish from reaching upstream habitat. Road culverts and other structures that are aging, too small, or improperly installed can block fish from reaching their spawning grounds. The same barriers then impede the movement of young rearing salmon to the ocean. FFFPP funds the replacement of eligible barriers with new structures. Since 2003, nearly 200 landowners have taken advantage of the program that has replaced 244 barriers and opened more than 524 miles of stream habitat. Fish passage barrier replacement also provide for the effective movement of woody debris downstream where it contributes to the physical and chemical integrity of the stream to the benefit of water quality.

Forestry Riparian Easement Program

The Forestry Riparian Easement Program compensates eligible small forest landowners in exchange for a 50-year easement on “qualifying timber.” This is the timber the landowner is required to leave unharvested as a result of forest practices rules protecting Washington’s forests and fish. Landowners cannot cut or remove the qualifying timber during the easement period. The landowner still owns the property and retains full access, but has “leased” the trees and their associated riparian function to the state. The intent of this program is to reduce the economic incentive to take land out of forestry in recognition that well-managed forest lands provide significant benefits to water quality and the fish and wildlife that depends on healthy streams.

Chapter 6: Recommended Management Measures

Best Management Practices (BMPs) can be implemented to prevent, mitigate, or eliminate nonpoint source pollution resulting from a particular land-use activity. Under the Federal Clean Water Act (CWA) and the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), Ecology is responsible for designating management measures and suites of BMPs that comply with Washington State's WQ Standards. Additionally, Ecology is the agency responsible for articulating how nonpoint pollution sources can comply with the state Water Pollution Control Act and the state WQ Standards.

Nonpoint source pollution has been documented to occur from urban and residential development, hydromodification, marinas and boating areas, agricultural activities, and forest practices. Ecology recognizes the need to have specific guidance covering all categories of nonpoint source pollution.

When identifying suites of BMPs and measures to control each category and subcategory of nonpoint sources, Ecology will meet the following objectives:

- Identified suites of BMPs and measures will be designed to comply with the WQ Standards at the site level and contribute to the protection of beneficial uses of the receiving waters, and ensure compliance with state and federal law.
- Utilize best available science to identify BMPs and measures.
- Apply the concept of AKART.⁷⁶

This chapter lays out the process that Ecology will use to identify management measures and BMPs for each category of nonpoint pollution in compliance with the CWA and CZARA.

Federal Requirements

Section 319 of the CWA requires that state nonpoint source (NPS) management programs “*identify best management practices and measures to control each category and subcategory of nonpoint sources...*” EPA guidance for NPS programs reinforces that state NPS management programs must include an “identification of measures (i.e., systems of practices) that will be used to control NPS pollution, focusing on those measures which the state believes will be most effective in achieving and maintaining WQ Standards.” Furthermore, EPA guidance allows for states to identify measures “individually ... or presented in manuals or compendiums, provided that they are specific and are related to the category or subcategory of nonpoint sources.”

⁷⁶ WAC 173-201A-020 states: “AKART” is an acronym for “all known, available, and reasonable methods of prevention, control, and treatment.” AKART shall represent the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge. The concept of AKART applies to both point and nonpoint sources of pollution. The term “best management practices,” typically applied to nonpoint source pollution controls is considered a subset of the AKART requirement.

CZARA requires states to develop management measures necessary to ensure attainment of the WQ Standards. Management measures are defined as “economically achievable measures” reflecting the “greatest degree of pollutant reduction achievable” through the “best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods or other alternatives.” Management measures are intended to prevent and control nonpoint source pollution, and are implemented through the use of management practices. While the management measures must be developed to ensure attainment of WQ Standards, the “management measure” approach is more akin to a technology-based rather than water-quality-based approach to addressing nonpoint pollution.

Any manuals, compendiums, or other guidance that identify BMPs and measures adopted by Ecology to fulfill the requirements of Section 319 do not have any independent regulatory authority and will not establish new environmental regulatory requirements.

Existing Guidance

Ecology presently has manuals that identify appropriate BMPs in place for several kinds of land uses that can generate pollution. Current Ecology manuals and guidelines include:

- Stormwater Management Manual for Western Washington
- Stormwater Management Manual for Eastern Washington

Additionally, Ecology’s grant and loan funding guidelines include information on BMPs that are eligible for funding with Section 319 grants. One of the key objectives of the funding guidelines is to ensure that BMPs implemented with Ecology grants comply with the WQ Standards at the site level. In 2013 the EPA and NOAA notified Ecology that it must take additional actions to protect salmon and salmon habitat. EPA required Ecology to include conditions on federal pass-through grants to be consistent with National Marine Fisheries Service (NMFS) buffer guidance to ensure compliance with the WQ Standards and help protect and recover Washington’s salmon runs.

Outside of the information provided in our funding guidelines, Ecology recognizes our state lacks freestanding manuals, compendiums, or other guidance that identify BMPs for agriculture that ensure compliance with the WQ Standards. However, we will continue to address agriculture sources of pollution as outlined in Chapter 3.

Existing Regulatory Programs and Permits

Where existing regulatory programs provide specific oversight and enforcement authority related to a category of NPS pollution, Ecology will generally defer to the implementation of those programs, and not develop independent guidance. Current regulatory programs include:

- Forest Practices Rules
- Onsite Sewage Systems Regulations and Ordinances
- Dairy Nutrient Management Program

Additionally, some sources that previously may have been considered nonpoint pollution sources are now regulated as point source discharges and covered under NPDES and/or State Waste

Discharge general permits. Any source that is ultimately regulated under a NPDES permit is no longer subject to the BMP guidance requirements of Section 319 and CZARA. However, as covered in Chapter 3, Ecology will work to ensure that our nonpoint pollution source, CZARA, and TMDL programs are well-integrated with our permit programs by clearly defining when an activity requires a permit versus being covered under our NPS program, and utilizing consistent guidance to inform the implementation of both programs. Further, state waste discharge permits can cover sources that may be considered nonpoint in nature.

Current permits include:

- Aquatic Pesticide Applications
- Boatyards
- Bridge and Ferry Terminal Washing
- Concentrated Animal Feeding Operation (CAFO) - Facilities that have a discharge
- EPA Vessel General Permit
- Fresh Fruit Packing
- Sand and Gravel mining operations
- Stormwater:
 - Construction Stormwater
 - Industrial Stormwater
 - Municipal Phase I and Phase II Permits
 - WSDOT Municipal Stormwater
- Upland Fin-Fish Hatching and Rearing
- Vessel Deconstruction

Information on these statewide regulatory programs and permits is provided in Chapters 2 and 3, and details on the above permits can be found at:

<http://www.ecy.wa.gov/programs/wq/permits/genpermits.html>.

Stakeholder Involvement

Ecology recognizes the need for early stakeholder involvement in any process that develops new management measure and BMP guidance, or updates existing guidelines or manuals. Ecology will seek involvement from local, state, tribal and federal agencies, as well as public interest groups, industries, academic institutions (including the Washington Stormwater Center), private landowners and producers, and concerned citizens during all steps of this process. Further, Ecology will seek the input of the Agriculture and Water Quality Advisory Committee (agriculture-related management measures), the Water Quality Partnership and the Financial Assistance Council on developing any processes necessary under this chapter.

Next Steps

To ensure compliance with Section 319 and CZARA requirements, Ecology will take the following actions:

- Perform a gaps analysis:

- o Work with EPA and NOAA to identify current “manuals or compendiums” for categories or subcategories of nonpoint pollution that fulfill the requirements of CWA Section 319 and CZARA.
 - o Work with EPA to identify gaps where Ecology does not have current “manuals or compendiums” for categories or subcategories of nonpoint pollution that fulfill the requirements of CWA Section 319 and CZARA.
- As necessary work with EPA, NOAA, stakeholders and tribes to design a process to identify measures “individually ... or presented in manuals or compendiums” that fulfill the requirements of CWA Section 319 and CZARA for any gaps that are identified, or alternatively consider covering under a general permit with the goal of incorporating guidance in the next update to the NPS plan (2020).
 - o EPA and NOAA have identified agriculture as a gap. Ecology will complete work with the Agriculture and Water Quality Advisory Group, Tribes, and other stakeholders to develop a process to address gaps in BMP guidance for agriculture categories of nonpoint pollution.
- As necessary, update funding guidelines and Chapter 3 to support implementation of suites of BMPs that are identified through the above process.

Additionally, Ecology will support updates to BMP guidance as necessary to ensure compliance with the WQ Standards.

- Support updates to the Stormwater Management Manual for Western Washington.
- Support updates to the Stormwater Management Manual for Eastern Washington.
- Support the Forest Practices Rules’ adaptive management process.
- Support adaptive management and updates to any new BMP guidance that is developed to ensure that the state WQ Standards are achieved and maintained.

July 2015-June 2016 Timeline

EPA and NOAA have identified BMP guidance for agricultural sources as a gap in our program. Ecology will work with stakeholders to develop and implement a process to develop BMP guidance for agriculture categories of nonpoint pollution. The following is a list of steps Ecology will take in the next year to address this gap:

- By December 31, 2015 Ecology will meet with stakeholders [including the Agriculture and Water Quality Advisory Committee, Tribes, environmental organizations, local governments, conservation districts, state agencies (WSCC, WSDA, DOH, Department of Fish and Wildlife, etc.), federal agencies (EPA, NOAA, NRCS, etc.), and other interested stakeholders] to receive input on what type of process we should use to develop BMP guidance for agricultural sources. Based on stakeholder input, Ecology will design a proposed process.
- By March 31, 2016 Ecology will meet with stakeholders [including the Agriculture and Water Quality Advisory Committee, Tribes, environmental organizations, local governments, conservation districts, state agencies (State Conservation Commission, Washington State Department of Agriculture, Department of Health, Department of Fish and Wildlife, etc.), federal agencies (EPA, NOAA, NRCS, etc.), and other interested stakeholders] to receive feedback on the proposed process. Based on feedback Ecology will finalize the process we will use to develop BMP guidance.

- By June 15, 2016 Ecology will submit to EPA and NOAA the process we will use to develop BMP guidance for agricultural sources.

Ecology will update this chapter to include information on the process and timelines for completing the process after we submit that information to EPA and NOAA.

Each BMP developed using this process will become part of Ecology's nonpoint program as soon as it is finalized. As necessary we will update our funding guidelines and Chapter 3 to support the implementation of suites of BMPs that are developed and finalized through this process.

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Chapter 7: Monitoring

The federal Clean Water Act (CWA) gives states the primary responsibility for implementing programs to protect and restore water quality, including monitoring and assessing the nation's waters and reporting on their quality. In Washington State, Ecology is the delegated agency primarily responsible for implementing the requirements and provisions of the CWA. Consequently, Ecology is also the agency responsible for satisfying the majority of the water quality monitoring and reporting requirements of the CWA. The purpose of this section is to describe Washington State's current water quality monitoring program.⁷⁷

While the monitoring program's focus is broader in scope than the nonpoint program, it supports the nonpoint program in a variety of ways. For example, the monitoring program is used to identify waters of the state that have impairments, help connect impairments to nonpoint sources of pollution, help identify unimpaired waters, help prioritize waters for implementation, and support effectiveness monitoring.

This section starts by describing the overall state monitoring strategy and Water Quality Assessment (WQA). Then key monitoring programs are briefly described to provide an overview of ongoing monitoring efforts in the state. After describing these key Ecology monitoring efforts, a brief description of other monitoring programs in the state is included to provide a more complete picture of ongoing monitoring that can support the state's nonpoint program. Finally, this section concludes with a description of effectiveness monitoring, quality assurance, and data management.

Ecology's Monitoring Strategy

Washington State adopted a tiered approach to monitoring in order to most efficiently meet its highest priority monitoring objectives at the various geographic and temporal scales needed for effective environmental management. This means that Ecology and its partner agencies will continue to conduct a variety of extensive and intensive, short- and long-term monitoring programs, and employ a number of monitoring designs to meet a wide range of monitoring objectives.

At Ecology the Environmental Assessment Program (EAP) serves as the technical arm of the agency and conducts much of the water quality monitoring needed to inform regulatory actions. The mission of EAP is to "To measure, assess, and communicate environmental conditions in Washington State."

⁷⁷ More information on Ecology's Monitoring program and strategy can be found at [Report title] and [link to EAP's webpage].

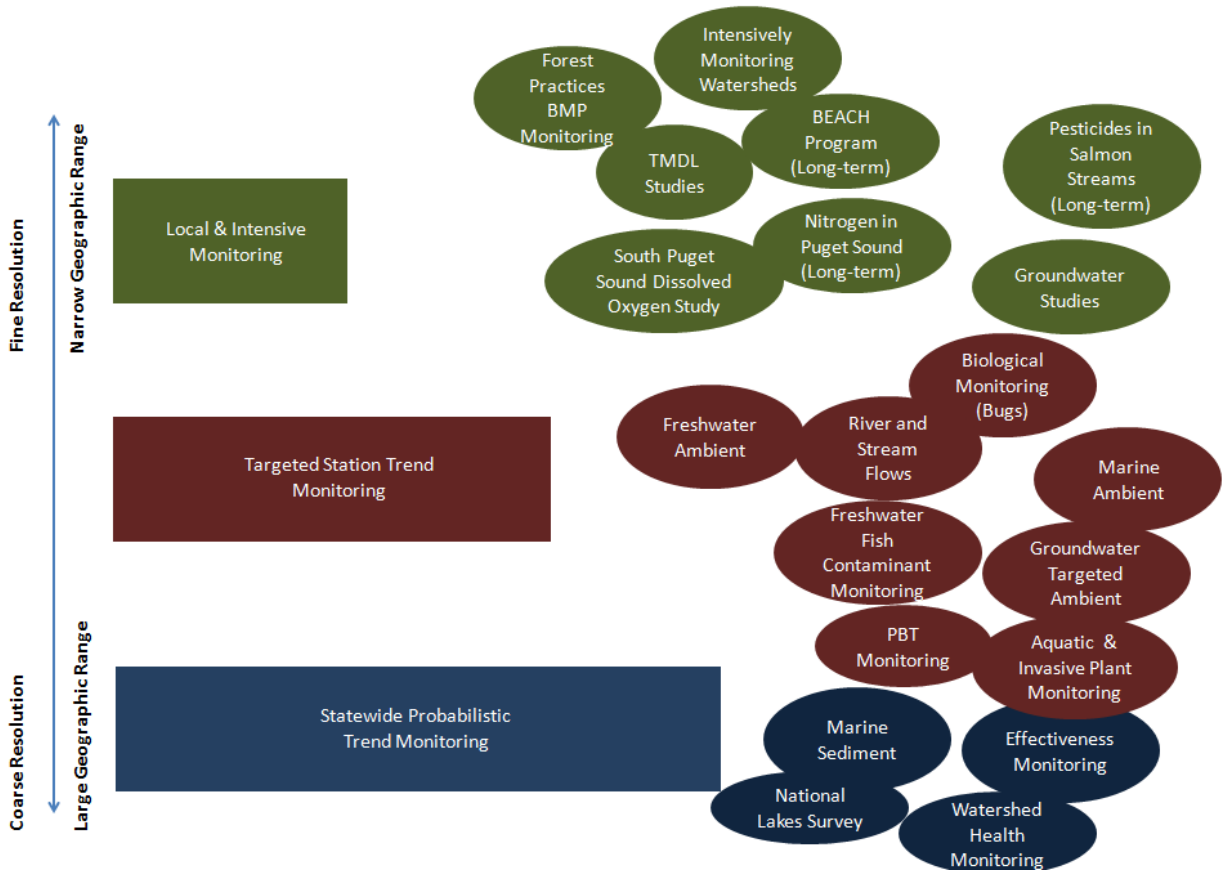


Figure 2 Ecology's Tiered Monitoring Strategy

Water Quality Assessment

The Water Quality Assessment (WQA) is the main tool for identifying impaired waterbodies for clean-up projects. The WQA uses all available data from Ecology's monitoring programs, plus data submitted by external entities.

Compiling Existing Sources of Data and Information

Ecology encourages all interested parties to submit data for the water quality assessment. Data are specifically solicited from many sources including federal, state, and local government agencies, and tribal governments. Ecology also publicizes a "call for data" period and assesses all data from all sources that are received.

Data Quality Requirements

Ecology's policy specifies the quality assurance requirements that must be met by all data used for the assessment. Sampling and analysis must be conducted under a documented Quality Assurance (QA) Project Plan or other quality assurance procedures that Ecology determines to be equivalent for providing high quality data. Documentation must be provided with all data submitted for assessment indicating that the objectives of the QA Project Plan or equivalent quality assurance procedures were met. If this documentation (or other equivalent assurance) is

not provided, the data are not to be used in the assessment. If Ecology determines there are flaws in quality assurance planning or implementation that significantly reduce confidence in any submitted data, including in data previously provided during earlier assessment cycles, then those data are not to be used as a basis for placing a water segment on the CWA Section 303(d) list, known as Category 5.

Data Review, Verification, and Validation

Once the measurement results have been recorded, they are examined to ensure that:

- Data are consistent, correct, and complete, with no errors or omissions.
- Results for quality control (QC) samples accompany the sample results.
- QC results indicate that acceptance criteria were met.
- Data qualifiers are properly assigned where necessary.
- Data specified in the sampling design were obtained.
- Methods and protocols specified in the QA Project Plan were followed.

Data review involves examination of the data for errors or omissions. Data verification involves examination of the QC results for compliance with acceptance criteria. Laboratory results are reviewed and verified by qualified and experienced laboratory staff and documented. Data validation involves detailed examination of the complete data package using professional judgment to determine whether the procedures in the methods, standard operating procedures, and QA Project Plan were followed. Validation is the responsibility of the project manager, who may wish to arrange for a qualified specialist to conduct the validation and document it in a technical report.

Once the data have been verified and validated, they are examined to determine if the management quality objectives (MQOs) have been met. MQOs are established for precision, bias, and required reporting limit. An experimental design for preliminary estimation of precision and bias and the use of control charts provide the best way to determine whether MQOs have been met. Results of QC samples analyzed during the project can also provide an indication as to whether the MQOs have been met.

Data Analysis Procedures

Ecology's Policy 1-11 specifies assessment criteria and describes assessment methods for different media and indicators. Specific assessment criteria are described for toxic pollutants in sediment and water, temperature, dissolved oxygen as well as for fecal coliform bacteria and other pollutants. In addition to assessing data using numeric standards, the assessment of water quality can be based on narrative information. For example, listings may be based on toxics in edible fish tissue, or swimming, fishing, or shellfish advisories from appropriate agencies. Impairments can also be caused by non-pollutants, as legally defined. Examples of non-pollutants are: Physical habitat alterations (e.g., stream channelization, loss of spawning gravels, reduced pool/riffle ratios, loss of large woody debris), physical barriers to fish migration (e.g., dams and culverts), loss of habitat due to invasive exotic species, flow alterations (e.g., low flows and flashier systems), and impaired biologic communities.

Reporting

Ecology's primary means of reporting on the status of water quality is through the development of *Washington State's Water Quality Assessment*, based on EPA's guidance, which integrates Clean Water Act requirements for both Section 305(b) water quality reports and the Section 303(d) list of impaired waters. Ecology's Water Quality and Environmental Assessment programs have jointly adopted Policy 1-11 that describes the methods used for assessing information to evaluate attainment of WQ Standards. The Policy includes criteria for compiling, analyzing, and integrating data on ambient conditions with project implementation information.

In preparing the assessment, Ecology evaluates data from *all* sources that are received during the "call for data" period. This includes not only data from Ecology's freshwater and marine ambient monitoring program and other Ecology studies, but also data from a wide array of entities external to Ecology who collect and submit data, including:

- Federal, state, and local government agencies
- Tribes
- Quasi-governmental entities, such as watershed planning councils
- Businesses
- Academic institutions
- Not-for-profit groups
- Private citizens

Ecology uses the *Water Quality Assessment* report to assign waterbody segments into one of five categories (see the following descriptions). All waters in Washington State (except on tribal reservation lands) fall into one of the five categories describing our knowledge of the status of that waterbody.

Category 1 - Meets tested standards for clean waters: placement in this category does not necessarily mean that a water body is free of all pollutants. Most water quality monitoring is designed to detect a specific array of pollutants, so placement in this category means that the water body met standards for all the pollutants for which it was tested. Specific information about the monitoring results may be found in the individual listings.

Category 2 - Waters of concern: waters where there is some evidence of a water quality problem, but not enough to require production of a water quality improvement (WQI) project (including total maximum daily load [TMDL]) at this time. There are several reasons why a water body would be placed in this category. A water body might have pollution levels that are not quite high enough to violate the WQ Standards, or there may not have been enough violations to categorize it as impaired according to Ecology's listing policy. There might be data showing water quality violations, but the data were not collected using proper scientific methods. In all of these situations, these are waters that we want to continue to test.

Category 3 - Insufficient data: water where there is insufficient data to meet minimum requirements according to Policy 1-11.

Category 4 - Polluted waters that do not require a TMDL: waters that have pollution problems that are being solved in one of three ways:

- o **Category 4a** - has a TMDL: water bodies that have an approved TMDL in place and are actively being implemented.
- o **Category 4b** - has a pollution control program: water bodies that have a program in place that is expected to solve the pollution problems. While pollution control programs are not TMDLs, they must have many of the same elements and there must be some legal or financial guarantee that they will be implemented.
- o **Category 4c** - is impaired by a non-pollutant: water bodies impaired by causes that cannot be addressed through a TMDL. These impairments include low water flow, stream channelization, and dams. These problems require complex solutions to help restore streams to more natural conditions.

Category 5 - Polluted waters that require a TMDL or other WQI project: the traditional list of impaired water bodies traditionally known as the **303(d) list**. Placement in this category means that Ecology has data showing that the WQ Standards have been violated for one or more pollutants, and there is no TMDL or pollution control program in place. TMDLs or other approved WQI projects are required for the water bodies in this category.

Washington State's Water Quality Assessment can be found on Ecology's website at <http://www.ecy.wa.gov/programs/wq/303d/index.html>. Policy 1-11, which Ecology uses to assess water quality data and determine if water bodies are polluted is found here: <http://www.ecy.wa.gov/programs/wq/303d/policy1-11.html>.

Ecology Monitoring Programs

Water Quality Improvement (WQI) Projects

Under the CWA and implementing federal regulations, Ecology is required to develop Water Quality Improvement Projects for impaired waters listed under Category 5 of the Water Quality Assessment (the 303(d) list). These projects could be Total Maximum Daily Load (TMDL) projects, or could involve simply implementing the appropriate pollution controls in watersheds impaired by nonpoint pollution. Implementing nonpoint pollution controls without a TMDL in place works well in watersheds in which the pollution problems are easy to identify and the solutions are known. Many of these projects are led by Ecology staff, but successful projects are also being implemented by a county, a watershed planning group, and the U.S. Forest Service.

When an impaired body is selected as a priority for a TMDL project, Ecology conducts scientific studies to identify sources and amounts of pollutants causing the water quality problem, and a technical analysis to determine how much pollution sources must be reduced to protect the water. These studies typically consist of multiple, several-day field surveys over the course of several months to a year or more. The studies may focus on conventional pollutants, or they may be conducted for a variety of metals and organic compounds. The most complex toxic projects may require sampling a wide range of media including surface water, stormwater, effluents from municipal and industrial facilities, suspended particulates, bottom sediments, bottom cores, and resident fish. In addition, biological evaluation of surface waters is being incorporated into TMDL study designs to provide a broader approach because degradation of sensitive ecosystem processes is more frequently identified. Since many of the waters identified on the CWA Section

303(d) list have diffuse pollutant sources, Water Cleanup Plans are usually conducted on a broad watershed scale. Implementation plans are developed to implement TMDLs.

River and Stream Ambient Monitoring

Ecology's river and stream monitoring program will continue to rely predominantly on a fixed station monitoring design. Ecology currently collects samples monthly from 66 long-term (core) and 11 basin, and 5 sentinel monitoring stations (82 total) ([Hallock and Von Prause 2013](#)). The 66 core stations were all selected using a "*judgmental sample survey monitoring design*" (EPA, 1997) which is based on the nonrandom selection of sampling sites to infer estimates of overall water quality for these basins. Core stations are generally located in a downstream reach of a mainstem river (often at bridge crossings for efficient sampling).

Data from these stations are used to assess overall condition or status of their respective basin, and to evaluate long-term trends. A few core stations are located in upper watersheds to reflect un-impacted conditions. Many core stations have been sampled for extended periods (some for over 40 years) allowing for site-specific trend analyses.

Basin stations are sampled monthly for (usually) one year, and new station locations are chosen each year to support Ecology's five-year watershed management process or to target specific concerns identified by Ecology's regional office staff. Ecology also records continuous temperature data at about 60 stations to determine compliance with current and proposed WQ Standards. Furthermore, Ecology conducts continuous monitoring for temperature, dissolved oxygen, pH, and conductivity at 10 stations, including six stations in support of "Intensively Monitored Watersheds" (IMW) research which is funded by the Salmon Recovery Funding Board (SRFB) and two stations supporting effectiveness monitoring efforts. Results are delivered in near-real-time to the Internet by satellite telemetry at most continuous stations.

Marine Water Ambient Monitoring

Ecology's Marine Waters Monitoring (MWM) Program employs a monitoring strategy composed of multiple components in order to assess marine ecosystem processes and water quality status and trends at various spatial and temporal scales. The Marine Flight and Joint Effort to Monitor the Straits (JEMS) programs focus on monthly sampling of the water column at 39 core monitoring stations in Puget Sound, the Strait of Juan de Fuca, and from Willapa Bay and Grays Harbor on the Washington coast, using consistent techniques to determine long-term trends in water quality over sufficiently long temporal scales. Station redundancy in each basin allows for a better statistical representativeness of monthly conditions. A monthly temporal resolution allows for a representative description of the seasonality of the system. While physical variables are continuously resolved in the vertical with in-situ sensors, discrete samples are resolved at higher resolution in the upper 30m of the water column to account for the connectivity between nutrient loading and freshwater inputs.

Data from the monthly water column monitoring provides the temporal backbone of Ecology's Marine Waters Monitoring program. These data are augmented by continuous in-situ mooring observations, higher spatially-resolved information from en route ferry transects, and aerial photography.

The program deploys in-situ sensors in restricted waterways or at key sites in Puget Sound and coastal bays to capture the variability of the inter-basin mass (water, biomass), and solute (salt and oxygen) transport. Monitoring focuses on events such as tides, weather, stormwater discharge, and large-scale oceanographic intrusions. The moorings provide high temporal resolution to understand:

- Variability of inter-basin transport (e.g. visualizing intrusions)
- Impact of water exchange on low-oxygen and local water quality
- Day-to-day variability and real time information.

Within the complex morphology of Puget Sound, near-surface variability in physical, chemical, and biological constituents is very high. Regional influences by rivers, local winds, density structure, tides, variable phytoplankton species and growth create a horizontally patchy and dynamic environment. Taking representative near-surface point samples is therefore challenging, and to overcome this challenge the program expanded monitoring by using en route ferry observations to capture this variability and integrate these observations into a spatially and temporally nested monitoring approach. En-route sensors obtain comprehensive data records with high horizontal and good temporal resolution which can be used to reconstruct the evolution of near surface features (e.g. stormwater, algal bloom, location of isotherms and isohalines). Fundamental to the en-route ferry approach is its integration into large-scale, regional products by using the information to provide spatially calibrated information for remote sensing observations.

Remote sensing and aerial observations from aircraft and satellite cover a wide range of geographic scales. Spatial distribution maps of debris, freshwater, suspended sediments and algae are information products of high public interest and are delivered on a monthly basis. Satellite images and processing procedures are obtained from available sources. The goal of remote observations is to statistically describe the extent and location of hydrographical boundaries and optical features (e.g., water clarity, water color, suspended sediment concentration, algae blooms and the accumulation of debris and oil) and relate them to physical processes. Environmental anomalies in surface water characteristics can be monitored using time-averaged baseline conditions and statistical distribution maps that delineate geographic change. Over time, remote sensing provides the statistical, spatial and historical context to identify regions with frequent biological responses to eutrophication. Remote sensing also supports the strategic placement of monitoring stations and focused studies (e.g. TMDL).

The scale of the sampling network allows for the quantitative separations of internal and external drivers of water quality. By separating the drivers, environmental management can raise water quality issues to the appropriate levels of attention.

Marine Sediment Monitoring

Ecology maintains a network of ten long-term, fixed marine sediment stations, which are sampled annually for infaunal community structure and every fifth year for chemical contaminants, to estimate trends in chemical contamination and benthic community structure. Annual analyses of benthic communities at some of these stations date back to the 1960s with research conducted by the University of Washington and others. Beginning in 1997, Ecology also developed a program to collect samples from an additional 40 sediment stations each year,

using a probabilistic (random), rotating panel design. Stations are selected from one of eight estuarine regions defined by the Puget Sound Ecosystem Monitoring Program (PSEMP) according to their unique hydrologic, bathymetric, and geological features. Separate Chemistry, Toxicity, and Benthic Indices, and an overarching Sediment Quality Triad Index are used to characterize sediments based on levels of chemical contamination and toxicity of the sediments, and on the composition of the benthic invertebrate communities. In 2007, funding from Ecology's Urban Waters Initiative was secured to begin similar sampling and characterization of sediments in six urban bays, with sampling conducted at 30 stations collected from one bay/year over a 6-year period.

Stream Biological Monitoring

Traditional measurements of chemical and physical components for rivers and streams may not provide sufficient information to detect all surface water problems. Biological evaluation of surface waters provides a broader approach because degradation of sensitive ecosystem processes is more frequently identified.

The Environmental Assessment Program at Ecology has three major projects monitoring biological condition in Washington's streams and rivers. The Sentinel and Ambient Biological Projects monitor macroinvertebrates and periphyton from 80 reference or "least impacted" sites throughout the state. Sixteen Sentinel sites are sampled annually, while an additional 64 sites are sampled on a rotating basis for the Ambient Biological Project. Since 2009, Ecology has collected samples from 159 reference site visits throughout Washington. This monitoring has provided a base of information describing biological characteristics of reference or "least impacted" condition. Additionally, since 2009 the Watershed Health Monitoring Project has sampled macroinvertebrates from over 375 randomly selected sites throughout Washington. Using a Washington master sample list and a probabilistic sampling design, 50 sites from each of seven Status and Trends Regions (STRs) throughout the state are sampled on a rotating basis (i.e. 1-2 STRs sampled per year). Each time an STR is revisited, 25 new randomly selected sites are sampled and another 25 sites visited previously are sampled again.

One of the goals of Ecology's monitoring program is to develop biocriteria using benthic macroinvertebrates, and to apply these biocriteria appropriately within the framework of the CWA. Two types of numeric biocriteria, based on biometrics and predictive modeling, are being developed for use throughout Washington State. When used alone or together, these criteria can give a statistically defensible case for determining the overall condition of a stream or waterbody.

Ecology now uses macroinvertebrate samples to assess potential streams for listing on the state's 303(d) list.

Stream Flow Monitoring

Ecology manages 73 streamflow monitoring stations across the state. Sixty-six of the 73 stations consist of automated, telemetered capabilities providing near real time reporting. Streamflow, as well as other parameters depending on the configuration of individual stations are presented on Ecology's web site.

The remaining seven stations include two stand-alone and five manual-stage-height stations. Stand-alone stations record continuous flow data, however they do not have near real time reporting capabilities. The manual-stage-height stations provide instantaneous flow information, although not a continuous record. Stand-alone and manual stage height stations are usually associated with special projects and operate through the duration of the project, typically one or two years.

Washington's *Comprehensive Monitoring Strategy* recommends additional stream gages be installed on ungaged mainstem rivers and major tributary streams in priority (i.e., salmon-critical) watersheds first, but in all watersheds eventually.

Invasive Aquatic Plant Monitoring

Ecology has been monitoring the occurrence and distribution of aquatic plants in lakes and rivers throughout the state since 1991. The program's main objective is to track aquatic plant community changes, concentrating on invasive non-native species such as Eurasian milfoil. Other objectives are to provide technical assistance on aquatic plant identification and control of invasive species, and to conduct special projects evaluating the impacts of invasive non-native species and their control. To date, aquatic plant (macrophyte) data have been obtained from approximately 550 lakes, reservoirs, and rivers across Washington. Monitoring locations are targeted each year based on requests or problems identified by regional office staff and local cooperators.

Beach Environmental Assessment, Communication and Health (BEACH) Prgm

EPA initiated the Beaches Environmental Assessment, Communication, and Health (BEACH) Program in response to the passage in 2000 of the BEACH Act. The Act amends the Clean Water Act and authorizes EPA to appropriate funds to states for the development of monitoring and notification programs to provide a more uniform system for protecting the users of marine waters.

In Washington, a BEACH Coordinator manages the development and implementation of the Program, including facilitating the Inter-agency BEACH Committee. The committee includes Ecology, the state Department of Health, and nine county health jurisdictions including Grays Harbor, Tacoma-Pierce, Seattle-King, Whatcom, Clallam, Jefferson, Island, Thurston and Kitsap.

The monitoring program focuses on sampling for indicator bacteria at about 60 public marine beaches in Washington State. Ecology implements the BEACH program collaboratively with the Department of Health and with the assistance and cooperation of local county health jurisdictions, non-profit organizations, volunteers and universities. The information is communicated to the public on Ecology's BEACH Program website and by signs posted on the beaches.

Freshwater Fish Contaminant Monitoring Program

The Freshwater Fish Contaminant Monitoring Program (FFCMP) was developed to address continuing concerns about toxic compounds in Washington's aquatic environments. Historical

monitoring efforts identified many areas where levels of contamination were high enough to harm humans and wildlife, sometimes resulting in fish consumption advisories issued by the state Department of Health. The goal of the FFCMP is to provide information to resource managers and the public about the status of toxic contamination in edible fish tissue from freshwater lakes, rivers, and streams that have not yet been monitored, or to track trends over time in areas that are undergoing cleanup activities. The FFCMP has conducted exploratory monitoring to identify occurrences of toxic contamination in fish tissue since 2003. Approximately 10-15 lakes, reservoirs, and rivers are sampled annually.

Lake/Reservoir Monitoring

National Lakes Assessment

Ecology participated in EPA's National Lakes Assessment (NLA) in the summers of 2007 and 2012. Sites were randomly selected using a probability-based sampling design which resulted in locations throughout the state. These surveys help to assess current conditions, evaluate change over time, and monitor the impacts of key stressors on lake environments (NLA; EPA 2012). Sites sampled include:

- 30 lakes in 2007
- 33 lakes in 2012

Aquatic Plants Monitoring

Aquatic plant monitoring, focused on invasive species, takes place at 40 to 60 lakes per year. Results are maintained in a publically accessible database <http://www.ecy.wa.gov/programs/eap/lakes/aquaticplants/index.html>.

Lakes Coastal Atlas Module

Information about lakes was added to Ecology's Coastal Atlas database in 2014. The lakes module will provide cohesive access to Ecology's lake data.

Toxic Algae Program

Ecology's Water Quality Program hosts the toxic algae program. In 2005, the Washington State Legislature established funding for an algae control program and asked the Washington Department of Ecology (Ecology) to develop the program. Reducing nutrient input to lakes is the only long-term solution to prevent algae blooms. However, the amount of money available for this program (about \$250,000 per year) is not enough to fund comprehensive lake-wide and watershed-wide nutrient reduction projects. Instead, the program focuses on providing local governments with the tools they need to manage algae problems. The program targets blue-green algae (also known as cyanobacteria) because these algae pose a health risk to humans, pets, and livestock. <http://www.ecy.wa.gov/programs/wq/plants/algae/index.html>

Groundwater Monitoring

There is currently no state-level program to monitor ambient groundwater quality trends over time in Washington, and no long-term funding source has been identified to date to support such an effort. In late 2007, Ecology's Watershed Advancement Group (WAG) convened an internal agency workgroup to develop a strategy for implementing a state-level ambient groundwater monitoring and reporting program to support the sustainable management of Washington's groundwater resources. The resulting 2008 report, adopted by WAG, laid out a phased approach

which we are using as a road map to form a foundation for a statewide program, in the absence of dedicated funding. To date, accomplishments include:

- Inventory and consolidation of Ecology groundwater monitoring data (ongoing).
- Standardization of data collection and quality assurance procedures (ongoing).
- Development of an agency-level groundwater data management interface for Ecology's EIM system (completed).
- Creation of an agency-level web site to improve access to state groundwater information (completed).

Future steps include:

1. Capture and, where appropriate, migration of external groundwater data to Ecology's EIM system.
2. Evaluation of existing ambient groundwater data.
3. Expansion of regional water level monitoring networks already in operation.
4. Establishment of a state-level groundwater status and trends monitoring program, by compiling data from an established network of index wells.

Intensively Monitored Watersheds

Ecology and the Washington Department of Fish and Wildlife are cooperating on a program to intensively monitor water quality, habitat conditions, and salmon response in paired sets of watersheds at four key locations in Washington (Hood Canal, Lower Columbia River, northern Olympic Peninsula, and the Skagit River estuary). The main objective of this approach is to understand the complex relationships between salmon habitat restoration actions and the response of fish habitat, and targeted salmonids species (parr numbers, overwinter survival, smolt production, and number of spawners). The cause-effect relationships between restoration actions and salmon response is needed to assess the effectiveness of habitat restoration actions implemented to restore salmon. Concentrating and integrating monitoring and research efforts at a few locations may enable enough data on physical and biological attributes of the system to be collected to develop a comprehensive understanding of the factors affecting salmon production in fresh water.

Water Quality Grants Projects

Ecology grant projects capture environmental outcomes and performance measures in the grant and loan competitive application process and in funding agreements. The program does not require water quality monitoring, but where monitoring is conducted under a grant or loan, monitoring data must be entered into EIM as a funding condition. The program coordinates with the technical arm of Ecology regarding BMP effectiveness monitoring and use of this data to help quantify benefits. The grant program has integrated "post project assessment" language in agreements that ensures follow-up to review the status and capture a summary of ongoing environmental outcomes or water quality improvements after 3 years.

Stormwater Work Group

The Stormwater Work Group (SWG) is a coalition of federal, tribal, state, and local governments; business; environmental; agriculture; and research interests that was convened at the request of the Puget Sound Partnership and Department of Ecology to develop a Stormwater Monitoring and Assessment Strategy for the Puget Sound Region. The strategy is intended to

provide a coordinated, integrated approach to quantifying the stormwater problem in Puget Sound and to help us efficiently and effectively manage stormwater to reduce harm to the ecosystem.

The SWG has numerous subgroups overseeing implementation of regional stormwater monitoring and developing recommendations. Each subgroup has its own purpose and goals. The chair, staff, and meeting schedule support each work group in achieving its goals. Subgroups include:

- Agricultural Runoff
- Effectiveness Study Selection
- Small Streams Status and Trends Oversight
- Marine Nearshore Status and Trends
- Pooled Resources Oversight
- Source Identification and Diagnostic Monitoring
- Roads and Highways

Other Monitoring Programs

U.S. Geological Survey

The U.S. Geological Survey (USGS) conducts monitoring for the National Water Quality Assessment (NAWQA) Program. Data collected from NAWQA are used to summarize the status and trends of the surface water and groundwater quality, describe the processes affecting water quality and aquatic ecology, and provide timely results to watershed managers, policy makers, and the public.

The USGS also operates and maintains the National Streamgaging Network collecting long-term streamflow data nationwide. Although the National Streamgage Network is operated primarily by the USGS, it is funded by a partnership of federal, state, tribal, and local agencies.

USGS also manages the National Streamflow Information Program which was created in response to Congressional and stakeholder concerns about (1) a loss of streamgages, (2) a disproportionate loss of streamgages with a long period of record, (3) the inability of the USGS to continue operating high-priority streamgages when partners discontinue funding and (4) the increasing demand for streamflow information due to new resource-management issues and new data-delivery capabilities.

U.S. Forest Service

The U.S. Forest Service conducts monitoring of aquatic resources in support of two broad scale plans: (1) the Northwest Forest Plan (i.e., Western Washington) and (2) Pacfish/Infish Biological Opinion (PIBO). Both plans require implementation and effectiveness monitoring of management activities that address issues with the Endangered Species Act. The goal of the regional monitoring program under the Northwest Forest Plan (NWFP) is to evaluate its effectiveness in achieving management objectives which include restoring and maintaining the ecological integrity of watersheds and aquatic ecosystems. The individual forest plans also have implementation and effectiveness monitoring of BMPs. Each national forest produces a Forest

Plan Monitoring Report each year that covers all the implementation and effectiveness monitoring accomplished. Additionally, to assess the effectiveness of the Legacy Roads and Trails Program in decreasing the potential risk of forest roads impacting water quality, the US Forest Service – Rocky Mountain Research Station is monitoring 47 sites across the western United States.

Habitat Conservation Plans

Habitat Conservation Plans (HCPs) are administered by the National Oceanic and Atmospheric Administration (NOAA) Fisheries and the U.S. Fish & Wildlife Service. Most of the HCPs in Washington are focused on the conservation of salmonids. These include programs administered under the Endangered Species Act, the Federal Power Act, the Clean Water Act, and the Magnuson-Stevens Act, among others. The HCP program provides policy and technical expertise to non-federal entities that want to develop HCPs.

Monitoring is a mandatory element of all HCPs and is part of the permittee's implementation obligation. The scope of a monitoring plan is directly related to the significance of the HCP's biological impacts. Monitoring data are needed to ensure proper compliance with an HCP and to determine whether biological goals and objectives are being met. Monitoring serves not only to ensure compliance and gauge the effect and effectiveness of HCPs, it also informs choices under the adaptive management provisions and assists in redefining biological goals. Applicants work with the Services to determine the level of monitoring appropriate for their specific HCP.

Four HCPs have been issued by NOAA Fisheries in Washington for the protection of anadromous salmonids.

Shellfish Growing Area Monitoring

The Office of Environmental Health and Safety of the Washington State Department of Health (DOH) is mandated to evaluate commercial shellfish growing areas to determine if shellfish are safe to eat. To this end, DOH operates a variety of monitoring programs that track conditions in marine waters. One program monitors the level of the marine biotoxins Paralytic Shellfish Poison (PSP), Diarrhetic Shellfish Poison (DSP) and Amnesic Shellfish Poison (ASP) in mussels sampled biweekly from sentinel mussel cages or scraped off substrate from 70-80 points throughout Puget Sound and the coastal estuaries. In addition, commercial shellfish species from active commercial harvest areas are sampled. When biotoxin levels in the mussels or commercial shellfish species from individual areas exceed the appropriate FDA levels, DOH informs the public and orders a halt to commercial/recreational harvest. DOH also operates a phytoplankton monitoring program that acts as an early warning system for Harmful Algal Bloom (HAB) events. This network helps the DOH to prioritize where shellfish samples are collected and to test samples more frequently during HAB events resulting in more effective closures that better protect public health.

DOH also operates other monitoring programs to support the classification of commercial shellfish areas. At present, there are 102 actively classified growing areas. DOH uses standards and guidelines set by the National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish to monitor and classify the growing areas. Classification is based on analysis of water quality, meteorology, hydrography, and an intensive survey of shoreline and

uplands for fecal pollution sources. An area cannot be approved for harvest if there are significant pollution threats despite acceptable water quality.

Once classified, all active growing areas are regularly monitored. Marine water samples are collected throughout the year. Shoreline surveys are conducted less frequently, but each year dozens of shellfish growing areas are surveyed. During those surveys, all potential pollution sources that may impact water quality are evaluated. The purpose of continued water sampling and shoreline surveys is to make sure that growing areas continue to meet the standards associated with their classification, to modify classifications when needed, and to notify the responsible agencies about identified and potential pollution sources. If a commercial shellfish growing area has its classification downgraded due to nonpoint pollution, state law calls for local governments to form a shellfish protection district within 180 days. The shellfish protection district is tasked with developing a shellfish closure response in order to address the pollution sources and improve water quality.

Salmon Recovery Act

The Salmon Recovery Funding Board funds several types of monitoring related to salmon recovery. These include project effectiveness monitoring, intensively monitored watersheds for validation monitoring, and implementation monitoring of the funded projects. In the past, they funded habitat status and trends monitoring. This is now funded by the Department of Ecology.

Strategy to Recover Salmon

In 1999, the State of Washington Joint Natural Resources Cabinet published the statewide strategy to recover salmon (JNARC, 1999). To evaluate success of the recovery strategy, the state uses the Salmon Recovery Scorecard published in the biennial *State of the Salmon* report. The Scorecard essentially is the state's business plan for salmon recovery. It's a performance management system for tracking data, measuring progress, and changing course where needed. However, of the 18 indicators tracked on the scorecard, only one is an outcome indicator related to nonpoint pollution sources. Scorecard element E-2 tracks the percentage of WRIAs that have acceptable scores according to Ecology's Water Quality Index (WQI).

The WQI is represented by numbers ranging from 1 to 100, indicating the general water quality at each station. The higher index numbers are indicative of better water quality. Multiple constituents of the water quality measured are combined, and the results are aggregated to produce a single score for each sample station. The WQI was calculated for the long-term monitoring locations in each WRIA sampled by Ecology in 2002. Results show that 5% of the WRIAs are in poor condition, 61% are fair, and 34% are considered in good condition.

Aquatic Nuisance Species Management Plan

The purpose of the Washington State Aquatic Nuisance Species (ANS) Management Plan is to coordinate all ANS management actions currently in progress within Washington, and to identify additional ANS management actions, especially those relating to ANS animals. The development of a state management plan is called for in Section 1204 of the National Invasive Species Act of 1996, which provides an opportunity for federal cost-share support for the implementation of state plans approved by the National Aquatic Nuisance Species Task Force. Management actions are undertaken and funded by the responsible state agencies. The Washington State Plan,

published in December 1998, was developed by the Washington State Aquatic Nuisance Species Planning Committee.

Several agencies are responsible for current efforts to monitor for ANS populations already present in Washington. The Washington State Aquatic Nuisance Species Planning Committee continues to revise the monitoring program to quickly detect new ANS introductions or the spread of those already present. They are working to collect accurate information about which ANS are present, where they are present, and an estimate of their population numbers and/or densities. The Committee established the following “Strategic Action”: Monitor waters that are vulnerable to new ANS introductions and track the distribution of existing ANS populations. Survey Washington lakes, rivers, estuaries, wetlands, and coastlines on a periodic basis to establish an accurate assessment of the presence of non-native species that have become, or have the potential to become, nuisance species, and make these data available statewide.

Yakima Ground Water Management Area

Washington State Department of Agriculture (WSDA) has been heavily involved with the nitrate groundwater contamination issues in the lower Yakima valley for over a decade. Recent work on the groundwater management area (GWMA) included staffing the technical committees and committing resources through an interagency agreement to conduct a comprehensive nitrogen loading assessment. Completion of this assessment will allow members of the GWMA to focus nitrogen management actions on land uses that contribute excess nitrogen most significantly to degradation of groundwater quality in the area.

Surface Water Monitoring for Pesticides in Salmon-Bearing Streams

WSDA’s Surface Water Monitoring Program for Pesticides in Salmon-Bearing Waters is entering its 13th year of existence and 2nd year where all field work, data analysis, and report writing is completed exclusively by WSDA. The study assesses pesticide-presence in salmon-bearing streams during a 27-week typical pesticide use period (March – September). Currently, the assessment evaluates samples for more than 200 pesticide active ingredients and their breakdown products, and compares those results with known toxicity criteria. The 2015 season will include glyphosate (Roundup™) monitoring at all sample locations (14 statewide) for five weeks in the spring. This is a first for WSDA’s program and it is hoped it will alleviate some concerns about possible glyphosate concentrations. Finally, sediment samples will be collected at 5 of their sites during three different seasons (spring, summer, fall) for pyrethroids and other chemical classes that bind to organic material.

The data generated by the monitoring program is used by WSDA, the U.S. Environmental Protection Agency, (EPA), the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, and the U.S. Fish and Wildlife Service (USFWS) to refine exposure assessments for pesticides registered for use in Washington State. Understanding the fate and transport of pesticides allows regulators to assess the potential effects of pesticides on endangered salmon species while minimizing the economic impacts to agriculture.

Identifying Viable Mitigation for Reducing Malathion Pollutant Loading to Streams

WSDA is working cooperatively with the Washington Red Raspberry and Blueberry Commissions to conduct a study assessing the effectiveness of streamside vegetation in reducing pesticide loading during aerial applications of malathion. The Biological Opinion (BiOp) for malathion is scheduled to be completed by 2017, and WSDA worked closely with National Marine Fisheries Service (NMFS) to design a study that would generate data that could offer growers buffer mitigations when the BiOp is complete. The goal is to assess aerial (helicopter) applications of malathion to red raspberry and blueberry plants in Whatcom County during the Summer of 2015. The sites will include three raspberry (two vegetated, one control) and three blueberry (two vegetated, one control) fields. Both water and depositional samples will be collected.

Assessing Effectiveness of Pesticide Rule Pertaining to Cranberry Growing Areas

Since 2011 WSDA has conducted surface water monitoring and provided technical assistance to growers of cranberries in the Grayland, Washington area. Using the EPA-approved *Pesticide Management Strategy*, and implementation of new regulations, WSDA sampled the Grayland Ditch for two insecticides, residues of which resulted in the waterbody's listing on the states class 5 303(d) list. The results of the sampling show continued improvement and were the basis for a targeted effort by WSDA compliance staff to assess operations at each farm in the area. Sampling will continue in 2015, coinciding with the application of the insecticides to assess progress and compliance with the rule.

Tribal Monitoring

Most of the monitoring reported by tribal governments has a geographic focus at the watershed level and, to a lesser degree, upon the area within the jurisdictional boundaries. More information on monitoring programs conducted by tribal governments is available in Crawford et al. (2003).

Local Government Monitoring

Most of the monitoring conducted by local governments has a geographic focus at the watershed level and, to a lesser degree, upon the area within the local government's jurisdictional boundaries. Only 26% of local governments surveyed for the Comprehensive Monitoring Strategy (2002) had been monitoring for more than five years. More information on monitoring programs conducted by local governments is available in Crawford et al. (2003).

Effectiveness Monitoring

Effectiveness monitoring uses a combination of monitoring types to evaluate whether specified activities have achieved the desired effect. It is an essential component to the adaptive management process when BMPs are implemented to control human-caused pollution. It is also one of the several required components when (1) we develop Total Maximum Daily Loads (TMDLs) or other watershed-based pollution control plans, or (2) state and federal funds are used to implement nonpoint-source pollution control strategies.

In Washington State, the Department of Ecology is the agency primarily responsible for implementing the requirements and provisions of the Clean Water Act, including monitoring the effectiveness of water pollution cleanup plans. In 2013, Ecology released the guidance document “*Guidance for Effectiveness Monitoring for Total Maximum Daily Loads in Surface Waters*” (Collyard, S 2013). This document will serve as a guide for determining the effectiveness of TMDL projects and other water quality clean-up efforts, and informing adaptive management.

Effectiveness monitoring evaluates whether management activities have achieved the desired effect. Rather than monitoring the effectiveness of a particular project, it is the intent of Ecology’s NPS effectiveness monitoring program to measure the cumulative effect of all activities in the watershed.

Effectiveness monitoring is a fundamental component of any water clean-up project and its associated implementation activity. It is an important tool in the adaptive management process because it informs and allows restoration strategies to be adjusted if clean-up goals are not being achieved. If implemented thoughtfully, it will increase the likelihood that activities to control NPS pollution will succeed.

The benefits of effectiveness evaluation include:

- More efficient allocation of funding.
- Optimization in planning/decision-making (program benefits).
- Watershed recovery status (how much restoration has been achieved, how much more effort is required).
- Adaptive management or technical feedback to refine restoration treatment design and implementation.

The effectiveness evaluation addresses four fundamental questions about restoration or implementation activity:

- Is the restoration or implementation work achieving the desired goal of significant improvement?
- How can restoration or implementation techniques be improved?
- Is the improvement sustainable?
- How can the work become more cost-effective?

Effectiveness Monitoring of the Forest Practices Rules

Ecology is participating in a monitoring program to evaluate the performance of the riparian management prescriptions in the Washington Forest Practices Rules. Statutes and rules governing the Forests & Fish program include a multi-stakeholder monitoring component that systematically evaluates the effectiveness of the forest practices rules. The program includes a full time administrator, a scientific monitoring committee, independent scientific peer review, and a policy committee. To date, the program has completed more than 28 peer-reviewed monitoring and effectiveness studies. Seventeen studies are under way and several more are in the process of being scoped. An additional \$5.9 million/biennium for studies and science is currently being considered by the Washington Legislature and supported by all of the Forests & Fish collaborators. DNR established a compliance monitoring program in 2006 that is now in its fifth biennial measurement cycle. The compliance monitoring team includes specialists from the Ecology and the Department of

Fish and Wildlife. Tribes are also invited to participate. The compliance monitoring has reported on riparian protection and road construction and maintenance activities -- the two areas of forest practices most likely to affect water quality. Each time, substantial overall compliance with the rules exceeds 80% or better.

Forest practices research examines the effectiveness of current and alternative riparian buffering strategies in protecting key water quality (stream temperature, water chemistry, sediment), habitat/channel stability (large woody debris [LWD]), and riparian (vegetation type, mortality rates, LWD recruitment) resources. The following table illustrates the type of projects and the current pace of monitoring the effectiveness of Washington's forestry rules. See the discussion in Chapter 3 for a more detailed discussion of the Forest Practices Rules and the adaptive management program.

Table 7 Projects-Forest Practice Rules Effectiveness

Projects Completed in 2014
Forest Practices and Wetlands Systematic Literature Review
Wetlands Program Research Strategy
Eastside Type N Forest Hydrology (model and characterization)
RMZ birds (response to harvest)
Projects in Study Design or Initial Field Phase in 2015
Eastside Type N Riparian Effectiveness
Unstable Slopes Criteria Evaluation and Development
Westside Type F Riparian Prescription Monitoring
Forested Wetlands Effectiveness Monitoring Study
Road Prescription-Scale Effectiveness Monitoring
Van Dykes Salamander Project
Extensive Alternative (remote sensing pilot study)
Projects Completed or expected in 2015-2016
Tailed Frog Literature Review
Glacial Deep Seated - Develop Research Strategy
Glacial Deep Seated – Literature Review
Buffer Integrity - Shade effectiveness (amphibian response)
Type N Experimental Buffer Treatment Project in Hard Rock Lithologies (initial 2 year post harvest response)
Eastside Riparian Assessment Project (riparian vegetation)
Ongoing Projects to be completed by 2017-2020
Type N Experimental Buffer Treatment Project - Hard Rock-Amphibian Genetics, Nutrients, Temperature – (longer-term effects and recovery pattern analysis)
Type N Experimental Buffer Treatment Project - Soft Rock Lithologies (initial 2 year post harvest response)
Riparian Hardwood Conversion (efficacy – post year 5 and 10)

Unstable Slopes Criteria Evaluation and Development
Projects to be completed or designed after 2020
Eastside Type N Riparian Effectiveness
Westside Type F Riparian Prescription Monitoring
Road Prescription-Scale Effectiveness Monitoring
Van Dykes Salamander Project
Research priorities after 2020
Wetlands Management Zone Effectiveness Monitoring
Wetlands Intensive Monitoring
Road Sub-Basin-Scale Effectiveness Monitoring (Resample)
Watershed Scale Assessment of Cumulative Effects (roads and riparian)
Amphibians in Intermittent Streams
Windthrow Data Synthesis

As these research projects are completed their findings are provided to the Forests and Fish Policy Committee. The Policy committee then determines what action, including changes in regulations or further clarifying research, should be recommended to the State's Forest Practices Board.

Quality Assurance

Most of the monitoring activities conducted by Ecology identify the primary use of the data in a Quality Assurance (QA) Project Plan. Ecology's Executive Policy 22-01 states that "A Quality Assurance Project Plan is prepared for each environmental study/activity that acquires or uses environmental measurement data." It further states that "This policy applies to environmental data collection studies/activities conducted or funded by Ecology." The *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Ecology, 2004b) describes 14 elements to be addressed in a plan and provides supporting information and examples relevant to the content of each element.

Quality assurance and quality control responsibilities for management and staff are described in the most recent *Ecology Quality Management Plan*, which can be found at <http://www.ecy.wa.gov/programs/eap/quality.html>. EPA's approval of the *Quality Management Plan* delegates to Ecology the authority to review and approve QA Project Plans prepared in that agency.

Washington State's Water Quality Assessment has specific quality assurance requirements identified in Water Quality Policy 1-11. Policy 1-11 directs the reader to several sources for guidance on how to develop the proper QA Project Plan.

- Washington State Department of Ecology: *Guidelines for Preparing Quality Assurance Plans for Environmental Studies*, publication 04-03-030 (available at <https://fortress.wa.gov/ecy/publications/SummaryPages/0403030.html>).

- *Sediment Sampling and Analysis Plan Appendix: Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards*, December 1995 Draft.
- Washington State Department of Natural Resources: *Timber/Fish/Wildlife Monitoring Program Method Manual for the Stream Temperature Survey*, TFW-AM9-99-005, DNR publication 107.
- U.S. Environmental Protection Agency: *The Volunteer Monitor's Guide To Quality Assurance Project Plans*, EPA 841-B-96-003.

In 2004, the Washington State Legislature passed the Credible Data Act (engrossed substitute Senate Bill 5957) with the intent to ensure that credible water quality data are used as the basis for the assessment of the status of a waterbody relative to the surface WQ Standards.

The Act requires Ecology to use credible information for:

- Determining whether any water of the state is to be placed on or removed from any Section 303(d) list.
- Establishing a Total Maximum Daily Load (TMDL) for any surface water of the state.
- Determining whether any surface water of the state is supporting its designated use or other classification.

The Act further states that data interpretation, statistical, and modeling shall be those methods that are generally acceptable in the scientific community as appropriate for use in assessing the condition of water.

In collecting and analyzing water quality data for any of these purposes, the Credible Data Act specifies that data will be considered credible if:

- Appropriate quality assurance and quality control procedures were followed and documented in collecting and analyzing water quality samples.
- The samples or measurements are representative of water quality conditions at the time the data were collected.
- The data consist of an adequate number of samples based on the objectives of the sampling, the nature of the water in question, and the indicators being analyzed.
- Sampling and laboratory analysis conform to methods and protocols generally acceptable in the scientific community as appropriate for use in assessing the condition of the water.

Data Management

Environmental Information Management System (EIM and MyEIM)

The Environmental Information Management System (EIM) is the Department of Ecology's main database for environmental monitoring data. EIM is a database containing data collected by the Washington State Department of Ecology and affiliates such as local governments and cleanup sites. EIM contains records on physical, chemical, and biological analyses and measurements. Supplementary information about the data (metadata) is also stored, including information about environmental studies, monitoring locations, and data quality. In 2013, EIM was upgraded and now includes a new search app with an improved map. Many fields were

updated in the database and the ability to accept time series data from field instruments was added.

Finally, MyEIM was added to EIM. It is an advanced toolset for searching and analyzing data. MyEIM replaced SEDQUAL, the former sediments database. MyEIM allows users to customize searches, analyze chemical and biological data, and map EIM data.

<http://www.ecy.wa.gov/eim/>

303(d)/305(b) Integrated Report Viewer (formerly known as WATS)

Washington State's Water Quality Assessment uses the 303(d) / 305(b) Integrated Report Viewer (WATS) to manage the five category listings of waterbody segments in the state. Data come from a variety of Ecology sources as well as sources outside of Ecology. The 303(d) / 305(b) Integrated Report Viewer was upgraded in 2013 with improved search and mapping tools and the ability to create and save queries.

<http://apps.ecy.wa.gov/wats/>

Ecology Administrative Grants and Loans Database (EAGL)

EAGL is an integrated web-based grant and loan management system. EAGL allows Ecology's grant and loan clients to complete grant applications, submit payment requests with progress reports, collect specific BMP implementation data, submit closeout reports, and request amendments online. The system provides a streamlined application and reporting process for both external clients and Ecology staff. EAGL is used to manage State Revolving Fund loans; Centennial Grants; and Clean Water Act Section 319 Grants.

<http://www.ecy.wa.gov/funding/EAGL.html>

Laboratory Information Management System

The Laboratory Information Management System (LIMS) is a database that contains analytical data for samples analyzed by Ecology's Manchester Environmental Laboratory. It is also a software system that provides capabilities in project management, sample scheduling, sample receiving, and sample control. The LIMS also interfaces with analytical instrumentation allowing direct upload of data results. The LIMS provides a platform allowing for statistical analyses of data, quality assurance monitoring and data review, approval and reporting in both electronic and hardcopy formats.

The Pacific Northwest Water Quality Data Exchange

The Pacific Northwest Water Quality Data Exchange (Exchange) comprises a number of related information management projects that collectively seek to facilitate the aggregation of and access to a comprehensive source of data related to water quality in the Pacific Northwest. The project is supported by funds allocated from the EPA Network Challenge Grant program, and with these projects the States are applying the concepts embodied in the National Environmental Information Exchange Network.

<http://deq12.deq.state.or.us/pnwwqx/>

Coastal Atlas

The Coastal Atlas contains information about Washington's marine shorelines and the land areas near Puget Sound, the outer coast, and the estuarine portion of the Columbia River, including public access and beach closures.

<https://fortress.wa.gov/ecy/coastalatlantlas/>

TMDL and Nonpoint Source Implementation Tracking Database

As stated in Chapter 3, tracking implementation data is important for accountability, transparency, effectiveness monitoring, and adaptive management. At a minimum, Ecology will track the following implementation data for TMDLs and STI projects:

- The location of nonpoint source problems identified by Ecology during watershed evaluations.
- Sites that Ecology contacted after the evaluations.
- The BMPs that were implemented in the watershed and their location.

A specific description of the BMPs that are implemented at a site is the most important information to track to support effectiveness monitoring efforts and promote accountability and transparency. For BMPs implemented with funds from an Ecology grant, specific information is collected on our BMP approval form. For other BMPs implemented in support of a TMDL or STI, Ecology will collect data consistent with the BMP approval form. Additionally, we will work with partners to promote the collection of consistent implementation data and share that data with partners and the public.

Finally, to support implementation tracking, Ecology is working to develop a TMDL and Nonpoint implementation database.

Chapter 8: Groundwater

A majority of Washington State citizens (approximately 60%) get drinking water from groundwater. Not counting Seattle, which is supplied by a surface water reservoir, the percentage of citizens who rely on groundwater is even higher. In fact, most rural residents get water from groundwater wells, although some get water from springs and surface water. A significant number of wells in specific areas of the state have been shown to violate standards. Impacts to groundwater are not distributed evenly throughout the state.

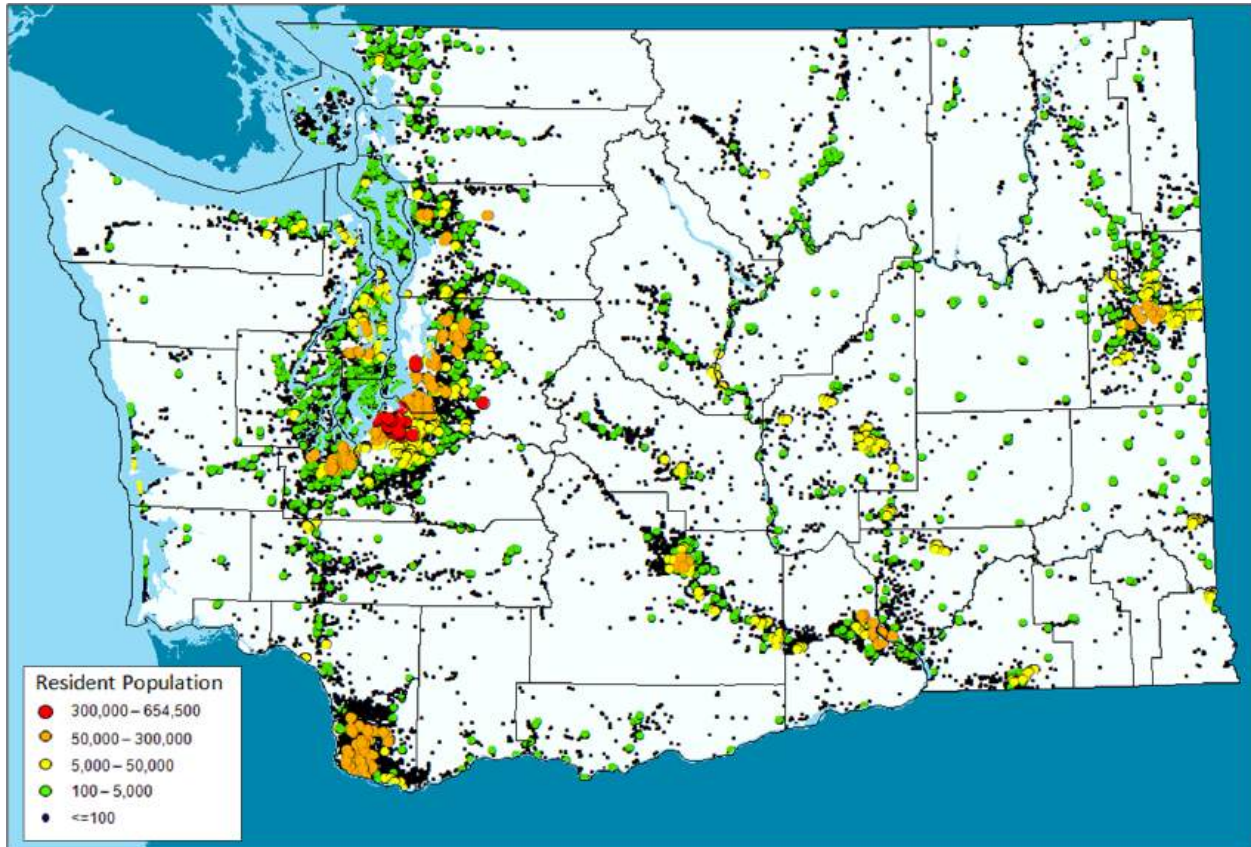


Figure 3 Public water supply system groundwater sources

Because groundwater is recharged from precipitation and snow melt, various chemicals and constituents of other materials used or dumped on the ground's surface can infiltrate into the ground, and pollute groundwater. Once these pollutants enter groundwater, they can be difficult to detect by taste or smell, and difficult to remove. The pollutants can then end up in drinking water and water used for irrigation. Because groundwater also supplies many of our rivers and streams, especially in the late summer, pollutants such as nutrients in groundwater can end up in those water bodies and negatively affect surface water quality.

The most typical nonpoint pollutants associated with groundwater pollution are nitrates, pathogens, and chemical constituents of pesticides, fungicides and herbicides. Failed residential septic systems, forestry and agriculture are common sources of these pollutants.

The affects of nonpoint source pollution of groundwater is costly. Costs are typically incurred when wells must be deepened or replaced, treatment systems are installed and maintained, water delivery infrastructure to alternative sources are developed, and when bottled water has to be supplied to affected citizens until permanent clean water sources can be secured.

For example, millions of dollars have been spent to address nitrate contamination of groundwater in Washington State. Royal City alone had to remove an existing well due to high nitrates and then construct a new well at a cost of nearly \$1.5 million dollars (Washington State Dept. of Health, 2012).

Causes of Nonpoint Pollution in Groundwater

Cities, rural residences, agriculture, and forestry can all contribute to nonpoint pollution of groundwater. Pesticides and fertilizers are used on crops, lawns, park fields, and golf courses. Animal manure is used as a fertilizer, and human waste is delivered to the ground by septic systems or land application of biosolids. Constituents of fertilizers, pesticides, and septic waste have all migrated to groundwater, causing groundwater pollution in multiple areas of the state. There are demonstrably many locations in various areas of the state where nitrate has exceeded 10 mg/L in groundwater. Over-application of commercial fertilizers and manure in sensitive areas is a nonpoint nitrate contamination source.

Regulatory Framework Nonpoint Pollution Control for Groundwater

Water Pollution Control Act

Under Chapter RCW 90.48 RCW, Ecology has authority for water pollution control. Under RCW 90.48.030, Ecology has the jurisdiction to “control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, water courses, and other surface and underground waters of the state of Washington.”

Under RCW 90.48.80 it is illegal to pollute waters of the state including groundwater. Discharges to waters of the state, including groundwater, require a State Waste Discharge Permit.

Ground WQ Standards

Groundwater Quality Standards list criteria for a variety of groundwater contaminants. The numeric criteria values and the narrative standards represent contaminant concentrations which are not to be exceeded in groundwater.

WQ Standards are designed to protect the beneficial uses of the waters of the state. Examples of such beneficial uses are drinking water and other domestic uses, stockwatering, industrial, commercial, and agricultural uses, and fish and wildlife maintenance and enhancement. For example, the criteria for nitrate is 10 mg/L, which is established to protect drinking water uses.

Washington's Groundwater Quality Standards require that groundwater is kept as clean as possible and to prevent man-made groundwater pollution. To achieve this, dischargers must implement "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to reduce the contaminant load sufficiently to assure the criteria will not be exceeded, and AKART must be applied to all wastes prior to entry into groundwater.

Additionally, antidegradation policy mandates the protection of background water quality, and prevents degradation of water quality which would harm a beneficial use or violate the Groundwater Quality Standards. Whenever groundwaters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected. Additional treatment may be necessary to achieve the antidegradation policy.

Washington State's Safe Drinking Water Act

Washington has a formal agreement with the Environmental Protection Agency (EPA) (PDF, 75 KB) for meeting the requirements of the federal Safe Drinking Water Act (SDWA), which was passed in 1974 and amended in 1986 and 1996.

The SDWA includes WQ Standards, sampling, treatment, and public notification requirements. The 1996 amendments added new requirements related to annual water quality reports, operator certification requirements, system capacity, and source water assessment and protection.

Generally, the SDWA applies to water systems with 15 or more connections, or those regularly serving 25 or more people daily, 60 or more days per year. Approximately 4,200 public water systems in Washington are subject to the SDWA.

Current Groundwater Pollution Control for Nonpoint Sources

Nonpoint pollution control programs that have a nexus to groundwater in Washington State include the following:

Washington State Department of Ecology

Ecology has regulatory authority to prevent pollution, require the Groundwater Quality Standards to be complied with and require that dischargers to waters of the state obtain a permit. Permits include the Concentrated Animal Feeding Operation General Permit, Biosolids General Permit and individual State Waste Discharge permits for land application of wastewater.

Ecology has regulatory authority over Ground Water Management Areas, which apply both to water resources and water quality. The department also administers state financial assistance for pollution prevention/mitigation through grants and loans.

Washington State Department of Agriculture

Washington State Department of Agriculture (WSDA) administers the following programs:

- Dairy Program under the Dairy Nutrient Management Act.

- Pesticide use, which regulates the use of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

On-Site Sewage System Regulation

See Chapter 3 for more information on the regulation of on-site sewage systems.

Washington State Department of Health Drinking Water Program

The DOH Drinking Water program requires that public water systems inventory potential contamination sources within their wellhead protection zones and report results to the state.

Ground Water Management Areas (GWMAs)

Washington State Law (RCW 90.44.400) allows the Department of Ecology to identify groundwater management areas in order to protect groundwater quality, to assure groundwater quantity, and to provide for efficient management of water resources for meeting future needs. The intent of GWMAs is to develop partnerships between local, state, tribal and federal interests to cooperatively protect the state's groundwater resources. Chapter 173-100 WAC establishes rules for establishing GWMAs.

Columbia Basin Ground Water Management Area

The Columbia Basin GWMA consists of Adams, Franklin, Grant and Lincoln counties. Nitrate control efforts focused on voluntary incentives. Incentives included distributing cost-share funds for converting irrigation systems to conserve water. They also conducted soil tests so that producers could find out how much nitrogen was being lost below the root zone. This was an educational effort to encourage producers to use less fertilizer.

Lower Yakima Valley Groundwater Management Area

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

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

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

Pollution prevention will be a guiding principle for all work in the Yakima GWMA. Further, they are looking to get nitrate contamination addressed by:

- Identifying the primary sources of nitrate contamination using scientific data.
- Identifying or develop practices that will minimize nitrate contamination of groundwater.
- Developing a plan that recommends strategies for implementing improved practices.

- Providing appropriate education and outreach on health risks and how to prevent exposure.

Nitrate

Nitrate is a primary indicator of nonpoint groundwater pollution and is one of the most widespread known nonpoint contaminants of groundwater in Washington State. Groundwater contamination by nitrate has increased as use of fertilizer, and manure production has increased, and the population of the state has increased.

Many studies over the years have clearly demonstrated that there are areas of the state where groundwater has been particularly susceptible to contamination from nonpoint sources. Both public water supply wells and individual residential wells have been contaminated in multiple areas of the state. The detection of excessive levels of nitrate in groundwater also indicates that chemicals used on land can reach groundwater.

The primary way nitrate pollution of groundwater is prevented and controlled is to reduce loading at the land surface. Nitrate is needed to grow crops, and this makes it especially challenging to regulate as a pollutant. Loading can be reduced by applying only what is needed by growing crops and lawns; timing nutrient applications closest to plant utilization; placing nutrients away from surface waters; eliminating late season nutrient applications; and managing irrigation to prevent over-watering and subsequent nitrate leaching.

Although most drinking water wells in Washington State have not been contaminated by nitrates (see Figure 5 at the end of this chapter), a significant number in specific areas have (see Figure 4 at the end of this chapter). Among others, these include the Sumas Blaine Aquifer in Whatcom County, the Lower Yakima Valley, and the Columbia Basin. Millions of dollars have been spent to cope with nitrate contamination of groundwater.

- Sumas Blaine aquifer in Whatcom County is impacted. Several public water supply systems are under state compliance orders for exceeding the nitrate limit. New treatment systems are being installed, bottled water is being provided and the area is investigating ways to transport in clean water.
- The Columbia Basin GWMA was formed to address widespread nitrate contamination in Adams, Franklin, Grant and Lincoln Counties.
- In the Lower Yakima Valley many people depend on ground water as a drinking water source. Past study results show that 12% of the valley's wells that have been tested do not meet drinking WQ Standards for nitrate. About 20% have elevated levels of nitrates, and many are above the background level for the area.

Nitrate Prioritization Project

This project was an outcome of a multi-agency discussion, at the director level which focused on how resource agencies could coordinate their data to produce tools to help address identified water quality concerns. This project aggregated available groundwater data throughout the state

to identify areas where nitrate contamination of groundwater is of greatest concern, and to examine information that would help us understand why these areas are more at risk of contamination than other area.

Objectives:

- Identify areas of the state where groundwater has been contaminated by nitrates.
- Examine the conditions that lead to contamination.
- Prioritize these areas by the affected population and severity of contamination.

Through the nitrate prioritization project, Ecology collected and aggregated nitrate sampling data collected by the U.S. Geological Survey, DOH and Ecology. The sampling history shows where monitoring was done and where nitrates were found to be high.

Ecology also examined the conditions that lead to contamination. This information is used to understand where the nitrate contamination “hot spots” are in our state. Based on the nitrate monitoring data and examination of regional conditions, Ecology developed preliminary nitrate prioritization boundaries and risk categories. These area boundaries and categorization may change upon review.

Maps in the report show statewide landscape patterns of conditions that tend toward nitrate contamination of groundwater or indicate these conditions are present. These include where soils and geologic materials drain water quickly, where loading sources are concentrated and where numerous wells that have tested for high nitrates are clustered.

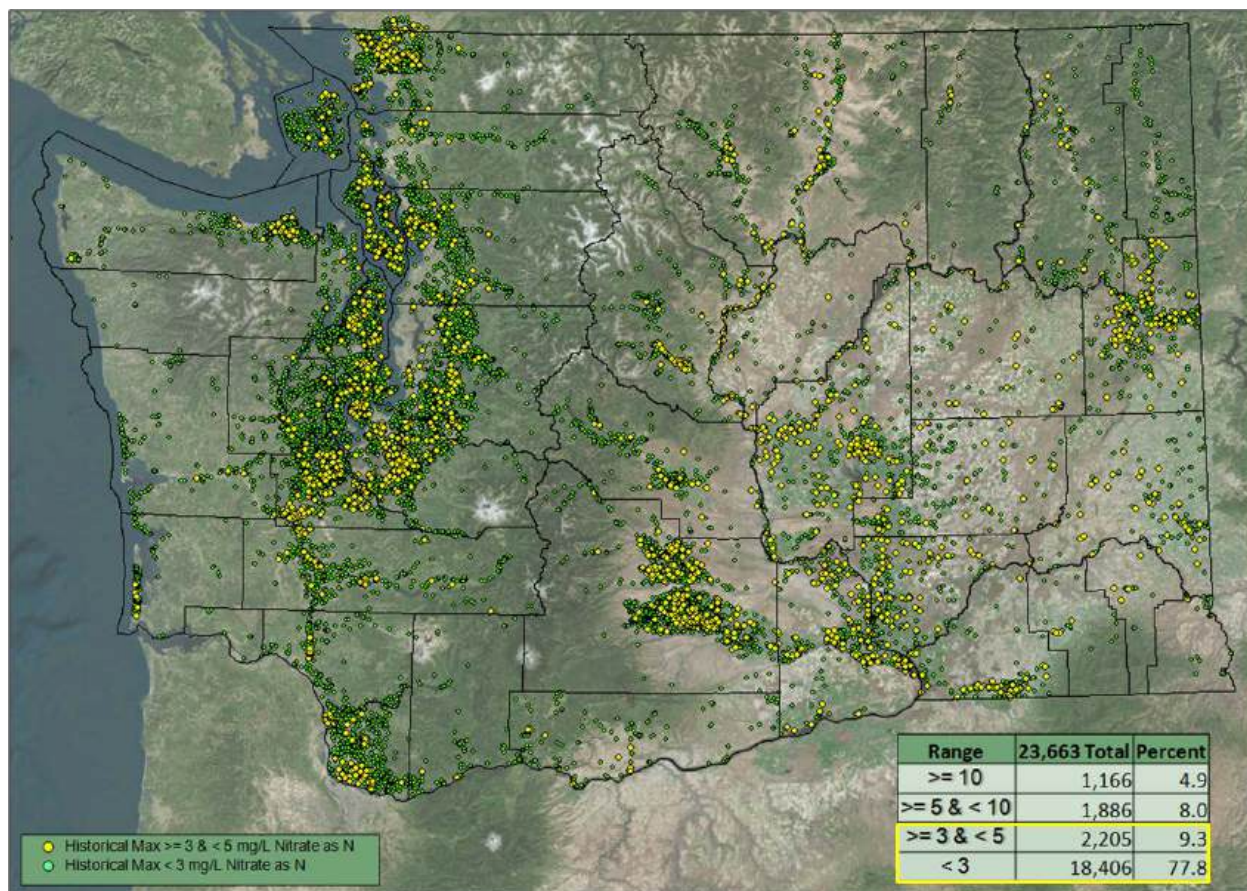


Figure 4 Groundwater Nitrate Sample Record Max <5 mg/L as N.

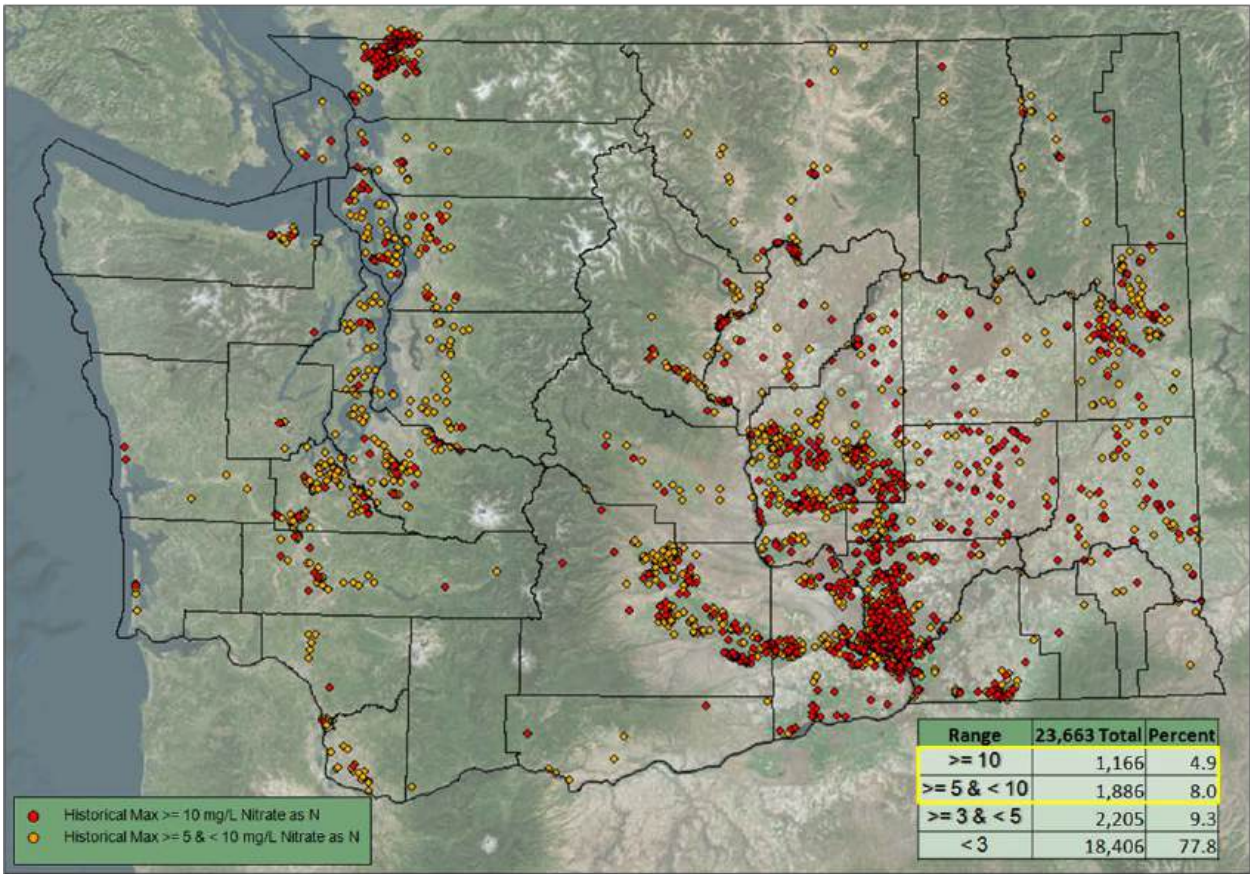


Figure 5 Groundwater Nitrate Sample Record Max >5 mg/L as N.

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Chapter 9: Goals and Strategies

This chapter addresses Element No. 1 of the “*Key Components of an Effective State Nonpoint Source Management Program*” guidance issued by the USEPA in April 2013. It contains set of goals, objectives, and strategies to restore and protect surface water and groundwater in Washington State. The table also provides measurable outputs that could be used to track progress and specific measurable milestones that will be used over the next five years.

Ecology’s ultimate goal for tracking our goals, strategies, and accomplishments is to use a database instead of the following table. Use of a database would offer several advantages:

1. Track implementation in real time, instead of simply providing a snapshot in time.
2. Provide an up-to-date accounting of what’s been implemented and what hasn’t.
3. Contain information that would help us assess the effectiveness of our implementation work and to make management decisions if we need to change or adapt strategies.

Table 8 Goals, Objectives, Strategies and Measurable Milestones

Goal 1: Clean-up impaired waters and meet water quality standards.			
<i>Objectives</i>	<i>Strategies</i>	<i>Measurable Outputs</i>	<i>Measurable Milestones (2015-2020)</i>
Provide incentives to drive implementation of watershed based plans.	Provide grants and loans to applicants for projects that will meet WQ Standards, ensure compliance with state law and implement a watershed based plan.	Number and types of BMPs implemented. Number of sites where complete suites of BMPs were implemented.	
Develop and implement watershed clean-up plans (TMDLs and STI projects).	Complete TMDLs and STI individual work plans that include all elements of a watershed based plan.	- Number of TMDLs and STI workplans completed. - Number of watershed evaluations completed. - Number of sites identified as having nonpoint source pollution problems. - Number of these sites that now have BMPs that protect water quality - Number and type of BMPs implemented to address nonpoint sources of pollution. - Watersheds where we are doing effectiveness monitoring and results of that effectiveness monitoring	Complete 265 TMDLs/STI by 2020 (average 53 per year).
	Implement TMDLs and STIs.		- Focus on a minimum of 8 priority watersheds to implement our nonpoint strategy per year. - In the 8 watersheds implement 10% of the STI/TMDL per year.
	Completing watershed evaluations. - Identify sites with nonpoint pollution sources. - Implement BMPs (stormwater, septic, forestry, agricultural) that ensure compliance with the WQ Standards.		
	If working in agricultural areas, implement the key changes to Ecology's Watershed evaluation process as recommended by the Agriculture and Water Quality Advisory Committee.		
Respond to complaints received.	Resolve complaints received by confirming whether a water quality problem exists and implementing BMPs as necessary.	- Number of complaints received, and responded to by Ecology. - Number of complaints resolved.	Respond to 100% of complaints received.
Support local PIC Programs that help meet WQ Standards and promote compliance with state law	- Ecology and DOH will provide technical and policy support to develop PIC programs as necessary. - Ecology will provide a regulatory backstop for PIC programs as necessary.	- Number of PIC programs developed. - Number and type of BMPs implemented to address nonpoint sources of pollution.	4 PIC programs established in accordance with DOH and Ecology guidance.

Support market based programs that help meet WQ Standards and support compliance with state law.	Support water quality trading programs that address WQ Standards and promote compliance with state law. - Continue to coordinate with regional partners in Idaho, Oregon and EPA Region 10 as water quality trading markets emerge in the Pacific Northwest. - Coordinate with State Conservation Commission to complete its project of determining whether there are potential credit purchasers.(add bill number) - Provide technical and policy support to develop water quality trading programs as necessary.	- Number and type of BMPs implemented to address nonpoint sources of pollution in these programs. - Conservation Commission report completed. - Number of NPDES Permits using water quality trading as a method to meet their permit limits.	
	Support certification/certainty programs address WQ Standards and promote compliance with state law. - Support the implementation of the Farmed Smart certification program. - Continue to coordinate with the Pacific Northwest Direct Seed Association on the Farmed Smart Certification. - Work with other groups interested in similar certification or certainty programs.	- Number of acres enrolled in the Farmed Smart program. - Number of certification or certainty programs developed with Ecology support. - Number of BMPs implemented to address nonpoint sources of pollution.	
Support no discharge zone designation for the Puget Sound.	Complete final petition to EPA.	Marine waters with no discharge zone designation.	Submit final petition to EPA by 2020 or earlier.
Work to coordinate our nonpoint program with state initiatives.	Support the Governor's Results Washington	Each one of these initiatives has its own set of performance measures that have a connection to the goals and strategies in the Nonpoint Source Plan. More information on these initiatives is found in Chapter 3.	
	Support the Washington Shellfish Initiative		
	Support the Puget Sound Action Agenda		
	Support the Marine Resources Advisory Council and efforts to address ocean acidification.		
	Support Salmon Recovery in Washington		
	Support Chemical Action Plans (CAP) Development		

Support implementation of other state authorities and promote consistency with the WQ Standards.	Support the implementation of forest practice rules statewide.	- Periodic reviews of the Forest Practices Rules adaptive management program and the Clean Water Act Assurances performed. - MOU between Ecology and WSDA is followed and updated as necessary. - Continue to fund projects that will address failing OSS.	
	Support implementation of the Dairy Nutrient Management Program.		
	Ecology and WSDA continue to work on the gaps identified in the Dairy Nutrient Management Act.		
	Support DOH and LHJ implementation of OSS laws.		
Support education and outreach and support for voluntary programs.	Use public education and outreach to build support of Ecology's nonpoint program by explaining nonpoint problems in clear and engaging language and pictures.	- Number of workshops. - Number of students/attendees. - Number of outreach tools used to explain nonpoint issues.	
	Support partners' education and outreach programs and voluntary programs		
Goal 2: Ensure clear standards			
Objectives	Strategies	Measurable Outputs	Measurable Milestones (2015-2020)
Identify BMPs and measures that are designed to comply with the WQ Standards and contribute to the protection of beneficial uses of the receiving waters, and ensure compliance with state and federal law. Utilize best available science.	Support updates to the forest practice rules based on adaptive management process.	- Number and type of efforts Ecology initiates or participates in to achieve this goal. - Completed BMP guidance in the form of manuals, compendiums or other guidance documents for each category of nonpoint pollution.	- Complete gaps analysis as outlined in Chapter 6 by the end of 2016. - Develop a process to address gaps in BMP guidance for agricultural activities by June 15, 2016. - Complete guidance for all categories of nonpoint pollution where gaps have been identified by June, 30, 2020.
	Support updates to stormwater manuals.		
	Continue work to provide information about what BMPs or suites of BMPs Ecology considers provide presumed compliance with state water quality laws.		
	Support DOH in updates to Washington's OSS rules if needed.		

Goal: 3 Develop and strengthen partnerships			
<i>Objectives</i>	<i>Strategies</i>	<i>Measurable Outputs</i>	<i>Measurable Milestones (2015-2020)</i>
Strengthen relationships and receive input from stakeholders.	Continue using the Agriculture and Water Quality Advisory Committee to receive input and recommendations from agriculture stakeholders, environmental stakeholders and tribes on agriculture related issues.	- Ideas generated by these groups are used by Ecology to improve its work, to improve communication and understanding, and to help Ecology put improved policy and procedural changes into practice. - Number of meetings at which Ecology solicits ideas for improvement.	Hold a minimum of 4 meetings per year for each group.
	Continue using the Financial Assistance Council to receive input from stakeholders on Ecology administrated grants and loans.		
	Continue using the Water Quality Partnership to maintain a dialogue with key interests on our nonpoint source pollution work.		
Strengthen relationships with federal and state agencies, and local governments and special purpose districts.	Coordinate with local governments and special purpose districts including conservation districts, and local health districts.	- Regional staff meet with CDs to talk about regional nonpoint priorities. - Meetings with the other resources agencies on water quality and better aligning programs to meet water quality standards.	Hold a minimum of 4 meetings with NRCS.
	Coordinate with other state agencies - Implement MOA with Department of Agriculture - Support DNRs implementation of the forest practices rules. - Continue to meet with state agencies to better coordinate work. Examples of agencies that we will coordinate with include the SCC, WDFW, Commerce, RCO, DOH, and PSP,		
	Coordinate with state and federal land managers to ensure they meet the WQ Standards and prevent nonpoint pollution from reaching state waters.		
	Coordinate with federal agencies.		
	Coordinate with Interagency Team to receive input on how to improve the Water Quality Assessment and TMDL programs in Washington.		

Strengthen relationships with Tribes.	Coordinate with tribes. Invite tribes to provide input on nonpoint policy development early in the process.		
Strengthen relationships with producer groups and agricultural producers.	Find opportunities to meet with producer groups and producers to explain nonpoint issues.	• Number of producer groups Ecology staff met with. • Increased implementation rates of BMPs that ensure compliance with the water quality standards as a result of meetings with producer groups and producers.	
Goal 4: Monitor waters for nonpoint source impairments, and program effectiveness.			
<i>Objectives</i>	<i>Strategies</i>	<i>Measurable Outcomes</i>	<i>Measurable Milestones (2015-2020)</i>
Continue monitoring efforts.	• Perform monitoring in locations and using methods that help Ecology make management decisions. • Ensure all Ecology monitoring efforts are supported with up-to-date QAPPs. • Ensure all Ecology funded monitoring efforts are supported with up-to-date QAPPs and work with partners to ensure the use of QAPPs for monitoring efforts and studies that will be used by Ecology.	• All projects (both Ecology projects and external projects) are guided by QAPPs. • All QAPPs are approved by Ecology environmental assessment program before data collection begins.	100% of Ecology led projects have an approved QAPP.
Effectiveness Monitoring.	Ensure adequate implementation data is collected prior to starting effectiveness monitoring.	• Number of effectiveness monitoring projects performed in which there is adequate implementation data to determine whether or not our efforts are driving a change in water quality.	Initiate 3 effectiveness monitoring studies per year in TMDL/STI watersheds.

Goal 5: Ecology will administer its Nonpoint Source Program as effectively and efficiently as possible.			
<i>Objectives</i>	<i>Strategies</i>	<i>Measurable Outcomes</i>	<i>Measurable Milestones (2015-2020)</i>
Align the nonpoint program with other relevant programs.	Align the nonpoint program with the following programs: • TMDL • CZARA • Point source program • National estuary program.	• Annual Section 319 project reports document accomplishments in aligning programs.	
Promote accountability.	Develop TMDL and nonpoint implementation tracking system. Continue support of EAGL. Continue using BMP approval form to track specific BMP implementation metrics. Work with partners to collect consistent implementation data. Information about projects funded with 319 funds entered into GRTS.	• TMDL/nonpoint implementation tracking system completed. • Grants Reporting Tracking System (GRTS) data entered by EPA deadlines. • Ecology identifies gaps in implementation data.	• Initiate work on a TMDL/nonpoint implementation tracking system by the end of 2016. • Achieve the following estimated reductions per year: - o 14,000 lbs. of phosphorous. - o 8,000 tons of sediment. - o 40,000 lbs. of nitrogen. • 70 OSS repair/replacement projects completed by SRF/Centennial funded local loan programs.
Keep the nonpoint program up-to-date.	Update plan as necessary but at least once every five years. Complete interim updates as necessary.	• Nonpoint plan updated in 2020 or before. • Interim updates completed to new certainty programs or other accomplishments as soon as they are achieved.	One updated plan submitted to EPA in 2020.
Administer grants and loans.	Oversight of grants and loans ensures that projects proposed are completed and that public money is spent appropriately.	• Final project reports document that project was completed. • Projects are closed out as soon as possible after completion.	

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Appendices

Appendix A. Assessment of Nonpoint Pollution in Washington State

Appendix A, which includes the report titled *Assessment of Nonpoint Pollution in Washington State* is attached as a separate pdf on the web. See also:

<https://fortress.wa.gov/ecy/publications/SummaryPages/1403028.html>

Appendix B. Letter from Ron Lavigne, Assistant Attorney General

Ecology's authority to prevent Nonpoint Source Pollution and Require Implementation of Management Measures



STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000

TTY 711 or 800-833-6388 (For the Speech or Hearing Impaired)

MEMORANDUM

July 14, 2004

TO: HELEN BRESLER, Water Quality Program

FROM: RONALD L. LAVIGNE, Assistant Attorney General *RL*

SUBJECT: **Ecology's Authority to Prevent Non-Point Source Pollution and Require Implementation of Management Measures**

This memo is in response to your request for a legal analysis of Ecology's authority to prevent non-point source pollution and to require implementation of management measures. As discussed below, it is my opinion that ch. 90.48 RCW provides Ecology with statutory authority to both prevent non-point source pollution and require implementation of Section 6217 management measures pursuant to the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA).

RCW 90.48.030 specifically gives Ecology the jurisdiction "to control and prevent the pollution of . . . waters of the state of Washington." Pollution is broadly defined in RCW 90.48.020 and includes the contamination or other alteration of the physical, chemical or biological properties of any waters of the state. Under state law, it does not matter whether the pollution comes from a point or a non-point source, all pollution of state waters is subject to Ecology's authority to control and prevent pollution.

RCW 90.48.080 makes it unlawful for any person to "cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged . . . any organic or inorganic matter that shall cause or tend to cause pollution of" waters of the state. Any person who violates or creates a substantial potential to violate the provisions of ch. 90.48 RCW is subject to an enforcement order from Ecology pursuant to RCW 90.48.120. Ecology is authorized to "issue such order or directive as it deems appropriate under the circumstances[.]" RCW 90.48.120.

It is worth noting that while RCW 90.48.120 gives Ecology the authority to take action in response to non-point source pollution, the statute also gives Ecology the authority to take action based on a "substantial potential" to pollute state waters via either a point or non-point source. Consequently, Ecology not only has authority to take action following non-point source pollution but has specific statutory authority to act proactively to prevent non-point source pollution from occurring in the first place. Ecology's authority includes the authority to require a non-point source polluter to implement specific management measures. Ecology's authority can be used to prevent nonpoint pollution and require 6217 management measure implementation, as necessary.

For the reasons set out above, it is my opinion that the department of Ecology has the statutory authority to prevent non-point source pollution and to require implementation of specific management measures to address non-point source pollution.

RL:tmr



Appendix C. Minimum Elements of a Watershed-based Plan

Although many different elements may be included in a watershed plan, EPA has identified nine minimum elements that are critical for achieving improvements in water quality. In general, EPA requires that nine-element watershed-based plans (WBPs) be developed prior to implementing project(s) funded with § 319 watershed project funding. In many cases, state and local groups have already developed watershed plans and strategies for their rivers, lakes, streams, wetlands, estuaries, and coastal waters that address some or all of the nine elements. EPA encourages states to use these plans and strategies, where appropriate, as building blocks for developing and implementing WBPs. If these existing plans contain all nine elements listed below, they can be used to fulfill the WBP requirement for watershed projects. If the existing plans do not address all nine elements or do not include the entire watershed planning area, they can still provide valuable components to inform, develop, and update WBPs.

For example, some watershed management plans contain information on hydrology, topography, soils, climate, land uses, water quality problems, and management practices needed to address water quality problems, but lack the quantitative analysis of current pollutant loads or expected load reductions from proposed management practices. In this case, the WBP developer could incorporate such existing information into the plan to help fulfill the nine WBP elements. If separate documents contain information that help meet the following list of nine WBP elements, but are too lengthy to be included in the WBP, they can be summarized and referenced in the appropriate sections of the plan, as long as the information is readily available.

Note: EPA recognizes that in select cases (outlined in section IX.B.ii of these guidelines) alternatives to WBPs can provide an effective roadmap to achieve the water quality goals of a § 319 funded watershed project. These alternative plans do not need to address the following nine elements, but must include the planning components listed in section IX.B.ii of these guidelines. EPA still encourages plan developers to build on prior planning efforts and incorporate related information, as described previously, when developing these alternative plans.

Nine Elements of Watershed-based Plans (WBPs)

Following are the nine elements, as well as short explanations of how each element fits in the context of the broader WBP. Although they are listed as *a* through *i*, they do not necessarily take place sequentially. For example, element *d* asks for a description of the technical and financial assistance that will be needed to implement the WBP, but this can be done only after you have addressed elements *e* and *i*.

The level of detail needed to address the nine elements of WBPs will vary in proportion to the homogeneity or similarity of land use types and variety and complexity of pollution sources. For example, densely developed urban and suburban watersheds often have multiple sources of pollution from historic and current activities (Superfund sites, point sources, solid waste disposal, leakage from road salt storage, oil handling, stormwater-caused erosion, road maintenance, etc.), in addition to some agricultural activities. Plans will be more complex than in predominantly rural settings in these cases. For this reason, plans for urban and suburban

watersheds may need to be developed and implemented at a smaller scale than watersheds with agricultural lands of a similar character.

Element a. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level along with estimates of the extent to which they are present in the watershed (e.g., X number of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; Y acres of row crops needing improved nutrient management or sediment control; or Z linear miles of eroded streambank needing remediation).

What does this mean?

Your WBP source assessment should encompass the watershed of the impaired waterbody(ies) throughout the watershed, and include map(s) of the watershed that locates the major cause(s) and source(s) of impairment in the planning area. To address these impairments, you will set goals to meet (or exceed) the appropriate WQ Standards for pollutant(s) that threaten or impair the physical, chemical, or biological integrity of the watershed covered in the plan.

This element will usually include an accounting of the significant point and nonpoint sources in addition to the natural background levels that make up the pollutant loads causing problems in the watershed. If a TMDL or TMDLs exist for the waters under consideration, this element may be adequately addressed in those documents. If not, you will need to conduct a similar analysis (which may involve mapping, modeling, monitoring, and field assessments) to make the link between the sources of pollution and the extent to which they cause the water to exceed relevant WQ Standards.

Element b. An estimate of the load reductions expected from management measures.

What does this mean?

On the basis of the existing source loads estimated for element *a*, you will similarly determine the reductions needed to meet WQ Standards. After identifying the various management measures that will help to reduce the pollutant loads (see element *c*), you will estimate the load reductions expected as a result of implementing these management measures, recognizing the difficulty in precisely predicting the performance of management measures over time.

Estimates should be provided at the same level as that required in the scale and scope described in element *a* (e.g., the total load reduction expected for dairy cattle feedlots, row crops, eroded streambanks, or implementation of a specific stormwater management practice). For waters for which TMDLs have been approved or are being developed, the plan should identify and incorporate the TMDLs. The plan needs to be designed to achieve the applicable load reductions in the TMDLs. Applicable loads for downstream waters should be included so that water delivered to a downstream or adjacent segment does not exceed the WQ Standards for the pollutant of concern at the water segment boundary. The estimate should account for reductions in pollutant loads from point and nonpoint sources identified in the TMDL as necessary to attain the applicable WQ Standards.

Element c. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in element b, and a description of the critical areas in which those measures will be needed to implement this plan.

What does this mean?

The plan should describe the management measures that need to be implemented to achieve the load reductions estimated under element b, as well as to achieve any additional pollution prevention goals outlined in the watershed plan (e.g., habitat conservation and protection). Pollutant loads will vary even within land use types, so the plan should also identify the critical areas (critical areas are those producing disproportionately high pollutant loads) in which those measures will be needed to implement the plan. This description should be detailed enough to guide needed implementation activities throughout the watershed, and can be greatly enhanced by developing an accompanying map with priority areas and practices. Thought should also be given to the possible use of measures that protect important habitats (e.g. wetlands, vegetated buffers, and forest corridors) and other non-polluting areas of the watershed. In this way, waterbodies would not continue to degrade in some areas of the watershed while other parts are being restored.

Element d. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.

What does this mean?

You should estimate the financial and technical assistance needed to implement the entire plan. This includes implementation and long-term operation and maintenance of management measures, information/education (I/E) activities, monitoring, and evaluation activities. You should also document which relevant authorities might play a role in implementing the plan. Plan sponsors should consider the use of federal, state, local, and private funds or resources that might be available to assist in implementing the plan. Shortfalls between needs and available resources should be identified and addressed in the plan.

Element e. An information and education component used to enhance public understanding of the plan and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.

What does this mean?

The plan should include an involvement effort (I/E) component that identifies the education and outreach activities or actions that will be used to implement the plan. These I/E activities may support the adoption and long-term operation and maintenance of management practices and support stakeholder involvement efforts.

Element f. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.

What does this mean?

You should include a schedule for implementing the management measures outlined in your watershed plan. The schedule should reflect the milestones you develop in *g*, and you should begin implementation as soon as possible. Conducting baseline monitoring and outreach for implementing water quality projects are examples of activities that can start right away. It is important that schedules not be “shelved” for lack of funds or program authorities; instead, they should identify steps towards obtaining needed funds as feasible.

Element g. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.

What does this mean?

The WBP should include interim, measurable implementation milestones to measure progress in implementing the management measures. These milestones will be used to track implementation of the management measures, such as whether they are being implemented according to the schedule outlined in element *f*, whereas element *h* will develop criteria to measure the effectiveness of the management measures by, for example, documenting improvements in water quality. For example, a watershed plan may include milestones for a problem pesticide found at high levels in a stream. An initial milestone may be a 30% reduction in measured stream concentrations of that pesticide after 5 years and 50 percent of the users in the watershed have implemented Integrated Pest Management (IPM). The next milestone could be a 40% reduction after 7 years, when 80% of pesticide users are using IPM. The final goal, which achieves the water quality standard for that stream, may require a 50% reduction in 10 years. Having these waypoints lets the watershed managers know if they are on track to meet their goals, or if they need to re-evaluate treatment levels or timelines.

Element h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining WQ Standards.

What does this mean?

As projects are implemented in the watershed, you will need water quality benchmarks to track progress towards attaining WQ Standards. The *criteria* in element *h* (not to be confused with *water quality criteria* in state regulations) are the benchmarks or waypoints to measure against through monitoring. These interim targets can be direct measurements (e.g., fecal coliform concentrations, nutrient loads) or indirect indicators of load reduction (e.g., number of beach closings). These criteria should reflect the time it takes to implement pollution control measures, as well as the time needed for water quality indicators to respond, including lag times (e.g., water quality response as it is influenced by groundwater sources that move slowly or the extra time it takes for sediment-bound pollutants to break down, degrade or otherwise be isolated from the water column). Appendix B of these guidelines, “Measures and Indicators of Progress and Success,” although intended as measures for program success, may provide some examples that may be useful. You should also indicate how you will determine whether the WBP needs to be revised if interim targets are not met. These revisions could involve changing management practices, updating the loading analyses, and reassessing the time it takes for pollution concentrations to respond to treatment.

Element i. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element h.

What does this mean?

The WBP should include a monitoring component to determine whether progress is being made toward attaining or maintaining the applicable WQ Standards for the waterbody(ies) addressed in the plan. The monitoring program should be fully integrated with the established schedule and interim milestone criteria identified previously. The monitoring component should be designed to assess progress in achieving loading reductions and meeting WQ Standards. Watershed-scale monitoring can be used to measure the effects of multiple programs, projects, and trends over time. Instream monitoring does not have to be conducted for individual BMPs unless that type of monitoring is particularly relevant to the project.

For more detailed information on developing watershed-based plans, please see *A Handbook for Developing Watershed Plans to Restore and Protect Our Waters*, U.S. EPA, EPA 841-B-08-002 March 2008, water.epa.gov/polwaste/nps/handbook_index.cfm. Other resources for watershed planning are available on the Watershed Central website, including the Watershed Central Wiki and Plan Builder tool at water.epa.gov/type/watersheds/datait/watershedcentral/index.cfm.

Appendix D. Letter from the Department of Health to Ecology concerning shellfish protection

Appendix D, which includes the issue paper titled *The Voluntary Stewardship Program and Clean Water* can also be found here:

<https://fortress.wa.gov/ecy/publications/SummaryPages/1310030.html>



STATE OF WASHINGTON

DEPARTMENT OF HEALTH

OFFICE OF SHELLFISH AND WATER PROTECTION

PO Box 47824 • Olympia, Washington 98504-7824
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July 8, 2013

Kelly Susewind, P.E., P.G.
Water Quality Program Manager
Washington State Department of Ecology
P.O. Box 47600
Olympia, Washington 98504-7600

Dear Mr. Susewind:

The purpose of this letter is to express our support for the Department of Ecology's (Ecology's) assistance to the Department of Health (department) in protecting shellfish resources in Washington State. It relates our experience working with Ecology on controlling pathogen pollution in Puget Sound and explains why we think this partnership is important for achieving the shellfish restoration goals.

The shellfish industry in Washington is valued at over \$270 million dollars and provides jobs in rural parts of the state. Shellfish are part of the cultural and tribal heritage in Puget Sound. Protecting this resource now and for future generations is a priority for Washington State and consequently was recognized as a major initiative in the Puget Sound Action Agenda.

We are one of the Lead Organizations that received a multi-year National Estuary Program (NEP) grant for shellfish restoration and other human health related targets in the Puget Sound Action Agenda. We're currently managing NEP investments of almost \$5 million dollars to support Pollution Identification and Correction (PIC) programs. These PIC programs control pollution sources through monitoring, education, technical assistance, and incentives backed up by enforcement.

For many years our staff has worked with local communities to establish shellfish protection districts. These districts improve management of pollution sources when they impact water quality in shellfish growing areas. Working with counties to correct pathogen pollution has yielded insights into the strengths and weaknesses of local PIC programs. It has also provided insight into where we need help from partners in managing PIC awards. We believe that local governments are in the best position to deal with local pollution problems. Counties can carry out most of the activities of a comprehensive PIC program because most landowners are willing to clean up pollution when provided with technical and financial assistance.

Counties are challenged when landowners deny access to property or refuse to cooperate. For example; while counties have regulatory authority to require landowners to fix failing onsite sewage systems,

addressing livestock pollution from farm owners is difficult. If one county has difficulty with an area of enforcement, it's a local problem; when many counties are stymied over the same issue, it's a systemic problem. To address this problem, we turned to Ecology's Water Quality staff to fill the regulatory gap. Specifically, when local governments cannot secure the regulatory authority or there is not the willingness to utilize the authority where it exists, we look to Ecology to use their nonpoint authority and compliance staff to support local governments' PIC programs by providing the correction support for nonpoint sources of pollution such as livestock. While local governments should still lead the identification portion of PIC programs, by recognizing clear roles around the correction portion of these programs we hope to make PIC efforts as effective and long lasting as possible while recognizing the realities of who can most consistently address different sources of nonpoint pollution.

When we make an offer for a PIC award, we require that the county provides evidence of its regulatory authority or be willing to work with Ecology as the regulatory backstop. We rely on Ecology's broad water quality experience and experience managing pollution from agriculture as we negotiate awards and manage projects. Over the past year, we've seen progress in local/state PIC collaborations. For example: Ecology and Skagit County inspectors both work in the Samish watershed and have developed an integrated inspection protocol; they meet frequently to coordinate the work and Ecology plays a significant role on the Clean Skagit Initiative steering committee. Ecology has contributed leadership as well as financial, technical and staff resources to the Whatcom Clean Water Program, which was recently launched as a multi-agency shellfish initiative in the lower Nooksack basin to reverse declining water quality.

We expect to see these state/local collaborations grow as PIC programs become established in Puget Sound. They are fueled by NEP now, but to protect water quality, they need to transition into self-supporting programs. The success of long term sustainable PIC programs in Puget Sound depends on a supportive regional infrastructure with smart leveraging of local, state and federal resources, identification and sharing of best practices, and identification of the most effective roles for local and state partners. We are working with Ecology to develop criteria to guide grant funding and which would help create self-sustaining local PIC programs designed to meet state water quality standards.

Much work remains to establish comprehensive, stable, and effective PIC programs in Puget Sound. Every week, we work with local, tribal and state partners to identify barriers and figure out solutions. We appreciate the value that Ecology adds to shellfish recovery and encourage our local and federal partners to support Ecology in this work.

Sincerely,



Jerrod Davis, P.E.
Director

cc: Tom Eaton, US Environmental Protection Agency

Appendix E. The Voluntary Stewardship Program and Clean Water



The Voluntary Stewardship Program and Clean Water

The purpose of this document is to clarify the relationship between the Voluntary Stewardship Program (VSP) and the state's clean water programs, as well as highlight the potential opportunities for the two programs to be consistent and reinforce shared goals.

The Voluntary Stewardship Program

The VSP was passed in 2011 as an amendment to the Growth Management Act (GMA). Its goals are to protect and enhance critical areas, maintain and improve the long-term viability of agriculture, and reduce the conversion of farmland to other uses. To accomplish these goals, the VSP relies primarily on incentives and voluntary stewardship practices. Counties that opt into the VSP are responsible for designating a local watershed group to develop a watershed plan that describes how critical areas on agricultural lands will be protected and enhanced.

Statutory Language—The VSP amended the Growth Management Act (GMA). It does not supersede or modify any state clean water law or regulation. The statute expressly states that it is not to be construed to:

(5) Limit the authority of a state agency, local government, or landowner to carry out its obligations under any other federal, state, or local law.

The VSP sets broad goals and requirements that the watershed group must follow. However, it intentionally provides a great deal of flexibility to the local watershed groups in developing their work plans. One question that has arisen, as people have thought more about the VSP and the watershed work plans, is how the VSP will intersect with the clean water laws and programs administered by the Washington State Department of Ecology (Ecology).

As a starting point, improved compliance with state and federal clean water law was a critical part of the Ruckelshaus agreement that led to the creation of the VSP. While this “regulatory backstop”—which was to take the form of better enforcement of clean water law *separate* from the VSP—was not included in the VSP statutory language, it was seen as a critical element by those involved with the Ruckelshaus process. The expectation that state and federal clean water laws will serve as a regulatory backstop is documented in correspondence to legislative leadership, the implementation budget for the law, and other sources.

Given these dynamics, it is important to understand the contents of the VSP statute, and how implementation of the VSP does and does not affect state and federal clean water laws.

VSP and Clean Water Programs

Given the ecological relationship between critical areas and water quality, it is logical to assume that VSP and clean water programs have mutually reinforcing actions and outcomes. While this is largely true, they are not the same laws and may not necessarily achieve similar environmental outcomes. Compliance with state and federal clean water laws does not guarantee that landowners will also accomplish the relevant VSP protection and enhancement goals for their watershed. Likewise, landowners who implement actions in accordance with a county's VSP may have to take additional actions to comply with state and federal clean water laws. Implementation and/or compliance with one does not mean compliance with the other.

Different purposes

The purpose of the federal and state clean water laws is to prevent and control water pollution and protect water quality. The federal Clean Water Act (CWA) requires all states to restore their waters to be "fishable and swimmable." The state Water Pollution Control Act's policy statement sets the goal of maintaining "the highest possible standards to insure the purity of all waters of the state."

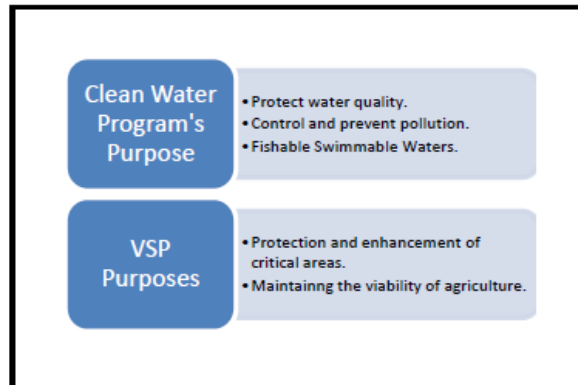
Water quality standards are a key tool for providing protection to state waters. The standards implement portions of the CWA by specifying the designated and potential uses of water bodies. They set water quality criteria to protect those uses. The standards also contain policies to protect high quality waters (antidegradation) and in many cases specify how criteria are to be implemented.

The VSP's purpose is to protect and enhance critical areas while maintaining the viability of agriculture and reducing the conversion of farmland to other uses in the watershed. Critical areas targeted by the VSP include critical aquifer recharge areas (CARAs), wetlands, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas.

Critical areas perform key functions that enhance our environment and protect us from hazards. The beneficial functions and values provided by critical areas include maintenance of water quality, fish and wildlife habitat, food chain support, flood storage, conveyance and attenuation (the slow release) of flood waters, groundwater recharge and discharge, erosion control, wave attenuation, protection from natural hazards, historical, archaeological and aesthetic value protection, and recreation.

Different standards

Ecology is responsible for controlling and preventing the pollution of surface and underground waters of the state. State water pollution law prohibits the discharge of any polluting matter into the surface or groundwater of the state, and requires "the use of all known available and reasonable methods ... to prevent and control the pollution of the waters of the state of Washington." Additionally, the water quality standards establish the basis for a water quality based approach to regulating waters that fail to



meet water quality standards despite the use of effluent limitations and other pollution control requirements.

Section 303(d) of the CWA establishes a process to identify and clean up polluted waters. Every two years, all states are required to perform a water quality assessment of the quality of surface waters in the state, including all the rivers, lakes, and marine waters.

The assessed waters are grouped into categories that describe the status of the water quality. The 303(d) list comprises those waters that are in the polluted water category, for which beneficial uses—such as drinking, recreation, aquatic habitat, and industrial use—are impaired by pollution.

The CWA requires that a water cleanup plan be developed for each of the water bodies on the 303(d) list. The technical name for a water cleanup plan is a Total Maximum Daily Load, or TMDL. A TMDL identifies how much pollution needs to be reduced or eliminated to achieve clean water. Further, the Washington State Water Pollution Control Act provides additional protection to state waters, as well as a basis for ensuring the implementation of nonpoint dominated TMDLs by prohibiting the discharge of nonpoint source pollution.

Under the CWA, a water body stays on the list until a TMDL has been developed for it, its pollution problem is addressed through some other pollution control process, or it meets water quality standards.

In comparison, the VSP sets the goal of protecting and enhancing critical areas. To “protect” critical areas generally means to preserve their functions and values. According to Washington State Department of Commerce guidance¹, the required standard of protection should be to prevent adverse impacts or to mitigate adverse impacts. At a minimum, VSP work plans should be written to ensure there is no net loss of the structure, functions, and value of the critical areas being protected. VSP work plans can go beyond the minimum standard of “protection” and include measures to enhance these critical areas.

In pursuing its goals, the VSP relies on voluntary actions and financial incentives to promote agricultural and environmental stewardship. Participation by landowners is voluntary. Even after electing to participate, a landowner may withdraw from the program and is not required to implement any voluntary measures after the expiration of an applicable contract.

Difference in enforcement

The VSP relies on voluntary actions and financial incentives to promote protection and enhancement of critical areas. If a landowner knowingly or unknowingly degrades a critical area, the VSP does not require that local governments have an enforceable mechanism to stop harm from being done (although local governments may take actions to enforce other existing development regulations to address impacts to a wetland, CARA, floodplain, or fish and wildlife habitat conservation area). The VSP only provides options to address impacts voluntarily and by using incentives.

¹ See the Department of Commerce’s *Critical Areas Assistance Handbook: Protecting Critical Areas Within the Framework of the Washington Growth Management Act* (<http://www.commerce.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&alias=CTED&lang=en&ItemID=976&Mid=944&wversion=Staging>).

In comparison, the CWA and state Water Pollution Control Act provide enforcement authority to control and prevent discharges of pollutants from both point and nonpoint sources. If a landowner is discharging or creating a substantial potential to discharge, Ecology can use technical assistance, financial incentives, and enforcement to gain compliance. Wetlands are also protected under the CWA and the state Water Pollution Control Act. Both of these laws require that impacts to wetlands and their functions and values (beneficial uses) must be avoided and any unavoidable impacts must be mitigated through the restoration or creation of new wetland areas.

TMDLs and watershed plans: similarities/differences

TMDLs focus on meeting water quality standards. For impaired water bodies, Ecology must establish a TMDL that quantifies pollutant sources, establishes a margin of safety, and allocates allowable loads to the contributing point and nonpoint source discharges so that water quality standards are attained.

Some of the key elements of a TMDL include:

- *An assessment of the water quality problems.* This assessment includes a technical study identifying the pollutants causing the water quality problem and the sources of those pollutants, and a technical analysis to determine how much pollution must be reduced to protect the water.
- *Public involvement.* Public involvement, along with coordination with tribal governments and consideration of environmental justice issues (as appropriate).
- *An implementation plan.* Details how pollution will be prevented, reduced, and/or cleaned up to meet the water quality standards.
- *A follow-up monitoring plan.* Evaluates the success of pollution controls contained in the implementation plan or the need for additional actions.

TMDLs and VSP Watershed Plans

Key Similarities	Key differences
• Watershed based plans • Technical assistance & financial incentives • Monitoring requirements • Public participation • Adaptive management • An implementation schedule and measurable milestones	• Water quality v. critical areas • Compliance requirements v. voluntary participation • All land uses v. agricultural lands • Water pollution reduction requirements v. no net loss requirement

Ecology uses many tools, including but not limited to permit requirements, technical assistance, financial incentives, educational programs, and nonpoint enforcement authority to bring impaired waters into compliance with the water quality standards.

In comparison, VSP work plans target critical areas. The work plan must include goals and benchmarks for the protection and enhancement of critical areas. Watershed groups seek input from farmers, tribes, local environmental groups, agencies and other involved parties, and develop goals for participation of agricultural operators, as well as provide technical assistance to farmers. Conservation districts or other qualified technical assistance organizations provide technical assistance to agricultural landowners and operators in developing individual stewardship plans. Voluntary

incentives for landowners are emphasized for all program phases. There is no requirement that the work plan include enforceable regulatory standards.

Can VSP watershed plans draw from TMDLs?

Yes. TMDLs are considered best available science and can inform VSP watershed plans. TMDLs describe the type, amount, and sources of water pollution in a particular water body, and then analyze how much of the pollution needs to be reduced or eliminated to meet water quality standards.

Considering the nexus that critical areas have with water quality, TMDL implementation plans are a valuable resource to use when developing protection strategies for fish and wildlife habitat conservation areas. Specifically, TMDL implementation plans' strategies to control nonpoint pollution could be utilized by watershed groups to inform how they can protect and enhance critical areas.

Wetland protection

The VSP work plans must protect critical areas to the extent they would be protected under a critical areas ordinance. Under critical areas ordinances, damages and losses of wetlands and their functions must be avoided and any unavoidable adverse impacts must be mitigated.

In agricultural areas, there are two conditions of wetlands. They may be in active agricultural production or they may exist in their natural state. Many productive farms contain farmed wetlands that have been partially drained for crop production. While these areas may meet the criteria for wetlands, these wetlands and their functions have been significantly altered. For wetlands in agricultural production, impacts are minimized through the use of best management practices, such as the use of buffers and timing of farming activities outside of the wettest portion of the year. Farmlands also include well-functioning natural wetlands such as old river oxbows, scrub shrub wetlands, and forested wetland areas. Any adverse impacts to existing natural wetlands, such as conversion to farming activities or drainage of existing natural wetlands through expanded drainage systems, must be mitigated.

In addition to protections afforded under critical areas ordinances, wetlands are protected under the CWA and the state Water Pollution Control Act. Both of these laws require that impacts to wetlands and their functions and values (beneficial uses) must be avoided and any unavoidable impacts must be mitigated through the restoration or creation of new wetland areas. Ecology issues 401 water quality certifications under the CWA and administrative orders under the state Water Pollution Control Act for projects affecting wetlands. VSP only provides for reducing local permitting for wetlands on agricultural lands. It does not change state or federal law. For new wetland impacts, permits are required under the CWA and Water Pollution Control Act.

Proposals to convert wetlands to agricultural use must still secure state, and in many cases federal approvals to impact wetlands. Ecology implements the state Water Pollution Control Act for protecting wetlands and addressing enforcement of unauthorized impacts to wetlands.

Implementing the VSP regulatory backstop

Under the VSP, there is no requirement that critical areas be protected through regulations in counties that opted-in unless the county is re-routed into the regular GMA critical areas process.

The VSP does not require counties to dedicate resources to encourage voluntary protection of existing critical areas until the VSP work plan is completed and approved by the executive director of the state Conservation Commission.

While the VSP does not include regulatory protection requirements, those involved in crafting the program decided to rely on enhanced enforcement of state and federal clean water laws to create a clear and immediate “regulatory backstop.” Improved compliance with state and federal law is needed because the VSP does not require county governments to have a local regulatory backstop that could ensure that needed protection of critical areas is provided in cases where a land owner rejects voluntary and incentive approaches. For wetlands, Ecology will continue to regulate conversions of wetlands in agricultural areas under the state Water Pollution Control Act to ensure that wetlands and their functions are protected and maintained. Additionally, continued and improved implementation of TMDLs and increased use of Ecology’s nonpoint enforcement authority under state law can provide protection to fish and wildlife habitat and CARAs.

Enhanced enforcement

Ecology currently dedicates staff in each region to compliance activities. Ecology staff engage in a variety of efforts including inspections, complaint response, technical assistance, and enforcement.

Ecology envisions implementing the regulatory backstop through additional enforcement and inspector staff. Their leads use water quality implementation plans—such as TMDL detailed implementation plans—along with ongoing complaint response to guide their compliance efforts. If a watershed does not have a completed TMDL, Ecology staff can use or develop a clean water compliance work plan to guide their efforts.

Coordination

While improved compliance with state and federal clean water laws is seen as a critical part of the Ruckelshaus agreement that led to the creation of the VSP, enhanced enforcement may create uncomfortable situations. The support of watershed groups is an important factor in the overall success of the program. Coordination between Ecology compliance staff, the watershed group (and the entity or entities designated to provide technical assistance) should be included in the VSP work plan.

Resources

Ecology currently does not have the resources available to adequately provide a regulatory backstop through enhanced enforcement. It is essential that proper levels of funding are provided to Ecology to be able to staff the compliance positions needed for on-the-ground compliance activities. The VSP draft budget calls for “6 FTE enforcement, phased in over 6 years.” Ecology supports those staffing levels as being the minimum necessary statewide to provide the regulatory backstop.

Limits of the regulatory backstop

Even if the clean water backstop is adequately funded, there are limits to having clean water laws serve as a regulatory backstop to a critical areas protection law. While there is a nexus between critical areas and clean water, enhanced enforcement of clean water laws does not guarantee that VSP requirements—no net loss of critical areas function and values—will be met, because the two types of laws have different goals and standards. For example, there may be a water resource or habitat function and value that a critical area provides that cannot be adequately protected through enforcement of clean water laws. Likewise, compliance with VSP requirements also does not

guarantee that the requirements of clean water laws will be met. The regulatory backstop does not enforce critical areas ordinances or the VSP work plan. Instead, the “regulatory backstop” relies on the imperfect nexus between clean water laws and critical areas.

Further, while the VSP includes the provision that the watershed group can request enhanced enforcement to facilitate progress toward watershed plan goals, the regulatory backstop should be considered as a stop-gap protection strategy that provides time for program implementation. If the incentive and voluntary approaches of the VSP are not resulting in landowner participation and critical areas protection goals being met, the law requires that modifications be made to the watershed plans.

Again, the keys to a successful implementation of the VSP regulatory backstop include:

- *Resources*—Ecology needs additional resources to implement the regulatory backstop. The VSP Draft budget calls for “6 FTE enforcement, phased in over 6 years.”
- *Compliance Staff*—If sufficient funding is provided, Ecology will dedicate compliance staff to implement the VSP regulatory backstop.
- *Coordination*—Support of Ecology’s enhanced enforcement activities from VSP watershed groups and technical assistance providers (CDs) is important if the regulatory backstop is to be successful.

Ecology’s enforcement philosophy

Enforcement is not an end, but a means to achieve compliance and environmental protection. Most people and businesses subject to Washington’s environmental laws comply voluntarily. When they do not, it is usually because they do not understand what is required, and education and technical assistance remedy the problem. Unfortunately, there is a small percentage of people and businesses that require a more direct response to achieve compliance. In these cases, a spectrum of enforcement tools, ranging from relatively informal to significant, are available to be used by Ecology.

When enforcement actions are required, Ecology carefully matches the significance of the violation to the type of enforcement actions taken. Some compliance tools fall between cooperation-based and deterrent-based enforcement, such as compliance inspections. Ecology’s goal is to ensure that all enforcement actions are based in fact and law, well documented, appropriate to the violation, and issued in a professional, equitable, and effective manner.

Ecology’s current nonpoint compliance efforts

Ecology uses its nonpoint enforcement authority judiciously. Following Ecology’s enforcement philosophy, Ecology staff provide technical assistance and financial incentives to correct nonpoint source pollution problems. Additionally, staff may refer landowners to the local conservation district. If nonpoint source pollution issues are not addressed, escalating enforcement may be used to gain compliance.

While there are some regional differences based on staff availability and regional priorities, Ecology continues to strive for clarity and consistency in its enforcement and technical assistance work. Recently, Ecology adopted inspection protocols to be used during livestock-related inspections and site visits. The inspection form and focus sheet outline what types of site conditions indicate past and continuing pollution, and/or future potential to pollute, as well as some best management practices that can help control and prevent pollution from happening.

Summary

Even though they have different purposes and standards, both clean water laws and the VSP should provide protection to the riparian corridor. This provides an opportunity for the two programs to take advantage of each other to achieve shared goals and intended outcomes. An effective VSP program could complement the protection and pollution reduction goals of federal and state clean water laws by helping to implement the best management practices needed to meet the water quality standards and clean water laws.

For more information

More information on Ecology's nonpoint pollution efforts can be accessed through Ecology's Web site. The address is:

www.ecy.wa.gov/programs/wq/nonpoint/index.html.

More information on TMDLs can be accessed through Ecology's Web site. The address is:

www.ecy.wa.gov/programs/wq/links/wq_assessments.html.

More information on the VSP can be accessed through the Washington State Conservation Commission's Web site. The address is:

www.scc.wa.gov/voluntary-stewardship/.

For special accommodations or documents in alternate format, call the Water Quality Program at 360-407-6600, 711 (relay service), or 877-833-6341 (TTY).

Appendix F. Response to comments received on the public review draft

Appendix F, which includes the response to comments received on the public review draft is attached as a separate pdf on the web. See also:

<https://fortress.wa.gov/ecy/publications/parts/1510015part1.pdf>