Total Maximum Daily Loads for the Willamette Subbasins

Water Quality Management Plan

Temperature

Amended, May 2025

State of Oregon
DEQ Department of Environmental Quality

This document was prepared by:
Brian Creutzburg, Grace Goldrich-Middaugh, Evan Haas, Andrea Matzke, Priscilla Woolverton

Oregon Department of Environmental Quality
Watersheds Section
700 NE Multnomah Street, Suite 600
Portland Oregon, 97232

Contact: Steve Mrazik
Phone: 503-229-5379 x267
www.oregon.gov/deq

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1. Introduction

DEQ provides this Water Quality Management Plan to guide implementation of the temperature Total Maximum Daily Load developed for 10 subbasins of the Willamette River Basin and the mainstem Willamette River (Figure 1; TMDL Rule, Figure 21). A WQMP is an element of a TMDL, as described by Oregon Administrative Rule 340-042-0040(4)(l), to guide implementation of management strategies to attain and maintain water quality standards. Each WQMP will guide the preparation of detailed TMDL implementation plans prepared by responsible persons including Designated Management Agencies.

This temperature WQMP will be proposed for adoption by Oregon's Environmental Quality Commission, by reference, into rule as OAR 340-042-0090(c)(B). This WQMP is intended to provide comprehensive information for implementation of the temperature TMDL, and will be amended, as needed, upon issuance of any future TMDLs within the Willamette Basin. Any subsequently amended or renumbered rules cited in this document are intended to apply.

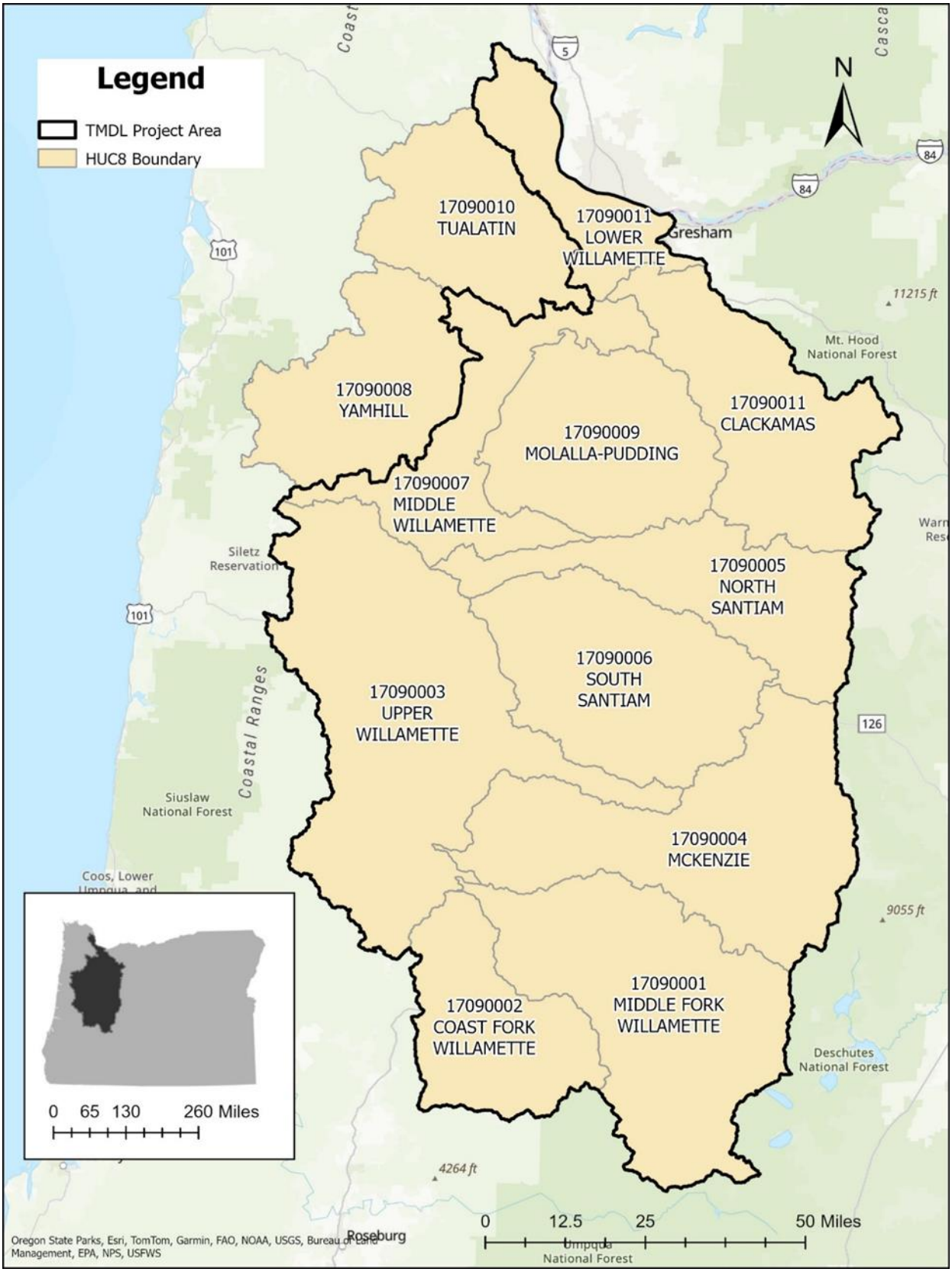

Figure 1: Map of Willamette HUC8 Subbasins.

The Willamette River Basin encompasses twelve subbasins. EPA previously approved three of DEQ's temperature TMDLs covering eleven of the twelve subbasins, as listed below in order of the issuance year. However, in 2013, EPA disapproved the Natural Conditions Criterion contained in Oregon's water quality standard for temperature due to the 2012 U.S. District Court decision for Northwest Environmental Advocates v. EPA. On October 4, 2019, the U.S. District Court issued a judgment in the lawsuit requiring EPA and DEQ to reissue 15 Oregon temperature TMDLs that were based on the Natural Conditions Criterion, including the Lower Columbia-Sandy Subbasin.

1. Molalla-Pudding Subbasin TMDL (2008)
2. Willamette Basin TMDL (2006)
    - Clackamas Subbasin
    - Coast Fork Willamette Subbasin
    - Lower Willamette Subbasin
    - McKenzie Subbasin
    - Middle Fork Willamette Subbasin
    - Middle Willamette Subbasin
    - North Santiam Subbasin
    - South Santiam Subbasin
    - Upper Willamette Subbasin
3. Tualatin Subbasin TMDL (2001)

This TMDL replaces the listed temperature TMDLs except for the Tualatin Subbasin TMDL, which remains in effect for temperature and other pollutants. The Tualatin TMDL did not use the natural conditions criteria to develop TMDL allocations and therefore is not required to be replaced as part of the federal court order to replace the 2006 and 2008 Willamette Basin and Molalla-Pudding temperature TMDLs. The Yamhill subbasin is the 12th subbasin and is not included in this TMDL because it was not included in the 2006 temperature TMDLs and is not under court order to be developed.

This TMDL applies to all waters of the state in the subbasins listed in Table 1. The subbasins and associated waterbodies listed in Table 1 will hereafter be referred to as the "Willamette Subbasins."

Table 1: Waterbodies included in Willamette Subbasins TMDL.

Subbasin	Waterbodies Included
1. Clackamas	All waters of the state in the Clackamas Subbasin
2. Coast Fork	All waters of the state in the Coast Fork Willamette Subbasin
3. Lower Willamette	All waters of the state in the Lower Willamette Subbasin
4. McKenzie	All waters of the state in the McKenzie Subbasin
5. Middle Fork	All waters of the state in the Middle Fork Willamette Subbasin
6. Middle Willamette	All waters of the state in the Middle Willamette Subbasin
7. Molalla-Pudding	All waters of the state in the Molalla-Pudding Subbasin
8. North Santiam	All waters of the state in the North Santiam Subbasin
9. South Santiam	All waters of the state in the South Santiam Subbasin
10. Upper Willamette	All waters of the state in the Upper Willamette Subbasin

11. Mainstem Willamette River	From the confluence of the Columbia River upstream to the confluence of the Coast Fork Willamette River and the Middle Fork Willamette River

Section 2 of the Willamette Subbasins Temperature TMDL Rule contains a listing of all Category 5 temperature impairments from the 2022 Integrated Report (DEQ, 2025). The TMDL Technical Support Document (TSD) contains a complete listing of all the Assessment Units included in this rulemaking (DEQ, 2025a).

1.1 Condition assessment and problem description

The first element of the WQMP according to OAR 340-042-0040(4)(l)(A) is an assessment of water quality conditions in the Willamette Subbasins with a problem description. There are assessment units in the Willamette Subbasins listed as impaired (category 5 or 4A) for temperature in Oregon's 2022 Integrated Report, which was approved by the U.S. Environmental Protection Agency on September 1, 2022.

DEQ must develop TMDLs for pollutants causing temperature impairments of waters within the Willamette Subbasins, as required by Section 303(d) of the federal Clean Water Act. These pollutants are solar radiation and heat from various sources and conditions that cause water temperatures to exceed criteria established to support aquatic life beneficial uses.

1.2 Goals and objectives

OAR 340-042-0040(4)(l)(B) requires identification of the goals and objectives of the WQMP. The goal of this WQMP is to provide an implementation framework for this Willamette Subbasins temperature TMDL. Implementing the TMDL is designed to achieve and maintain the temperature water quality criteria, including narrative criteria, and meet antidegradation requirements in streams within the Willamette Subbasins. The primary objectives of this WQMP are to describe responsibilities for implementing TMDL management strategies and actions necessary to reduce excess pollutant loads to meet all TMDL allocations, and to provide a strategy to evaluate progress towards attaining water quality standards throughout the Willamette Subbasins.

2. Proposed Management Strategies

The following section presents proposed management strategies, by pollutant source and activity, that are designed to meet the load and wasteload allocations required by the Willamette Subbasins temperature TMDL, as required by OAR 340-042-0040(4)(l)(C).

OAR 340-042-0030(6) defines management strategies as "measures to control the addition of pollutants to waters of the state and includes application of pollutant control practices, technologies, processes, siting criteria, operating methods, best management practices or other alternatives."

2.1 Streamside vegetation management strategies

DEQ's water quality analysis and modeling show that streamside vegetation planting and management are the strategies necessary to meet water quality standards in the temperature impaired sections of streams in the Willamette Subbasins. Streamside overstory vegetation reduces solar radiation loads to streams by providing shade. Protecting and restoring streamside overstory vegetation is essential to achieving the TMDL surrogate measure of

effective shade. More information about the physical and ecological factors affecting effective shade can be found in Section 9.4 of the TMDL Technical Support Document.

The primary streamside vegetation planting and management strategies are summarized as follows:

1. **Vegetation planting and establishment**
   This strategy restores locations that have little or no shade producing overstory vegetation. These locations are important for streamside tree and shrub planting projects. These sites may currently be dominated by invasive species.

2. **Vegetation protection (enhancement, maintenance and growth)**
   This strategy addresses streamside areas that have existing vegetation that needs to be protected from removal to maintain current shade levels. In some cases, protection is needed because effective shade can only be achieved with additional growth. Protecting and maintaining existing vegetation ensures that it can grow and mature, enhances vegetation success and survival, and provides for optimal ecological conditions.

3. **Vegetation thinning and management**
   This strategy addresses streamside areas that might need vegetation density reduction to achieve optimal benefits of shade in the long term. Current site conditions at some riparian areas have been shown to be overly dense with trees or dominated by invasive species that inhibit a healthy streamside community, and thinning may be an option to promote development of a healthy mature streamside forest. However, it must be ensured that riparian thinning and management actions will result in limited (i.e., quantity, duration, and spatial extent) stream shade loss. TSD Appendix I presents material describing potential shade and temperature impacts resulting from riparian buffer management and actions to limit these effects.

2.2 Flow management strategies

DEQ's modeling and evaluation of water quality data and research (DEQ, 2025; DEQ, 2025a) found that water withdrawals decrease the capacity of streams to assimilate pollutant loads. Because temperature is a flow-related parameter, water withdrawals can result in increased pollutant concentrations and warmer stream temperatures. In waterbodies where temperatures are already known to exceed standards, further withdrawals from the stream will reduce the stream's assimilative capacity and cause greater fluctuation in daytime and nighttime stream temperatures.

Water conservation is a best management practice that directly links the relationship between water quantity and water quality. Leaving water instream functions as a method to protect water quality from flow-related parameters of concern, such as temperature. Under state law, the first person to file for and obtain a water right on a stream is the last person to be denied water in times of low stream flows. Therefore, restoration of stream flows may require establishing instream water rights. One way this can be accomplished is by donating or purchasing out-of-stream rights and converting these rights to instream uses.

2.3 Hydromodification management strategies

Hydromodification refers to alterations of natural hydrological processes which affect characteristics of a waterbody and impact water quality. Examples of hydromodification in streams include human activities such as modifying stream channel morphologic attributes such as width, depth and course, construction and operation of dams and impoundments for flood control, drinking water, recreation, irrigation, and other uses, as well as activities meant to restore and protect streams. These activities can change the loading, timing, and delivery of nonpoint source pollutants, including thermal pollution (EPA, 2007).

Hydromodification activities that alter channel morphology can impact stream temperature (Galli and Dubose, 1990), e.g., wide, shallow streams allow solar radiation to increase stream temperature compared to narrower and deeper channels (Larson and Larson,1996). Activities that make streams more prone to erosion, such as uncontrolled livestock access, can also result in shallower streams and increased stream temperatures. As streambanks erode and slough, sediments can accumulate on the bottom of the stream, which reduces stream depth. Established riparian vegetation is frequently lost, reducing the shade provided to a stream (EPA, 2007). Channelization is another hydromodification activity that impacts channel morphology. Channelization disconnects streams from their floodplains through activities such as urban development or road construction. Streams that have been disconnected from floodplains are not able to slow and store floodwaters during the rainy season or recharge groundwater to support summer flows, factors that increase summer stream temperatures (EPA, 2017).

Management of hydromodification activities to prevent stream temperature increases can include BMPs for point and nonpoint source discharges like riparian restoration, livestock fencing, flow augmentation, reservoir operations, and projects including instream channel restoration. Note that permits are often needed to conduct stream restoration work involving removal and fill activities, and to ensure activities occur during the in-water work period to avoid harming fish. In addition, responsible persons including DMAs need to conduct site-specific evaluations of streams to determine what specific channel modifications are appropriate to meet the desired future condition. For more information about hydromodification sources and impacts, see EPA's *National Management Measures to Control Nonpoint Source Pollution from Hydromodification* (EPA, 2007), as well as a DEQ study, *Water Temperature Impacts from In-Channel Ponds in Portland Metro and Northwest Region* (DEQ, 2023b).

2.3.1 Large dam owners and reservoir management

There are approximately 206 reservoirs located within the Willamette Subbasins temperature TMDL project area that are large enough to require evaluation for dam safety. DEQ compiled this basic list of 206 dams from the U.S. Army Corps of Engineers (USACE) National Inventory of Dams (NID) database and a similar database maintained by the Oregon Water Resources Department (OWRD), dam safety program (see Appendix D). The OWRD prescribes dam safety rules that apply to dams 10 feet or higher, or store 9.2 acre-feet or more (OAR 690-020-0000). "Dam" means a hydraulic structure built above the natural ground line that is used to impound water. Dams include all appurtenant structures and together are sometimes referred to as "the works". Dams include wastewater lagoons and other hydraulic structures that store water, attenuate floods, and divert water into canals. Where possible, DEQ removed reservoirs from this list that were not relevant to the TMDL, such as treatment lagoons or reservoirs not connected to a waterbody.

Dams of all sizes can increase stream temperatures, depending on factors that include dam and stream characteristics, location, and density of dams in a watershed. For these reasons, DEQ expects all dam owners to manage their reservoirs to meet water quality standards, including standards for temperature. For details on reservoir operator implementation requirements, see Section 5.3.7.

2.4 Summary of nonpoint source priority management strategies

Table 2 includes proven strategies (and practices within the strategies) summarized by pollutant source. These strategies and practices are adapted from published sources. DEQ used the categories and terminology from Oregon Watershed Enhancement Board's Oregon Aquatic Habitat Restoration and Enhancement Guide and Oregon Watershed Restoration Inventory Online List of Treatments. Additional strategies included in Table 2 are supported by Oregon Department of Agriculture, the U.S. Department of Agriculture Natural Resources Conservation Service, Oregon State University Extension Service, Oregon Plan for Salmon and Watersheds, and other available published sources. DEQ identified the strategies in Table 2 as appropriate for the conditions and sources within the subbasins. These are considered priority strategies and practices that should receive special focus during TMDL implementation plan development.

DEQ expects that entities identified in Section 5.1 will include strategies and practices listed in Table 2 that are applicable to their jurisdiction in their implementation plans. Implementation plans must include specifics on where and when priority and other strategies and practices will be applied. Implementation plans must also include measurable objectives and milestones to document efficacy of each strategy and practice. See Section 5.3.4.1 for methods for determining where land conditions require restoration, protection, and enhancement.

Although not specifically detailed in this WQMP, climate change is another important factor affecting stream temperature. Potential climate change impacts to waterbodies in Oregon may include:

- higher air temperature;
- decreased snowpack leading to less water in reservoirs, streams and groundwater; and
- large-scale wildfires, which can reduce effective shade in streamside areas.

Continued efforts across multiple scales (including local, state, federal, and international) will be required to address the causes of, adapt to, and mitigate the impacts of climate change and support attainment of temperature water quality standards (Section 7.1).

Table 2: Priority temperature management strategies by source.

Pollutant	Source or Activity	Management Strategies
Heat or thermal loading	Insufficient riparian vegetation height, density or width	The primary goal is to increase site effective shade (combination of vegetation height, buffer width and canopy density) through streamside vegetation management strategies using regulatory programs and voluntary activities, including incentive-based projects.

		Streamside tree planting (conifer and hardwood); streamside vegetation planting (shrub or herbaceous cover); streamside vegetation management (invasive thinning, removal or other treatment); voluntary streamside tree retention; streamside invasive plant control; streamside fencing or other livestock streamside exclusion methods; identify and protect cold water refuges Maintain plants until free to grow; monitor survival rates. Develop, update and/or enforce streamside code/ordinance to ensure streamside native vegetation and intact bank conditions are protected or restored following site development; purchase, acquire, designate conservation easements along streamside areas.
	Water withdrawals, flow alteration	Pursue instream water right transfers and leases; water right application reviews; irrigation conservation and management; repair or replace leaking pipes and infrastructure; provide incentives for water conservation; implement water consumption restrictions during the summer months, such as lawn watering
	Channel modification and hydromodification	Conduct whole channel restorations (e.g., enhance channel, wetlands, and floodplain interactions, reduce width-to-depth channel ratios, bank stabilization, large wood placement, create/connect side channels, etc.); streamside road re-construction/obliteration activities; streamside fencing or other livestock exclusion methods; protect and enhance cold water refuges; remove in-channel ponds or modify pond structures to reduce temperature increases downstream; and protect areas that don't require restoration actions
	Dam and reservoir management	Modifications to the quantity and nature of water releases to meet water quality standards for temperature

2.5 Point source priority management strategies

Point sources may be assigned wasteload allocations and/or other requirements under the TMDL. These point sources are required to have National Pollutant Discharge Elimination System (NPDES) permits for any wastewater discharges. Under federal rules, effluent limits within NPDES permits are required to be consistent with the assumptions and requirements of any available wasteload allocation. Applicable wasteload allocations for point sources are available in the TMDL document (TMDL Rule, Section 9.1).

The primary way DEQ addresses numeric wasteload allocations is by including effluent limits in permits (though different mechanisms may be used if they are consistent with the TMDL). There are many ways to achieve compliance with these limits and requirements, which can be incorporated into NPDES permits during renewal or issuance. These include, but are not limited to, immediate compliance with the limits, the use of compliance schedules, water quality trading, and other pathways allowed under state and federal rules.

2.6 Water Quality Trading Opportunities

DEQ encourages Willamette Basin DMAs and NPDES-permitted point sources to develop water quality credit trading plans that meet the TMDL allocations for the Willamette Subbasins. Water quality trading is a well-established feature of TMDL implementation in Oregon that is designed to achieve water quality goals more efficiently and with enhanced outcomes. Trading is allowed statewide so long as the requirements of OAR 340-039 are met. Trading is based on a more holistic understanding that pollutant sources are distributed throughout a watershed, and that eliminating these pollutant sources benefits the entire watershed. Trading programs allow facilities to meet their regulatory obligations by exchanging environmentally equivalent (or greater) pollution reductions from sources elsewhere in a watershed. Trading in Oregon includes the use of green infrastructure, which has the additional benefits of enhancing the resilience of natural systems to the effects of climate change. Many trading plans can achieve higher levels of heat load reduction at a lower cost. For more information, please refer to DEQ's web page on water quality credit trading.

3. Timelines for Implementing Strategies

OAR 340-042-0040(4)(l)(D) requires schedules for implementing management strategies including permit revisions, achieving appropriate incremental and measurable water quality targets, implementing control actions and completing measurable milestones. DEQ's water quality permitting program has responsibility for revising permits to comply with TMDLs. Timelines for implementation of management strategies by responsible persons including DMAs is discussed separately.

3.1 DEQ permit revisions

NPDES permits have five-year terms. DEQ incorporates any required TMDL wasteload allocations into NPDES permits when the permit is renewed. NPDES permittees with assigned wasteload allocations are available in the TMDL document (TMDL Rule, Section 9.1).

3.2 Management strategies implemented 2007- 2021 by responsible persons including DMAs

DEQ uses multiple sources to establish current conditions and track implementation progress in the Willamette Subbasins project area. One of these sources is the Oregon Watershed Enhancement Board's Oregon Watershed Restoration Inventory which is a repository for watershed restoration activities. OWRI contains project level information from watershed councils, landowners and other groups who have implemented restoration projects to improve aquatic habitat and water quality conditions. Stream temperature projects in OWRI that have been implemented in the Willamette Basin include riparian fencing, channel modification, voluntary riparian tree retention, dam management and others. The OWRI database reflects

183 total miles of riparian area planted in the Willamette Basin between 2007 and 2021 including 161.6 miles of conifer and hardwood, 13.9 miles of hardwood and 7.4 miles of conifer.

Another resource to track implementation progress is the Willamette Basin Year Five Report, which summarizes data and information submitted to DEQ by DMAs. DMA reporting during the 2013-2018 period documented 17.3 total linear miles of streamside trees planted in the Willamette Basin. There were also 0.7 miles planted in the Molalla-Pudding Subbasin from 2016-2021, which had a separate Year Five Report. DEQ did not collect total linear miles of streamside trees planted by DMAs in the 2013 Year Five Report. Additionally, DEQ did not collect information from DMAs on linear feet or acres of streamside land acquisitions, which is an important strategy in protecting water quality. Some of the data reported in the Year Five Reviews may have also been included in the OWRI data.

Note that the number of miles of streamside trees planted reported above in the Willamette Basin Year Five Report includes the Tualatin Basin, which is not included in the Willamette Subbasins TMDL.

DEQ also utilized effective shade gap modelling to assess current conditions within the project area. Where DEQ completed modeling for this TMDL, effective shade targets were calculated at 25-meter node intervals (Lower Willamette model area) and 200-meter node intervals (Southern Willamette model area) for each waterbody. A mean effective shade was then calculated for DMAs where this modeling occurred, and a shade gap assessment was completed. The shade gap results for the modeled areas include shade conditions that may have been impacted by streamside planting projects that were completed following the approval of the 2006 Willamette Basin Temperature TMDL.

While DEQ was not able to directly quantify the impact that planting projects documented in OWRI and the DEQ Willamette Basin Year Five Report had on modeled streamside shade gaps, available data indicate that the pace and scale of streamside planting will need to increase to meet the shade target timelines in Table 3.

3.3 Timeline for implementation of management strategies

This section of the WQMP includes an estimate of the timeline for implementation of management strategies that will be sufficient to attain water quality standards.

For solar radiation, excess pollutant load is quantified in kilocalories/day units (kcal/day), whereas effective shade percent is the primary surrogate measure used in this TMDL. DEQ developed timelines to meet water quality standards based on the assumptions that responsible persons including DMAs will consistently implement the three primary streamside vegetation strategies in Section 2.1 until the streamside vegetation class reaches a mid-seral stage conifer-deciduous mix or equivalent characteristics. For this timeline, DEQ also assumed:

- No measurable existing overstory vegetation is removed, thereby reducing the current shade condition;
- Overstory vegetation continues to grow, consistent with average conifer and deciduous growth curves for this portion of the Willamette Basin; and

- Associated effective shade is produced at a rate commensurate with tree growth without significant disturbance (Means and Helm, 1985).

Significant uncertainty exists in meeting timelines for establishing shade. DEQ completed a shade gap assessment covering approximately 21,483 stream kilometers of the Willamette Subbasins project area. This assessment showed that 9,607 stream kilometers currently have an effective shade gap between 15 and 100 percent. For this analysis, DEQ assumes that both current effective shade gaps and future implementation rates will be consistent across assessed and non-assessed areas of the Willamette Subbasins.

Estimating timeframes for meeting the percent effective shade targets across the project area is influenced by several factors:

- The project area is large and the percent effective shade targets to be met are developed at a small scale (i.e., 25- and 200-meter increments) or through shade curves.
- A shade gap analysis is unavailable for all streams in the Willamette Basin to gauge what percent of streamside areas across the Willamette Subbasins area are not currently meeting effective shade targets.
- DEQ is unable to determine whether the rate of planting that has occurred over the past 16 years would be similar to planting efforts following the adoption of this TMDL.
- DMAs that have a large percentage of private property within their jurisdiction will have challenges in meeting effective shade targets. It will likely take additional time to develop more protective streamside ordinances or regulations, work with landowners, or partner with other organizations to conduct streamside planting and restoration projects in these areas.
- It is unclear how much future planting will be targeted in priority shade gap areas given that some planting projects are opportunistic in nature.
- The scale of implementation, location, and water quality benefits from future in-stream restoration and flow augmentation projects are unknown.
- The effects of climate change and invasive species on streamside tree assemblages is unknown. For example, the emerald ash borer, which is now present in Oregon, could result in fewer ash species found in streamside areas.
- The frequency and magnitude of natural disturbances such as wildfires is unknown.

DEQ expects responsible persons including DMAs to consider the timeline projections and interim targets presented in Table 3 in establishing commitments for streamside planting and protection in TMDL implementation plans. Based on DEQ analysis of the number of stream miles that will need restoration, and the pace of restoration logged in OWRI over the previous years of implementation, restoration rates will need to accelerate to meet the targets below. Timelines for attainment of percent cumulative effective shade were estimated based on time for trees to grow to heights sufficient to provide effective shade, and considers the factors and assumptions described above. This equates to meeting 10 percent of shade targets across the basin every 10 years beginning in 2030 and meeting all shade targets in 90 years. Meeting shade targets on all waterbodies may not be possible due to various factors, for example natural disturbances, the built environment, and private streamside ownership.

Table 3: Timelines to meet percent shade targets in the Willamette Subbasins TMDL in 10-year increments.

Assessment Year	Percent Cumulative Shade Targets Met in Willamette Subbasins TMDL
2030	10%
2040	20%
2050	30%
2060	40%
2070	50%
2080	60%
2090	70%
2100	80%
2110	90%
2120	100%

4. Attaining Water Quality Standards

Based on TMDL analyses, achieving the excess load reductions identified will result in attainment of water quality standards. Each management strategy identified in this WQMP, and in implementation plans provided by responsible persons including DMAs, represents part of a system of measures and practices that collectively reduce pollutant loads and improve water quality.

4.1 How management strategies support attainment of water quality standards

OAR 340-042-0040(4)(l)(E) requires an explanation of how implementing the management strategies will result in attainment of water quality standards.

DEQ identified priority implementation management strategies and specific practices in Table 2 and Section 2.1. DEQ expects these strategies and practices to increase site effective shade and address the excess solar radiation and shade deficits calculated along streams within the Willamette Subbasins (TMDL Rule, Section 8). DEQ focused on the three vegetation strategies described in Section 2.1 to identify timelines for achieving surrogate effective shade targets in

Table 3, and by extension solar radiation load reductions to meet temperature water quality standards.

DEQ developed site-specific effective shade targets and effective shade curves to meet temperature load allocations in the TMDL Rule (TMDL Rule, Section 9.1.5.2). Shade curves identify the relationship between stream width, orientation, and effective shade for specific

streamside vegetation types. Effective shade curves are applicable to any stream that does not have site specific shade targets. Effective shade curves represent the maximum possible effective shade for a given vegetation type.

Landowners, foresters, restoration professionals and horticulturists have expertise and experience needed to develop site-specific planting prescriptions that will ensure that the best combination of streamside species are planted. These site-specific planting prescriptions will typically contain a higher diversity of shrub and overstory species than the vegetation types used in developing the shade curves. The overall goal is to establish and protect streamside vegetation to meet effective shade targets established for that site. Maintenance activities, such as removal of invasive species and watering newly established trees and shrubs will be important for trees to become fully established (free to grow).

In addition to streamside shading strategies, significant water quality benefits will be achieved through implementation of stream restoration and flow augmentation management strategies.

4.2 Timelines for attaining temperature water quality standards

OAR 340-042-0040(4)(l)(F) requires an estimated timeline for attaining water quality standards through implementation of the TMDL, WQMP and associated TMDL implementation plans. Based on DEQ's source assessment and TMDL analyses (TSD, Section 7), nonpoint sources contribute nearly all of the excess solar radiation pollutant loading associated with temperature impairments in the Willamette Subbasins TMDL. Therefore, it is critical for nonpoint sources to make timely progress toward reducing anthropogenic pollutant loads to meet the TMDL load allocations.

The TMDL calculates NPS load allocations using a percent effective shade surrogate. Therefore, estimated timelines to meet water quality standards are primarily based on streamside planting activities, although stream channel restoration and increasing instream flows would also improve stream temperature conditions. Based on the timeline to meet effective shade targets shown in

Table 3, temperature water quality standards for the Willamette Subbasins will be met by 2120. Any uncertainty associated with this date stems from unknowns related to current conditions, the potential for natural disturbances and the pace of future restoration activities. Achieving the identified timelines for cumulative effective shade and resulting water quality benefits will require active participation from all responsible persons including DMAs within the basin.

5. Implementation Responsibilities and Schedule

5.1 Identification of implementation responsibility

OARs 340-042-0040(4)(I)(G) and 340-042-0080(1) require identification of persons, including Designated Management Agencies, responsible for implementing management strategies and preparing and revising implementation plans.

OAR 340-042-0030(2) defines Designated Management Agency as a federal, state or local governmental agency that has legal authority over a sector or source contributing pollutants and is identified as such by DEQ in a TMDL.

The TMDL rule provides numerous mentions of the term 'responsible person' with associated requirements. OAR 340-042-0025(2) indicates that responsible sources must meet TMDL load allocations through strategies developed in implementation plans. OAR 340-042-0030(9) defines 'reasonable assurance' as a demonstration of TMDL implementation by governments or individuals. OARs 340-042-0040(4)(I)(G) requires identification of persons, including DMAs, responsible for developing and revising implementation plans. OAR 340-042-0040(4)(I)(I) requires a schedule for submittal and revision of implementation plans by responsible persons including DMAs. OAR 340-042-0080(4) reiterates the requirement for persons, including DMAs, responsible for development, submittal and revision of implementation plans, along with the required elements of those plans. For purposes of this Willamette Subbasins WQMP, for implementation of the temperature TMDLs, 'responsible person' is defined as any entity responsible for any source of pollution addressed by the TMDL.

Responsible persons including DMAs are organized by DMA type in the following subsections. These persons are responsible for developing or revising implementation plans and implementing management strategies to achieve the TMDL allocations. A complete list of responsible persons including DMAs for the Willamette Subbasins Temperature TMDL is in Appendix A. There are 133 responsible persons including DMAs such as cities, counties, federal and state agencies, and other entities.

Appendix A is not an exhaustive list of every individual that bears responsibility for improving water quality in the Willamette Subbasins. It may be necessary for all people that live, work, and recreate in the basin to take steps to reduce pollution and protect or restore water quality to attain standards and protect the designated beneficial uses.

As shown in Figure 2 and Figure 3 four DMAs manage or own the bulk of the land area referenced in the Willamette Subbasins Temperature TMDL. Figure 2 illustrates the estimated land area owned or managed by these entities, and Figure 3 shows the percentage of estimated acres that are within 150 feet of a stream for these DMAs. Appendix A contains jurisdictional acres associated with many DMAs, however, that information was not available for all responsible persons including DMAs. Appendix B and Appendix C contain further information divided by subbasin and show jurisdictional area of each DMA by subbasin and within 150 feet of a stream.

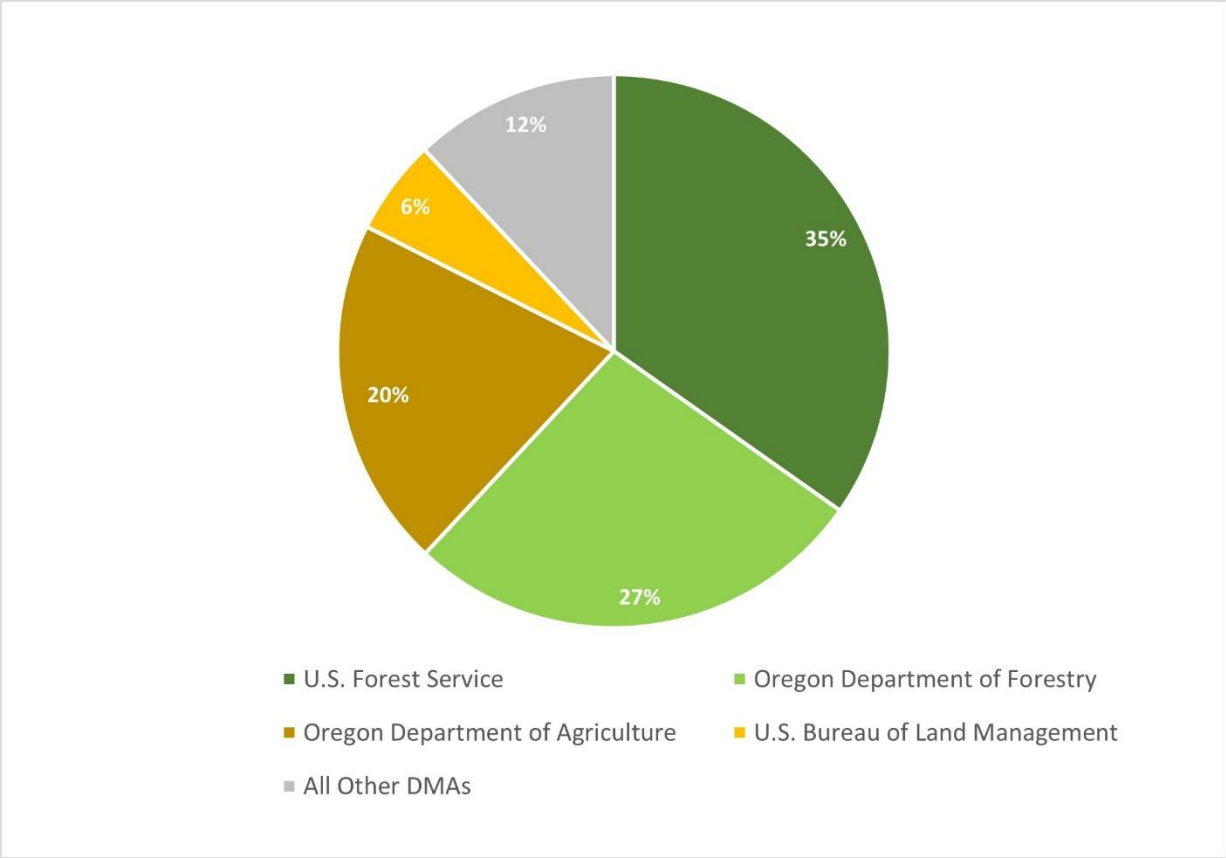

Figure 2: Percent estimated acres owned or managed by responsible persons including DMAs in Willamette Subbasins TMDL.

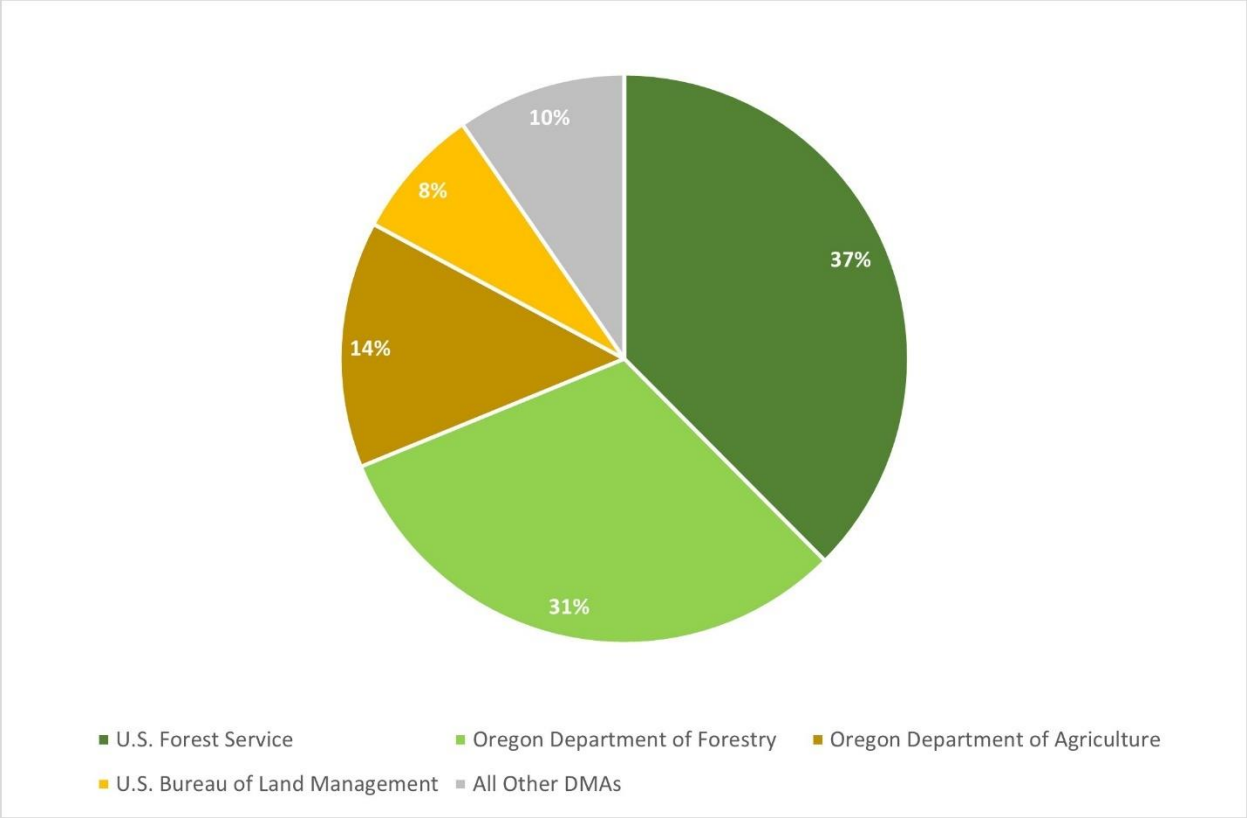

Figure 3: Percent estimated acres owned or managed by responsible persons including DMAs 150 feet from stream centerline.

5.1.1 Responsible persons including DMAs not required to develop a TMDL implementation plan

Some responsible persons including DMAs will not be required to submit implementation plans at this time for the following reasons:

1) Responsibilities are covered under the Tualatin Temperature TMDL.
2) Does not have ownership or jurisdiction over land management activities within the streamside area, so they are unable to implement actions identified in
3) Table 2 in this WQMP.
4) Other implementation pathway:
    a. Area is managed by other authorities already required to develop a plan.
    b. Water protection actions are implemented through permits (e.g., DOGAMI).
5) Has limited ability or opportunity to conduct stream restoration activities (e.g., railroads).
6) Has limited streamside area under its jurisdiction (generally less than 7 acres within 150 feet of a stream in the entire project area).

Table 4 identifies the entities that are named as responsible persons including DMAs in this TMDL that are not required to develop and submit an implementation plan at this time. DEQ may require implementation plans from these entities in the future if ownership or jurisdiction of streamside areas increases, or other data or information indicates a TMDL implementation plan is needed to achieve temperature allocations and shade targets identified in this TMDL. DEQ

may revise the WQMP or issue individual orders to notify them of the required schedule for submitting an implementation plan.

Table 4: List of Responsible Persons including Designated Management Agencies for which no TMDL implementation plan is required at this time.

No.	Responsible Persons including Designated Management Agencies	DMA Type
1	Tualatin	City
2	McMinnville	City
3	Curry County	County
4	Lincoln County	County
5	Washington County	County
6	Bonneville Power Administration	Federal
7	Pacific Power and Light	Private Utility
8	Portland Terminal Railroad Company	Railroad
9	Vennel Farms Railroad Company	Railroad
10	Willamette Shore Trolley	Railroad
11	Oregon Pacific Railroad	Railroad
12	BNSF Railway	Railroad
13	Central Oregon & Pacific Railroad	Railroad
14	TriMet	Railroad
15	Willamette Valley Railway	Railroad
16	Albany & Eastern Railroad	Railroad
17	Port of Coos Bay	Railroad
18	Portland & Western Railroad	Railroad
19	Union Pacific Railroad	Railroad
20	Ash Creek Water Control District	Responsible Person
21	East Valley Water District	Responsible Person
22	Santiam Water Control District	Responsible Person
23	West Labish Water Control District	Responsible Person
24	Palmer Creek Water District Improvement Co.	Responsible Person
25	G A Miller Drainage District No 1	Responsible Person
26	Sidney Irrigation District	Responsible Person
27	Hawn Creek District Improvement Co.	Responsible Person
28	Creswell Water Control District	Responsible Person
29	Creswell Irrigation District	Responsible Person
30	East Valley Water District	Responsible Person
31	Fertile Improvement District	Responsible Person
32	Grand Prairie Water Control District	Responsible Person
33	Junction City Water Control District	Responsible Person
34	Lacomb Irrigation District	Responsible Person
35	Lake Labish Water Control District	Responsible Person
36	Muddy Creeks Irrigation Project	Responsible Person
37	North Lebanon Water Control District	Responsible Person
38	Sauvie Island Drainage Improvement Company	Responsible Person
39	Scappoose Drainage Improvement Company	Responsible Person
40	Urban Flood Safety and Water Quality District	Responsible Person
41	Oregon Department of Environmental Quality	State
42	Oregon Department of State Lands	State
43	Oregon Department of Geology and Mineral Industries	State

5.2 Existing implementation plans

OAR 340-042-0040(4)(l)(H) requires identification of any source or sector-specific implementation plans available at the time of TMDL issuance. Following the issuance of the 2006 Willamette Basin and 2008 Molalla-Pudding TMDLs and WQMPs, DEQ required responsible persons including DMAs to develop implementation plans that included specific management strategies and best management practices to meet load allocations for temperature. Reporting requirements for many of these entities included an annual progress report and a comprehensive assessment of activities every five years. For information on each DMA, including which DMAs are existing DMAs, see Appendix A. DEQ notes that not all existing DMAs have DEQ-approved TMDL implementation plans. Existing DMAs will need to update their current implementation plans for temperature to ensure any new requirements in this WQMP are met.

In addition, certain statewide rules, programs and management plans for forestry and agriculture are intended, in part, to reduce or control nonpoint sources of pollution. The programs described in OAR 340-042-0080(2) and (3), respectively, represent existing implementation plans for non-federal forest and agricultural lands, and their sufficiency is discussed below.

5.2.1 Oregon Department of Forestry: Adequacy of Forest Practices Act to meet TMDL load allocations

Waterway protection measures were established in 1994 for state and private forest practices in Oregon, as codified in Oregon Revised Statutes 527.610 through 527.992, Oregon's Forest Practices Act (OAR 629-600 through 629-665) and Oregon's Plan for Salmon and Watersheds (Executive Order 99-01). As provided in ORS 527.770, forest operations conducted in accordance with the Forest Practices Act and other voluntary measures are generally considered to be in compliance with water quality standards. However, as provided in OAR 340-042-0080(2), revisions to the Forest Practices Act rules may be required when DEQ determines that these rules are not adequate to implement load allocations in an approved TMDL.

Periodic revisions to the Forest Practices Act rules occurred between the 1990s through 2022. With the publication of the Private Forest Accord Report and subsequent passage of Senate Bill 1501, 1502 and HB 4055, Forest Practices Act rule revisions were adopted by the Board of Forestry in October 2022 and additional amendments are anticipated through 2025. Implementation of these rules, including increased riparian widths and additional tree retention, may be effective at meeting shade allocations. The streamside vegetation retention and riparian management area distances in the current Forest Practices Act are summarized in Table 5 below. There are multiple other requirements or exceptions found in the forest practice rules not included in the table.

Table 5: Summary streamside vegetation retention riparian management area distances in Forest Practices Act rules OAR 629-643.

ODF Stream Type*	Standard Practice Vegetation Retention (Feet)	Small Forestland Option Vegetation Retention (Feet)
Large Type SSBT	110	100
Medium Type SSBT	110	80
Small Type SSBT	100	60

Large Type F	110	100
Medium Type F	110	70
Small Type F	100	50
Large Type N	75	70
Medium Type N	75	50
Small Type N	See Type Np	See Type Np
Small Type Np flows into to Type SSBT	75 feet vegetation retention for 500 feet upstream from the confluence with the Type SSBT, then 50 feet buffer retention for 650 feet upstream. Retention distance is the shorter of 1,150 feet (RH Max[+]) or the uppermost flow feature.	35 feet vegetation retention from the confluence with the Type SSBT to the upper most flow feature or 1,150 feet upstream (RH Max), whichever is shorter.
Small Type Np flows into to Type F	75 feet vegetation retention from the confluence with the Type F to the upper most flow feature or 600 feet upstream (RH Max), whichever is shorter.	35 feet vegetation retention from the confluence with the Type F to the upper most flow feature or 600 feet upstream (RH Max), whichever is shorter.
Small Type Ns	35' Equipment Limitation Zone (ELZ)	

***ODF Stream Type Definitions:**
SSBT—salmon, steelhead, or bull trout
F—fish-bearing (non-SSBT)
N—non-fish-bearing, non-domestic
Np—perennial, Type-N
Ns—seasonal, Type-N

[+] "RH Max" means the maximum distance described for any particular small Type Np stream.

DEQ finds the no-harvest vegetation retention buffers of 100-110 feet (e.g. large SSBT, Large F, small and medium SSBT/F standard practice) may be sufficient to meet some shade targets, depending on density of residual trees, stream orientation, topography, and other site-specific factors (TSD, Appendix I). However, based on the findings in Appendix I, it is probable that in some cases these buffers will not provide shade equivalent to 120-foot no-harvest buffer. Smaller no-harvest buffers are progressively less likely to meet shade targets and more likely to result in temperature increases beyond the assigned TMDL human use allowance of (0.0°C) and equivalent load allocation for all fish-bearing and perennial non-fish-bearing streams. This is more pronounced for the Small Forestland Option. Adoption of forest conservation tax credits on small forestlands to align protections with standard practice will increase the effectiveness. Overall, required riparian protections under the Forest Practices Act are unlikely to consistently meet shade targets and load allocations. For these reasons, ODF is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval. See Table 8 for the schedule.

As agreed in the 2021 Memorandum of Understanding between DEQ and ODF, DEQ will work with ODF to identify additional regulatory or non-regulatory measures that could be implemented by rule revisions, stewardship agreements, incentive programs or other means to provide reasonable assurance of achieving TMDL solar radiation load allocations. Collaboration on these additional measures may occur during development of ODF's implementation plan.

5.2.2 Oregon Department of Agriculture: Adequacy of agricultural water quality management programs in attaining TMDL load allocations and effective shade surrogate measures

The Oregon Legislature passed the Agricultural Water Quality Management Act in 1993, which directed Oregon Department of Agriculture to adopt rules as necessary and to develop plans to prevent water pollution from agricultural activities (ORS 568.900 to 568.933 and ORS 561.191 and OAR chapter 603, divisions 90 and 95). Subsequently, ODA worked with Local Advisory Committees and Soil and Water Conservation Districts to develop Agricultural Water Quality Area Rules and Area Plans for 38 watershed-based management areas across the state.

The Willamette Subbasins TMDL includes eight ODA Agricultural Water Quality Management Areas that each have an Area Plan (TSD, Section 11). DEQ participates in ODA's Area Plan review process by providing water quality status and trends for each management area, as well as assessments of land conditions, agricultural activities and implementation gaps that likely contribute to water quality impairments. The Area Plans for the eight management areas included in this TMDL were reviewed by DEQ within the last three years, however not all reviews resulted in Area Plan revisions.

Willamette Basin streams continue to be identified as impaired on Oregon's Section 303(d) list for temperature in part due to the lack of adequate streamside vegetation in agriculturally influenced streamside areas. DEQ's assessments of Area Plans identified protecting, maintaining and establishing streamside vegetation as a high priority to achieve TMDL load allocations. However, ODA's Area Plans lack specific measurable goals related to streamside conditions that will achieve TMDL shade measures.

The agricultural Area Rules and Area Plans that regulate and guide streamside management in the Willamette Subbasins TMDL project area do not identify quantitative targets for effective shade based on site specific factors, including stream width or orientation. DEQ also notes the disparity between ODA's implementation of their Area Rules for "site capable vegetation" in streamside areas and the streamside conditions needed to meet effective shade targets in this TMDL. ODA has not demonstrated that voluntary landowner implementation of Area Plans will bridge the gap between current conditions and what is needed to meet TMDL allocations.

DEQ concluded that current ODA WQ program Area Rules combined with implementation of Area Plans' voluntary measures are not adequate in all locations to meet the streamside vegetation requirements necessary to achieve TMDL effective shade targets, load allocations, and temperature water quality standards. Therefore, ODA is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval. See Table 8 for schedule.

5.2.3 U.S. Bureau of Land Management: Adequacy of streamside management strategies in attaining TMDL load allocations and effective shade surrogate measures

Streamside vegetation on BLM managed lands in the Willamette Subbasins are currently managed based on BLM's Northwestern and Coastal Oregon Resources Management Plan (BLM, 2016).

BLM defines riparian management areas called 'riparian reserves' using slope distance from the ordinary high water line on each side of a stream. Slope distance is specific to different types of

waterbodies as summarized in Table 6. The slope distance or *riparian reserve distance* is defined based on site-potential tree height. Site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site's class. BLM states that site-potential tree heights generally range from 140 feet to 240 feet, depending on site productivity.

Management practices in riparian reserves vary, however, clearcut harvesting within the riparian reserve is prohibited. Some tree removal or thinning activities are allowed based on certain circumstances such as to protect public safety, or to keep roads and other infrastructure clear of debris. Tree removal for yarding corridors, skid trails, road construction, stream crossings and road maintenance or improvement are allowed where there is no operationally feasible and economically viable alternative. On fish bearing streams and perennial streams between 0- and 120-feet slope distance, there is no thinning except in cases of sudden oak death or for individual tree cutting or tipping that achieve restoration or habitat enhancement objectives. On intermittent, non-fish bearing streams, the same management strategy is applied but only from 0 to 50 feet.

Table 6: Summary of BLM riparian reserve buffer distance for different waterbody features.

Feature	Riparian Reserve Distance measured as slope distance
Fish-bearing streams and perennial streams	One site-potential tree height distance from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels, whichever is greatest, on each side of the stream
Intermittent, non fish-bearing streams	Class I and II subwatersheds: One site-potential tree height distance from the ordinary high water line on each side of the stream
	Class III subwatersheds: 50 feet from the ordinary high water line on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area; where there is stable area between such unstable areas and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area
Lakes, natural ponds and reservoirs > 1 acres, and wetland > 1 acres	100 feet extending from the ordinary high water line
Natural ponds < 1 acres, wetlands < 1 acres (including seeps and springs), and constructed water impoundments (e.g. canal ditches and pump chances) of any size	25 feet extending from the ordinary high water line

DEQ finds that BLM's streamside vegetation management strategies on fish-bearing streams and perennial streams are adequate and will likely lead to achievement of the TMDL load allocation and effective shade targets. Riparian reserves located on intermittent, non-fish bearing streams may not be adequate to achieve the load allocation or effective shade targets. Streamside management on intermittent streams is a concern because they may contain residual pools that support aquatic life; or be flowing during periods when the TMDL allocations apply. The classification and mapping of intermittent streams often do not account for these situations. See TSD Section 2.4 for additional details. In locations where an intermittent stream has surface flow in Class III subwatersheds, a riparian reserve distance of 50 feet is unlikely to

provide sufficient shade and will result in stream warming. In Class I and Class II subwatersheds, thinning is authorized between 50- and 120-feet slope distance and must maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average. Thinning at these levels within 120-foot slope-distance from the stream may reduce effective shade and contribute to stream warming (TSD, Appendix I). The amount of effective shade reduction and temperature response will depend on the thinning intensity and spacing of thinning treatments (Roon et. al., 2021).

For these reasons, BLM is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval. See Table 8 for schedule.

5.2.4 U.S. Forest Service: Adequacy of streamside management strategies in attaining TMDL load allocations and effective shade surrogate measures

Streamside vegetation on USFS lands in the Willamette Subbasins currently managed based on Northwest Forest Plan (USFS and BLM 1994). As part of the plan, the Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems, including salmon and steelhead habitat on federal lands managed by USFS. Maintaining and restoring water quality is one of the stated objectives of the Aquatic Conservation Strategy. These aquatic ecosystems and the streamside adjacent areas are called *riparian reserves.* Like BLM, USFS defines many of the reserve distances using site-potential tree height. The Northwest Forest Plan states a site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site class and is consistent with the BLM definition. The following text is a description of the riparian buffer distance for different types of waterbodies. The text was extracted from USFS and BLM (1994), Attachment A, Standards and Guidelines, Section C, pages C-3- through C-31.

> ***Fish-bearing streams*** *- Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest.*
>
> ***Permanently flowing nonfish-bearing streams*** *- Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream channel), whichever is greatest.*
>
> ***Constructed ponds and reservoirs, and wetlands greater than 1 acre*** *- Riparian Reserves consist of the body of water or wetland and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the wetland greater than 1 acre or the maximum pool elevation of constructed ponds and reservoirs, whichever is greatest.*
>
> ***Lakes and natural ponds*** *- Riparian Reserves consist of the body of water and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally*

saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance, whichever is greatest.

Seasonally flowing or intermittent streams, wetlands less than 1 acre, and unstable and potentially unstable areas *- This category applies to features with high variability in size and site-specific characteristics. At a minimum, the Riparian Reserves must include:*

- *The extent of unstable and potentially unstable areas (including earthflows),*
- *The stream channel and extend to the top of the inner gorge,*
- *The stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation, and*
- *Extension from the edges of the stream channel to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.*

DEQ finds that USFS's streamside vegetation management strategies on fish-bearing streams, perennial streams, non-fish bearing streams, constructed ponds and reservoirs, lakes and natural ponds, and wetlands greater than 1-acre are adequate and will likely lead to achievement of the TMDL load allocation and effective shade targets. Vegetation management strategies on intermittent streams, and wetlands less than 1-acre may not be adequate to achieve the load allocation or effective shade targets (TSD, Appendix I). Streamside management on intermittent streams is a concern because they may contain residual pools that support aquatic life; or be flowing during periods when the TMDL allocations apply. The classification and mapping of intermittent streams often do not account for these situations. See TSD Section 2.4 for additional details.

For these reasons, USFS is required to develop a TMDL implementation plan to be submitted to DEQ for review and approval. See Table 8 for schedule.

5.3 Implementation plan requirements

Appendix A lists the responsible persons including DMAs that are required to submit an implementation plan. As required in OAR 340-042-0080(4)(a), implementation plans must include:

- Management strategies that the entity will use to achieve load allocations and reduce pollutant loading;
- Timeline for strategy implementation and a schedule for completing measurable milestones;
- Performance monitoring and a plan for periodic review and revision of implementation plans;
- To the extent required by ORS 197.180 and OAR chapter 340, division 18, provide evidence of compliance with applicable statewide land use requirements; and,
- Any other analyses or information specified in this WQMP.

The following subsections provide detail on each component required by this WQMP that must be included in implementation plans. Some implementation plan requirements vary depending on the responsible person including DMAs.

TMDL implementation plans and annual reports must be posted to each DMA's website for public transparency. If a DMA does not have a website, these documents must be made available to the public in another manner.

Figure 4 is provided to help responsible persons including DMAs determine the information and analyses they are responsible for submitting to DEQ. DEQ will work with each entity required to develop a TMDL implementation plan to ensure that all required elements are included with sufficient detail for their plan to be approved on the schedule required in Section 5.3.8 (Table 8)

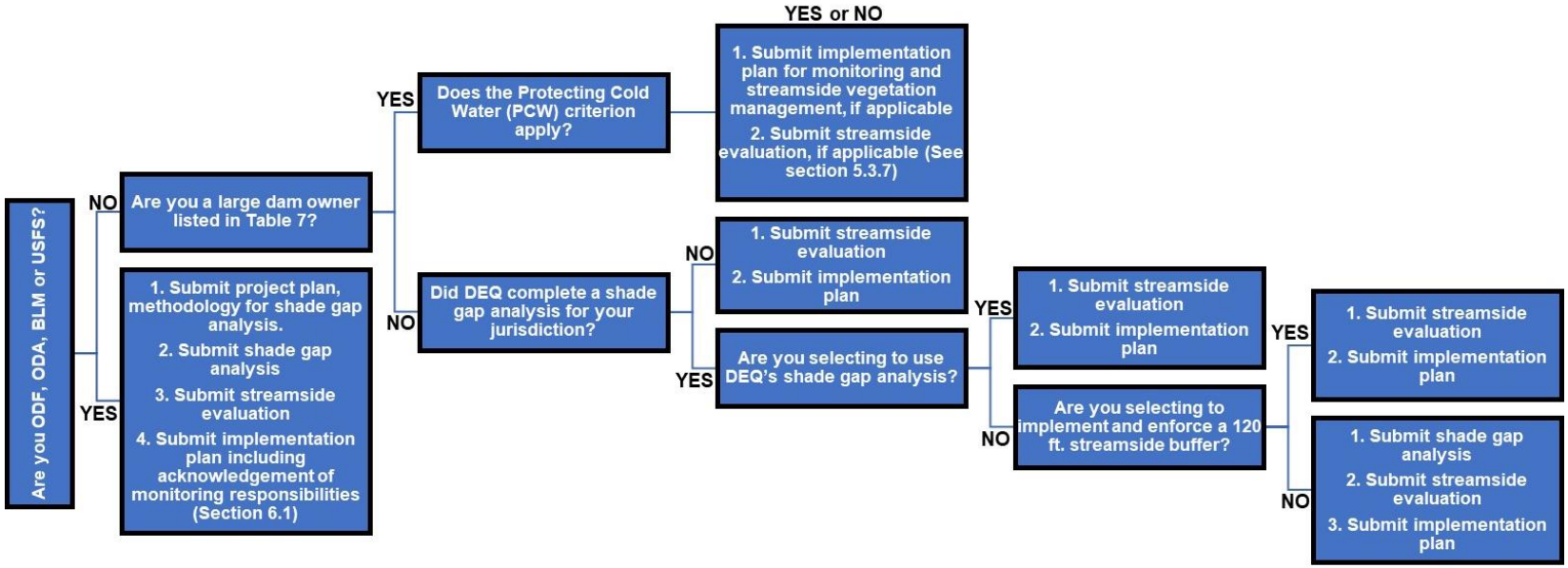

Figure 4: Decision support tree to help identify information and analyses requirements for different responsible persons including DMAs.

5.3.1 Management strategies

Responsible persons including DMAs in Appendix A that are required to develop a TMDL implementation plan must include applicable priority management strategies from Table 2. Other practices and actions appropriate for activities and landscape conditions specific to their pollutant sources or source sectors should also be included. Implementation plans must identify all streamside areas or streamside activities within a responsible person's, including DMA's, jurisdiction or responsibility.

5.3.2 Streamside evaluation

Responsible persons including DMAs that are required to submit an implementation plan must complete a streamside evaluation. The streamside evaluation will use a review of current conditions to support implementation of measurable objectives and milestones. The streamside evaluation must be included in the TMDL implementation plan.

Entities that have a DEQ shade gap analysis, and entities that must complete a shade gap analysis (see Section 5.3.4), must include the shade gap analysis results in their streamside evaluation. The streamside evaluation must also include the following data and information:

- **a.** Quantify the streamside area in acres that needs enhancement (e.g., areas that do not currently meet shade targets, are comprised of non-native vegetation, need additional planting)
- **b.** Quantify the streamside area in acres that may not need action beyond protection.
- **c.** Quantify the streamside area in acres where physical constraints exist (e.g., buildings) that preclude implementation of vegetation management strategies that provide stream shade.
- **d.** Quantify the streamside area in acres where jurisdictional constraints (e.g., private ownership) limit implementation of vegetation management strategies that provide stream shade.
- **e.** Opportunities that may exist to address constraints to implementing vegetation management strategies that provide stream shade.
- **f.** Any areas within your jurisdiction where there is the potential to implement best management practices such as in-stream restoration, flow augmentation projects, experimental temperature management techniques, as well as enhancing and protecting cold water refuges where identified.
- **g.** An evaluation of the data from **a – f** to prioritize implementation. This evaluation must include a description of the rationale utilized to prioritize implementation in addition to a description of the data and analysis methods used to estimate quantities **a – d,** and the reasoning specific areas will or will not be prioritized for implementation actions. It is expected that DMAs prioritize areas with the greatest shade gaps for implementation of riparian restoration, unless physical, jurisdictional, or other identified constraints exist.
    - i. Entities that have a DEQ shade gap analysis, and entities that must complete a shade gap analysis (i.e. ODA, ODF, USFS and BLM), must include the shade gap analysis results in their streamside evaluation.
    - ii. DEQ expects entities that do not have a DEQ shade gap analysis to use other available data to estimate the quantities outlined in items **a – d** and address these data in their streamside evaluation.

DEQ acknowledges that factors such as climate change and local geology, geography, soils, climate, legacy impacts, wildfires and floods may hinder achieving the target effective shade. No enforcement action will be taken by DEQ for reductions in effective shade caused by natural disturbances. Where natural disturbances have occurred, DEQ expects responsible persons including DMAs to assess and prioritize these areas for streamside restoration following an event.

The streamside evaluation must be completed according to the timeline assigned in Table 8. The streamside evaluation will be utilized during the year five review (see Section 5.3.9.2) to help assess progress in meeting implementation timelines, milestones, and measurable goals in subsequent five-year implementation cycles.

5.3.3 120-foot slope streamside buffer as an alternative to a streamside shade gap analysis

The responsible persons including DMAs that are required to complete a shade gap analysis and those that choose not to use DEQ's shade gap analysis (where available) for their streamside evaluation (Section 5.3.4) may instead choose to establish and protect overstory, woody vegetation within a 120-foot slope buffer, as measured up-slope along the ground's contour from top of bank (TSD, Appendix I). The streamside buffer must be established through development of enforceable ordinances or regulations. The literature review presented in TSD Appendix I indicates that potential stream shade loss associated with a 120-foot buffer will not cause stream temperature increases for most waterbodies. For this option, responsible persons including DMAs must ensure that any activity occurring within this 120-foot slope buffer would result in limited stream shade reduction and ensure that stream shade targets are still achieved at that location following management actions. Entities that choose this option must also complete a streamside evaluation but do not have to complete a shade gap analysis. (Sec. 5.3.2).

5.3.4 Streamside shade gap analysis

DEQ conducted a vegetation height and shade gap analysis within approximately 150 feet of modeled waterbodies in the Lower Willamette (partial analysis completed) and Southern Willamette Subbasins, as detailed in Section 9.1.5.2 in the TMDL Rule. DEQ did not complete a shade gap analysis for all responsible persons including DMAs.

The shade gap analysis calculates the difference between current effective shade (i.e., assessed) versus the target effective shade. Where DEQ calculated a shade gap, DEQ averaged the percent shade gap across all waterbodies within a DMA's jurisdiction. DEQ will provide the site-specific shade gap results upon request.

5.3.4.1 Streamside shade gap analysis methods for responsible persons including DMAs

If DEQ did not provide a shade gap analysis for a jurisdiction then that DMA is not required to complete a shade gap analysis unless they are named in Section 5.3.4.2. If DEQ has provided a shade gap analysis for a jurisdiction, then DMAs must either use DEQ's analysis to inform their streamside evaluation (Sec. 5.3.2), or other methods, for example on the ground measurements and remote sensing, to assess the current effective shade within their jurisdiction and whether effective shade allocations along Willamette Subbasins assessment units are met. These methods are described below.

1. Measure current effective shade at the stream surface using monitoring equipment, such as the Solar Pathfinder™, or using a hemispherical camera system and imagery analysis software.
    a. Determine general vegetation category, canopy density, stream width and stream orientation.
    b. Compare current effective shade results to either target effective shade from DEQ's shade gap analysis, or to the target percent effective shade values derived from the shade curves in the TMDL to assess the percent effective shade gap.
    c. Entities choosing to use this methodology must submit their assessment strategy to DEQ for approval. Assessments should conform to guidelines outlined in OWEB's Addendum to Water Quality Monitoring Technical Guidebook, Ch. 14: (OWEB, 1999).
2. Conduct modeling using the Heat Source model (as used in this TMDL).
3. Another method approved by DEQ through the TMDL implementation plan approval process.

A project plan which includes a description of the assessment methodology must be submitted to DEQ for review and approval according to the timeline assigned in Table 8. The Method documentation for Solar Pathfinder™ is online.

5.3.4.2 Shade gap analysis requirements for ODF, ODA, BLM and USFS

Together, the ODF, ODA, BLM, and USFS either manage or regulate approximately 93 percent of the land area within 150 feet of streams within the Willamette Subbasins project area (Figure 3). Increasing shade on streams within the extensive areas within their jurisdictions is important to achieving the surrogate shade measures of this TMDL. Therefore, ODF, ODA, BLM, and USFS must complete a streamside evaluation (Section 5.3.2) as well as a shade assessment for streamside areas within their jurisdiction. The assessment must use methods outlined in Section 5.3.4.1 for determining whether effective shade allocations along the Willamette Subbasins assessment units are met. A shade assessment is not needed for those streamside areas where DEQ has completed a shade gap analysis, or for streamside areas where DEQ has determined the streamside buffers are sufficient (Section 5.2). The shade gap analysis requirement includes intermittent streams as defined in the TMDL. For more information on intermittent streams and which are included in temperature TMDLs see TSD Section 2.4. A project plan, which includes a description of the shade gap assessment methodology including any methodology that proposes target effective shade values different from shade curves developed by DEQ, must be submitted to DEQ for review and approval according to the timeline assigned in Table 8.

5.3.5 Target Effective Shade Values and Shade Curves

Shade curves, which are charts that represent the mean effective shade target for different mapping units, stream aspects, and active channel widths (TMDL, Section 9.1.5.3), were developed to allow users to find target percent effective shade values for streams based on several stream characteristics. Unlike the site-specific shade targets and shade gap analysis (TMDL, Section 9.1.5.2), shade curves do not calculate current effective shade. Any responsible person including DMAs can use DEQ shade curves, site-specific shade targets or other DEQ-approved method to assess and recommend an effective shade target for their jurisdiction.

TMDL implementation plans must include the mean effective shade targets calculated by DEQ, if available, (TMDL Rule, Section 9.1.5.2), or any updated effective shade target assessment approved or performed by DEQ in the future.

5.3.6 Cold Water Refuge Requirements

Responsible persons, including DMAs who have jurisdiction along the lower 50 river miles of the Willamette River must include actions in their TMDL implementation plans to identify, enhance and protect cold water refuges. This reach extends from the mouth of the Willamette River at the confluence with the Columbia River to the confluence of the Willamette River and Chehalem Creek in the area of the Newberg pool. This reach of the river has been designated as a migration corridor in OAR 340-041-0028(4)(d):*The seven-day-average maximum temperature of a stream identified as having a migration corridor use on subbasin maps and tables OAR 340-041-0101 to 340-041-0340: Tables 101B, and 121B, and Figures 151A, 170A, 300A, and 340A, may not exceed 20.0 degrees Celsius (68.0 degrees Fahrenheit). In addition, these water bodies must have cold water refugia that are sufficiently distributed so as to allow salmon and steelhead migration without significant adverse effects from higher water temperatures elsewhere in the water body. Finally, the seasonal thermal pattern in Columbia and Snake Rivers must reflect the natural seasonal thermal pattern.*

According to OAR 340-041-0002(10) “Cold Water Refugia” means those portions of a water body where, or times during the day when, the water temperature is at least 2 degrees Celsius colder than the daily maximum temperature of the adjacent well-mixed flow of the water body.

DEQ expects DMAs with jurisdiction along these lower 50 river miles of the Willamette River to reference DEQ’s *Lower Willamette River Cold-Water Refuge Narrative Criterion Interpretation Study,* or other cold water refuge studies, as a resource for protecting cold water refuges that have already been identified. This study identified a total of 48 cold water refuge locations within the migration corridor.

DMAs along this reach may protect existing refuges by:

1. Maintaining or enhancing vegetation for shade
2. Protecting the watersheds of cold tributaries
3. Protecting channel features that create cold water flows from physical alteration
4. Protecting sources of groundwater inflows
5. Removing or prohibiting barriers to fish access in areas of cold water

Potential cold-water refuges may also be restored by improving access or enhancing characteristics that form cold-water refuge where they have been altered by human activity.

DMAs not along this 50 river mile reach should also consider including best management practices in their implementation plans that support identifying, enhancing and protecting cold water refuges, which are important to fish seeking escape from warm stream temperatures, in other waterbodies within the Willamette Basin.

5.3.7 TMDL implementation plan requirements for dam owners

DEQ is using a surrogate measure to implement the load allocation for dam and reservoir operations. This means that reservoir operations must not contribute any additional warming

above and beyond upstream water temperatures entering the reservoir. See Section 9.1.5.1 in the TMDL Rule for more information.

All dam and reservoir operators named in Table 7 must submit an implementation plan that addresses the monitoring and assessment requirements described in Section 5.3.7.1. If monitoring and assessment show that dam operations contribute additional warming above upstream temperatures entering the reservoir, then the operator can choose to either:

1. Complete a cumulative effects analysis which demonstrates that releasing waters warmer than the surrogate measure would not contribute to downstream exceedances of water quality standards, or
2. Update their TMDL implementation plan to include structural and operational strategies for mitigating temperature increases.

If a cumulative effects analysis demonstrates that dam operations will contribute to additional downstream warming, then the operator must update their implementation plan to include specific mitigation strategies for temperature. If DEQ determines sufficient data are available to demonstrate that stream temperature does not increase between a reservoir's inflow and outflow, then the reservoir operator may not be required to update their implementation plan for structural and operational management strategies.

Dam and reservoir operators that have jurisdiction over streamside areas must also develop a TMDL implementation plan to implement streamside management strategies even if a future updated TMDL implementation plan is not required for dam and reservoir management. See Sections 5.3.2 through 5.3.4 for additional information regarding streamside management implementation plan requirements.

Given the large number of dams within the Willamette Basin, DEQ is not focusing implementation requirements on dams owned and operated by individuals or businesses (See Appendix D for the entire list of dams in the Willamette Subbasins project area). Additionally, DEQ is not requiring reservoir management plans for dams that are operated to manage seasonal flow to sustain ecological benefits associated with wetlands and marshes. These individual, business, and ecological entities comprise only about 1.2 percent of the large reservoir storage capacity in the Willamette Basin. DEQ encourages partnerships between responsible persons including DMAs and individual dam operators within their jurisdictions to evaluate ways in which these dams could be managed to reduce temperature impacts.

Table 7: Large dam and reservoir owners responsible for monitoring. Owners may be required to submit an implementation plan that includes reservoir management strategies.

No.	Owner	Dam Name	Reservoir Storage (ac-ft)
1	City of Adair Village	Plywood Products Reservoir	39
2	City of Albany	Lebanon Dam	149
3	City of Corvallis	North Fork	305
4	City of Dallas	Mercer	1,550
5	City of Gresham	Binford Dam	30
6	City of Silverton	Silver Creek	2,500
7	City of St. Helens	Salmonberry Reservoir	61
8	Eugene Water and Electric Board	Carmen Diversion	260
9	Eugene Water and Electric Board	Leaburg	345

10	Eugene Water and Electric Board	Leaburg Canal and Forebay	459
11	Eugene Water and Electric Board	Smith	17,530
12	Eugene Water and Electric Board	Trail Bridge	2,263
13	Eugene Water and Electric Board	Walterville Forebay	275
14	Eugene Water and Electric Board	Walterville Storage Pond	345
15	Portland General Electric Company	Faraday Diversion	1,200
16	Portland General Electric Company	Faraday Forebay	550
17	Portland General Electric Company	Harriet Lake	400
18	Portland General Electric Company	North Fork	18,630
19	Portland General Electric Company	River Mill	2,300
20	Portland General Electric Company	Timothy Lake	69,000
21	USACE - Portland District	Big Cliff Dam	5,930
22	USACE - Portland District	Blue River Dam	89,000
23	USACE - Portland District	Cottage Grove Dam	50,000
24	USACE - Portland District	Cougar Dam	220,000
25	USACE - Portland District	Detroit Dam	455,000
26	USACE - Portland District	Dexter Dam	29,900
27	USACE - Portland District	Dorena Dam	131,000
28	USACE - Portland District	Fall Creek Dam	125,000
29	USACE - Portland District	Fern Ridge Dam	121,000
30	USACE - Portland District	Foster Dam	61,000
31	USACE - Portland District	Green Peter Dam	430,000
32	USACE - Portland District	Hills Creek Dam	356,000
33	USACE - Portland District	Lookout Point Dam	477,700

5.3.7.1 Monitoring and assessment requirements for dam owners

Dams and reservoirs alter solar radiation flux and seasonally increase surface temperatures compared to free-flowing stream segments. Increased temperatures may lead to violations of water quality temperature standards and impact aquatic life. Water released from the hypolimnion of stratified reservoirs may cool downstream reaches during the summer leading to attainment of water quality standards. In the fall, a reservoir may become isothermal and warm stream reaches below a reservoir.

The TMDL rule (Section 9.1.5.1) identifies a temperature surrogate measure target for dam and reservoir operations. Attainment of this target requires assessment of temperatures up and downstream of the dam and reservoir based on the seven-day average of the daily maximum temperature (7DADM).

Large dam and reservoir owners in Table 7 will collect temperature data and assess temperature dynamics associated with their dam and reservoir operations using a mechanistic model, empirical model, and/or analysis of continuous temperature data collected upstream, downstream, and in the reservoir. The assessment shall include:

1. Collection of continuous temperature data to characterize reservoir inflow and outflow temperatures. If multiple streams flow into the reservoir, 7DADM temperatures upstream of the reservoirs may be calculated as a flow weighted mean of temperatures from each inflowing tributary. The estimated free flowing (no dam) temperatures may be calculated using a mechanistic or empirical model to account

for any warming or cooling that would occur through the reservoir reaches absent the dam and reservoir operations.

a. Continuous temperature data must be collected for four consecutive years and must be collected during the critical period as defined in the TMDL document. Previously collected data can be used as long as it meets DEQ QA/QC protocols and has been collected within the last five years.

2. Reservoir temperature profiles to sufficiently characterize timing and extent of thermal stratification, and

3. Measurement of reservoir water level fluctuations and outflow rates

Temperature data must be submitted to DEQ and uploaded to the Ambient Water Quality Monitoring System, or through another online publicly accessible database approved by DEQ. These data will be used for the following purposes:

1. establishing baseline conditions,
2. adaptive management, and
3. evaluation of site-specific approaches to reduce temperature impacts.

DEQ recommends dam owners develop a mechanistic or empirical model to predict and compare inflow and outflow temperatures. This model will be used to develop effective management strategies to reduce temperature impacts.

For reservoirs on reaches where DEQ has determined that the protecting cold water criterion does not apply, operators are required to select one of the two following options. The first option is to ensure that discharges meet the temperature target surrogate measure (TMDL Rule, Section 9.1.5.1). The second option is to prepare a cumulative effects analysis to demonstrate that water releases that periodically exceed the ambient temperature criteria would not contribute to cumulative warming above water quality standards at downstream locations. Reservoir operators who choose this second option will be required to submit a Quality Assurance Project Plan (QAPP) to DEQ for review and approval. Required elements of the QAPP include descriptions of the dataset and cumulative effects approach that will be used to assess downstream temperature impacts.

5.3.7.2 Protecting Cold Water Criterion

The “protecting cold water” criterion in OAR 340-041-0028(11) applies to waters of the state that have summer seven-day-average maximum ambient temperatures that are colder than the biologically based criteria. With some exceptions, these waters may not be warmed cumulatively by anthropogenic point and nonpoint sources by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the colder water ambient temperature. Reservoir operators on reaches where protecting cold water apply must meet the cold water criterion. DEQ’s current assessment shows that the protecting cold water criterion likely applies at the following three dams:

1. Carmen Diversion (McKenzie River)
2. Harriet Lake (Oak Grove River)
3. Trail Bridge and Trail Bridge Saddle Dike (McKenzie River)

Water flowing above these dams is likely to have cooler ambient temperatures than the temperature criteria. To meet the cold-water criterion, these dams cannot warm up ambient temperature to the applicable temperature criteria. Additional information on protecting cold water is found in the TMDL Rule (Section 9.1.5.1). This list could change given updated assessments.

If DEQ determines sufficient data are available to demonstrate that stream temperature does not increase from upstream of dam to downstream of dam, then the reservoir operator may not be required to develop a TMDL implementation plan for dam management.

5.3.8 Timeline and schedule

Each implementation plan must include a commitment to enact specific management strategies on a reasonable timeline, including a schedule for meeting measurable milestones to demonstrate progress. To meet the intent of this requirement and be useful for the requirement to track and report progress, entities should develop management strategies using the SMART elements: Specific, Measurable, Achievable, Relevant, Time-bound (Doran, 1981).

Timelines and milestone schedules should be informed by the Streamside Evaluation, as described in Section 5.3.2 above, and each entity should consider all factors relevant to their situation. The due dates and timelines for specific information and analyses discussed in Sections 5.3.2 and 5.3.4 are shown in Table 8 below. DMA timelines in TMDL implementation plans that differ from timelines stated below must be approved by DEQ.

Table 8: Due dates for implementation plans, information, and analyses. See sections 5.3.1 through 5.3.7 for more details.

Requirement	Due Date / Timeframe
TMDL implementation plan (Appendix A)	18 months after EQC adoption of amendment to Willamette Subbasins TMDL
Streamside Evaluation (Sec. 5.3.2)	Three years after EQC adoption of amendment to Willamette Subbasins TMDL
Project plan and description of the assessment methodology to be used to complete a shade gap analysis (Sec. 5.3.4)	18 months after EQC adoption of amendment to Willamette TMDL
Streamside shade gap analysis (Sec. 5.3.4) and updated streamside evaluation OR 120 ft. streamside buffer that establishes and protects overstory, woody vegetation (sec. 5.3.3)	Four years after implementation plan submission deadline

Large dam and reservoir owners named in Table 7 (Sec. 5.3.7): TMDL implementation plan for temperature monitoring and assessment requirements for each reservoir	18 months after EQC adoption of amendment to Willamette Subbasins TMDL. Following the temperature assessment, the DMA will consult with DEQ on a timeframe for submitting a cumulative effects analysis, or updated TMDL implementation plan as needed. Some reservoir operators must also submit a streamside evaluation and implementation plan for streamside management. See section 5.3.2 for details.
ODA, ODF, USFS, BLM: Quality Assurance Project Plans or project-specific Sampling and Analysis Plans for temperature (Sec. 6.1)	As directed by DEQ following development of a Willamette Basin wide monitoring strategy.

5.3.9 Reporting of performance monitoring and plan review and revision

5.3.9.1 Reporting on performance monitoring

Each implementation plan must include a commitment to prepare annual reports on performance monitoring and specify a day of the year they will be submitted to DEQ. These reports must include implementation tracking for each of the identified management strategies, progress toward timelines and measurable milestones specified in the implementation plan, and evaluation of the effectiveness of each strategy.

DMAs should track and report implementation actions including the number, type and location of projects, best management practices, education activities, or other actions taken to improve or protect water quality. Most DMAs will track implementation actions they are directly responsible for completing, and some may need to track and report on actions that they implement through their support of other land managers, e.g., private landowners.

Oregon Watershed Restoration Inventory Reporting Requirement

Projects designed to control thermal pollution that use practices listed in OWEB's Oregon Watershed Restoration Inventory (OWRI) Online List of Treatments must be reported by responsible persons including DMAs to the OWRI database (OWEB 2023, OWEB 2023a) upon project completion. DEQ utilizes OWRI's database to track implementation activities statewide and within watersheds for various reporting metrics. Responsible persons including DMAs must also report BMP implementation annually to DEQ to document progress and track actions over time.

Other publicly accessible databases may be used to document restoration activities when approved by DEQ.

Adaptive Management

Implementation plans must include a commitment to use adaptive management to evaluate the effectiveness of implementation activities in improving streamside conditions including stream

shade. Annual reports must summarize the status and results of these evaluations on the relevant time scale. At a minimum, reports in year five must summarize implementation and effectiveness over the preceding four years.

5.3.9.2 Implementation plan review and revision

Implementation plans must be reviewed by each responsible person including DMAs, revised to incorporate lessons learned, and approved by DEQ every five years. At a minimum, plans must be revised to reflect updated timelines for the continuation of implementation activities for the next five years. DEQ will use implementation and effectiveness evaluations from annual reports for this review. If implementation plan revisions are needed to correct deficiencies or otherwise ensure the plan is effective following the year five review, DEQ will identify a date for submission of the revised plan for DEQ approval.

5.3.10 Public involvement

As required in OAR 340-042-0040(4)(l)(L), implementation plans prepared by designated management agencies must include a plan to involve the public in implementation of management strategies. Public engagement and education must be included to meet this requirement.

5.3.11 Maintenance of strategies over time

As required in OAR 340-042-0040(4)(l)(M), implementation plans prepared by responsible persons including DMAs should include discussion of planned efforts to maintain management strategies over time.

5.3.12 Implementation costs and funding

As required in OAR 340-042-0040(4)(l)(N), this section provides a general discussion of costs and funding for implementing management strategies. Implementation of management strategies to reduce or prevent pollution into waters of the state may incur financial capital or operating costs. These costs vary in relation to pollutant sources and loading, proximity to waterways and type or extent of preventative controls already in place. Certain management practices, such as preventative infrastructure maintenance, may result in long-term cost savings to responsible persons including DMAs, or landowners.

OAR 340-042-0040(4)(l)(N) also indicates that sector-specific or source-specific implementation plans may provide more detailed analyses of costs and funding for specific management strategies in the plan. DEQ requires each DMA to provide a fiscal analysis of the resources needed to develop, execute and maintain the programs and projects described in implementation plans to the extent that these costs can be accounted for or estimated. DEQ recommends that all responsible persons including DMAs prepare the following level of economic analysis:

- Staff salaries, supplies, volunteer coordination and regulatory fees
- Installation, operation and maintenance of management measures
- Monitoring, data analysis and plan revisions
- Public education and outreach efforts
- Ordinance development (if needed to implement a management strategy)

This analysis should be in five-year increments to estimate costs, demonstrate sufficient funding is available to begin implementation and identify potential future funding sources to sustain management strategy implementation. DMAs may include actual costs spent on implementation activities as part of annual TMDL reporting. This information may help DEQ estimate actual costs associated with implementing current and future temperature TMDLs.

There are multiple sources of local, state, and federal funds available for implementation of pollutant management strategies and control practices. Table 9 provides a partial list of financial incentives, technical assistance programs, grant funding and low interest loans for public entities and with principal forgiveness available in Oregon that may be used to support implementation of assessment, pollution controls and watershed restoration actions or land condition improvements that improve water quality in the Willamette Basin. Soil and water conservation districts and watershed councils are additional resources that may support responsible persons including DMAs in implementation of pollutant management strategies and control practices through the programs listed in Table 9.

Table 9: Partial list of funding programs available in the Willamette Subbasins.

Program	General Description	Contact
Clean Water State Revolving Fund	Loan program for below-market rate loans for planning, design, and construction of various water pollution control activities.	DEQ
Conservation Reserve Enhancement Program (CREP)	Provides annual rent to landowners who enroll agricultural lands along streams. Also cost-shares conservation practices such as riparian tree planting, livestock watering facilities, and riparian fencing.	NRCS
Conservation Reserve Program (CRP)	Competitive CRP provides annual rent to landowners who enroll highly erodible lands. Continuous CRP provides annual rent to landowners who enroll agricultural lands along seasonal or perennial streams. Also cost-shares conservation practices such as riparian plantings.	NRCS
Conservation Stewardship Program (CSP)	Provides cost-share and incentive payments to landowners who have attained a certain level of stewardship and are willing to implement additional conservation practices.	NRCS
Drinking Water Source Protection Fund	These funds allow states to provide loans for certain source water assessment implementation activities, including source water protection land acquisition and other types of incentive-based source water quality protection measures.	OHA
Emergency Watershed Protection Program (EWP)	Available through the USDA-Natural Resources Conservation Service. Provides federal funds for emergency protection measures to safeguard lives and property from floods and the products of erosion created by natural disasters that cause a sudden impairment to a watershed.	NRCS
Emergency Forest Restoration Program (EFRP)	Available through the USDA-Natural Resources Conservation Service. Helps owners of non-industrial private forests restore forest health damaged by natural disasters.	USDA

Oregon 319 Nonpoint Source Implementation Grants	Fund projects that reduce nonpoint source pollution, improve watershed functions and protect the quality of surface and groundwater, including restoration and education projects.	DEQ
Environmental Quality Incentives Program (EQIP)	Cost-shares water quality and wildlife habitat improvement activities, including conservation tillage, nutrient and manure management, fish habitat improvements, and riparian plantings.	NRCS
Agriculture Water Quality Support Grant	Provides capacity to support voluntary agricultural water quality work in small watersheds and to meet the goals of the Agricultural Water Quality Management Area Plans and the SIA initiative.	ODA
Agricultural Conservation Easement Program (ACEP)	Provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.	NRCS
Farm and Ranchland Protection Program (FRPP)	Cost-shares purchases of agricultural conservation easements to protect agricultural land from development.	NRCS, SWCDs, ODF
Federal Reforestation Tax Credit	Provides federal tax credit as incentive to plant trees.	Internal Revenue Service
Grassland Reserve Program (GRP)	Provides incentives to landowners to protect and restore pastureland, rangeland, and certain other grasslands.	NRCS
Landowner Incentive Program (LIP)	Provides funds to enhance existing incentive programs for fish and wildlife habitat improvements.	U.S. Fish and Wildlife Service
Oregon Watershed Enhancement Board (OWEB)	Provides grants for a variety of restoration, assessment, monitoring, and education projects, as well as watershed council staff support. 25 percent local match requirement on all grants.	OWEB
Oregon Watershed Enhancement Board Small Grant Program	Provides grants up to $10,000 for priority watershed enhancement projects identified by local focus group.	OWEB
Partners for Wildlife Program	Provides financial and technical assistance to private and non-federal landowners to restore and improve wetlands, riparian areas, and upland habitats in partnership with the U.S. Fish and Wildlife Service and other cooperating groups.	U.S. Fish and Wildlife Service
Public Law 566 Watershed Program	Program available to state agencies and other eligible organizations for planning and implementing watershed improvement and management projects. Projects should reduce erosion, siltation, and flooding; provide for agricultural water management; or improve fish and wildlife resources.	NRCS
Resource Conservation & Development (RC & D) Grants	Provides assistance to organizations within RC & D areas in accessing and managing grants.	Resource Conservation and Development
ODF Small Forestland Investment in Stream Habitat (SFISH) Grants	Provides funding for Small Forestland Owners (SFO's) to improve road conditions and stream crossings as part of forest operations.	ODF
State Forestation Tax Credit	Provides for reforestation of under-productive forestland not covered under the Oregon Forest Practices Act.	ODF

	Situations include brush and pasture conversions, fire damage areas, and insect and disease areas.	
Forest Stewardship Program	Provides cost share dollars through USFS funds to family forest landowners to have management plans developed.	ODF
Western Bark Beetle Mitigation	ODF administers a cost share program for forest management practices pertaining to bark beetle mitigation for forest health and is funded through the USFS.	ODF
State Tax Credit for Fish Habitat Improvements	Provides tax credit for part of the costs of voluntary fish habitat improvements and required fish screening devices.	ODFW
Wetlands Reserve Program (WRP)	Provides cost-sharing to landowners who restore wetlands on agricultural lands.	NRCS
Wildlife Habitat Tax Deferral Program	Maintains farm or forestry deferral for landowners who develop a wildlife management plan with the approval of the Oregon Department of Fish and Wildlife.	ODFW
Funding Resources for Watershed Protection and Restoration	EPA's Funding Resources for Watershed Protection and Restoration (EPA, 2023) contains links to multiple funding sources	Various

5.4 Schedule for implementation plan submittal

OAR 340-042-0040(4)(l)(I) specifies that the WQMP contain a schedule for submittal of implementation plans. As stated in OAR 340-042-0080(4)(a), entities identified in the WQMP with responsibility for developing implementation plans are required to prepare and submit an implementation plan for DEQ approval according to the schedule in the WQMP.

Within 18 months of EQC adoption of the amendment to the Willamette Basin Subbasins TMDL persons, including DMAs, responsible for developing implementation plans must submit implementation plans to DEQ for review and approval (See Table 8).

OAR 340-012-0055(2)(e) identifies failure to timely submit or implement a TMDL implementation plan, as required by DEQ order or rule, as a Class II violation. OAR 340-012-0053(1) identifies failure to report by the reporting deadline, as required by DEQ order or rule, as a Class I violation.

Should a sector or sector-wide DMA fail to submit an approvable TMDL implementation plan or fail to timely implement the plan, DEQ may pursue enforcement under OAR 340-012-0055(2)(e) or identify individual sources (landowners/operators) as persons responsible for developing and implementing TMDL implementation plans to address the load allocations relevant for the sector. DEQ may revise the WQMP or issue individual orders to identify additional responsible persons including DMAs and notify them of the required schedule for submitting source-specific implementation plans.

Following the issuance of this TMDL and WQMP, DEQ may determine that nonpoint source implementation plans are not necessary for certain entities identified in the WQMP based on available information or new information provided by those entities. For these entities, DEQ will provide a written determination for why a plan is not required. This determination could be based on a variety of factors, such as inaccurate identification within the geographic scope of

the TMDLs, or documentation that an entity is not a source of pollution or does not discharge pollutants to a waterbody within the geographic scope of a TMDL.

Once approved, DEQ expects implementation plans to be fully implemented according to the timelines and schedules for achieving measurable milestones specified within the plans. Implementation plans must be reviewed and revised as appropriate for DEQ approval every five years and submitted on the date specified in DEQ's approval letter for an implementation plan.

6. Monitoring and Evaluation of Progress

OAR 340-042-0040(4)(l)(K) requires that the WQMP include a plan to monitor and evaluate progress toward achieving the TMDL allocations and associated water quality standards for the impairments addressed in the TMDL. Additional objectives of monitoring efforts are to assess progress towards reducing excess pollutant loads and to better understand variability associated with environmental or anthropogenic factors. This section summarizes DEQ's approach, including the required elements of identification of monitoring responsibilities and the plan and schedule for reviewing monitoring information to make TMDL revisions, as appropriate.

There are two fundamental components to DEQ's approach to monitoring and evaluating TMDL progress:

1. Tracking the implementation and effectiveness of activities committed to by responsible persons including DMAs in DEQ-approved implementation plans, and
2. Periodically monitoring the physical, chemical and biological parameters necessary to assess water quality status and trends for the impairments that constitute the basis for this TMDL.

All responsible persons including DMAs are responsible for tracking the implementation and effectiveness of their actions and meeting milestones where established. The streamside evaluation (Section 5.3.2) will provide a baseline for DMA implementation plans against which DMA progress will be assessed. DEQ acknowledges that it will take decades for restored streamside areas to provide mature, overstory woody vegetation that shades streams, so DEQ will rely on tracking implementation compliance through DEQ approved implementation plans, annual reports, and comprehensive year five reviews (Sections 5.3.9 and 5.3.10) in the coming years.

DEQ effective shade targets are regulatory and can be used to assess implementation progress in the future. In areas where stream temperature criteria are not met, DEQ will assess the status of current conditions and effective shade targets as part of the adaptive management process (Section 6). DEQ will also evaluate other restoration efforts that have been implemented to improve stream temperature, for example channel morphology and stream flow restoration, protection and enhancement of cold water refuges, etc. In cases where DEQ determines implementation actions are not making sufficient progress, DEQ will rely on the adaptive management process and our enforcement authority to assess compliance with the load allocations.

With input from partners, DEQ will develop overarching water column sampling and analysis plans to finalize the first iteration of the Willamette Basin Temperature Monitoring Strategy after the issuance of the amendment to the Willamette Subbasins Temperature TMDL and WQMP. DEQ will continue to work with partners to implement the sampling and analysis plan and periodically refine the strategy as needed. Although DEQ encourages responsible persons including DMAs to conduct physical, chemical or biological monitoring to better evaluate how implementation actions may impact water quality conditions, DEQ is only requiring the DMAs listed under section 6.1 to conduct water column monitoring associated with this TMDL.

6.1 Persons responsible for water quality monitoring

Section 5.1 identifies responsible persons including DMAs that are responsible for developing TMDL implementation plans and implementing the management strategies described on the timelines committed to in approved plans. Section 5.3 details the content required in implementation plans and annual reports, as well as the schedules for their submittal.

DEQ is requiring ODA, ODF, BLM, and USFS to undertake monitoring actions in areas within their jurisdiction or ownership to help determine the status of instream water quality and landscape conditions associated with water quality. These four agencies have jurisdiction over approximately 93 percent of streamside areas in the Willamette Subbasins TMDL. For this reason, DEQ considers it appropriate for these large agencies to collaborate with DEQ on the Monitoring Strategy. DEQ encourages and invites other DMAs to collaborate with DEQ on collecting water quality data, especially DMAs that have been collecting temperature data as part of TMDL implementation or other related programs.

This effort will be iterative, beginning with review of existing data and monitoring locations, then adjusted as needed to improve understanding of current water quality status and develop a temperature trend monitoring network. DEQ expects to refine this monitoring strategy over time and modify as necessary.

The objectives for monitoring and assessment will be described in DMA implementation plans and will include, but are not limited to:

1. Provide information necessary to determine locations for applying management strategies or to assess the effectiveness of those strategies.
2. Refine information on source-specific or sector-specific pollutant loading.
3. Provide information necessary to demonstrate progress towards meeting load allocations.
4. Provide information used to identify roles and participate in collaborative effort among responsible persons including DMAs to characterize water quality status and trends.
5. Provide information integral to an adaptive management approach to inform and adjust management strategies over time.

Environmental media and water column monitoring activities conducted by ODA, ODF, BLM, USFS, or other DMAs to meet TMDL objectives, data collection and management must be performed in adherence to Quality Control procedures and Quality Assurance protocols established by DEQ, U.S. EPA or other appropriate organizations. This requirement will be met through developing or adapting Quality Assurance Project Plans or project-specific Sampling and Analysis Plans, and submitting to DEQ for review and approval based on a schedule determined by DEQ once development of the Monitoring Strategy has been initiated. ODA,

ODF, BLM, USFS or other DMAs can also agree to participate in a collaborative monitoring plan under an umbrella QAPP. DEQ staff will coordinate QAPP development with ODA, ODF, BLM, and USFS upon request in advance of submission. Resources for developing quality assurance project plans and sampling and analysis plans are available on DEQ's water quality monitoring website (DEQ, 2023a).

At a minimum, ODA, ODF, BLM, and USFS must acknowledge in their implementation plans their responsibility in collaborating with DEQ to develop the Willamette Basin Temperature Monitoring Strategy. DEQ encourages these agencies to begin evaluating their existing temperature monitoring networks, if any, and explore opportunities to establish future long-term monitoring sites. Data collected by DMAs participating in the monitoring strategy must be in a format accessible to DEQ.

6.2 Plan and schedule for reviewing monitoring information and revising the TMDL

DEQ recognizes that it will take time before management practices identified in a WQMP are fully implemented and effective in reducing and controlling pollution. DEQ also recognizes that despite best efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL. Such events include, but are not limited to, floods, fire, insect infestations and drought. In addition, DEQ recognizes that technology and practices for controlling nonpoint source pollution will continue to develop and improve over time. DEQ will use adaptive management to refine implementation as technology, and knowledge about these approaches progress.

Adaptive management is a process that acknowledges and incorporates improved technologies and practices over time to refine implementation. A conceptual representation of the TMDL adaptive management process is presented in Figure 5.

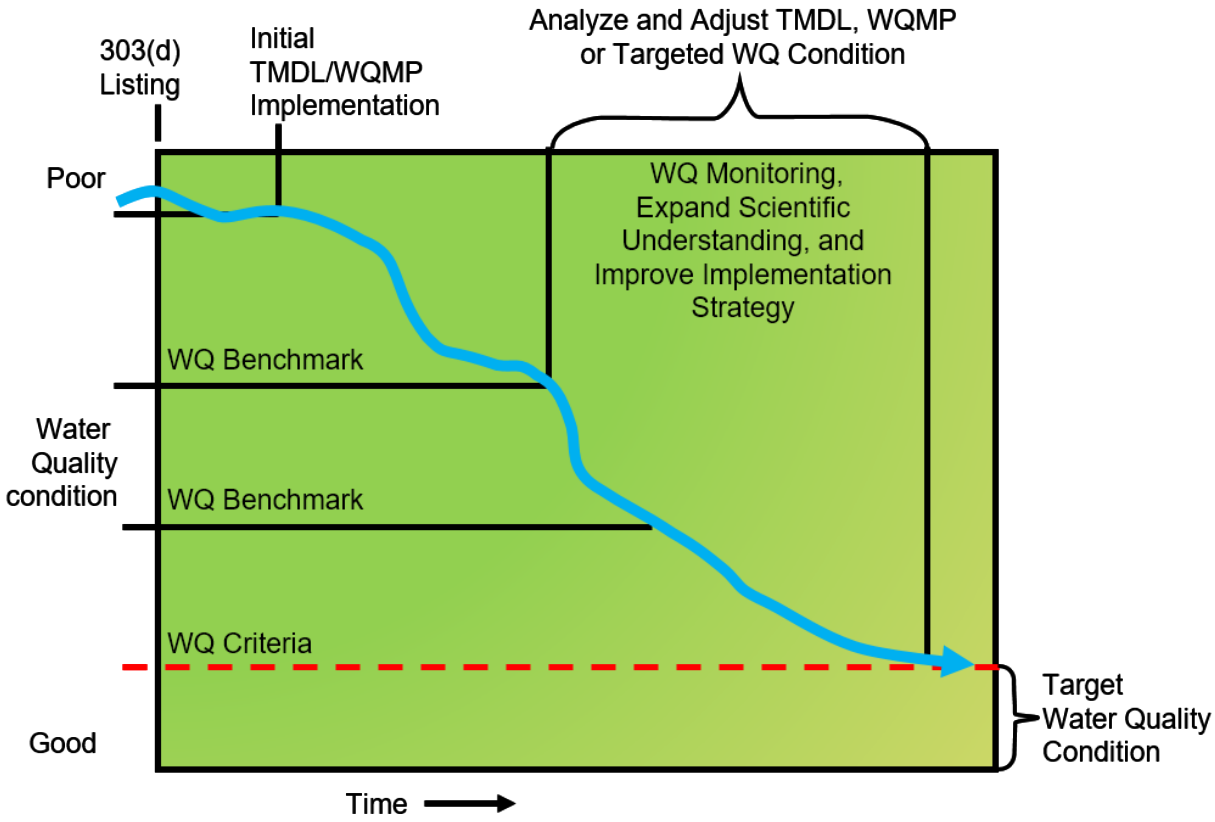

Figure 5: Conceptual representation of adaptive management.

DEQ considers entities complying with DEQ-approved TMDL implementation plans to be in compliance with their respective requirements contained in the TMDLs. The annual reports and Year Five Reviews submitted to DEQ by each of the responsible persons including DMAs in the Willamette Basin will be evaluated individually and collectively. DEQ will use this information to determine whether management actions are supporting progress towards TMDL objectives, or if changes in management actions and/or TMDLs are needed.

DEQ will review annual reports, participate with responsible persons including DMAs in review of monitoring information, and participate in implementing the Willamette Basin Monitoring Strategy.

Every five years, DEQ will collectively evaluate annual reports and all available monitoring data and information to assess progress on meeting the goals of the TMDLs and WQMP.

- DEQ will require responsible persons including DMAs to revise their implementation plans to address deficiencies where DEQ determines that implementation plans or effectiveness of management strategies are inadequate.
- DEQ and partners will revise sampling and analysis plans or other aspects of the Monitoring Strategy where progress toward meeting Monitoring Strategy objectives is not being made.
- DEQ will consider TMDL revisions if DEQ's evaluation of water monitoring data and supporting information indicate that the TMDL load allocations for a given pollutant-impairment are insufficient to meet state numeric criteria or narrative criteria, or insufficient to protect the designated beneficial uses.

- DEQ will follow all public participation requirements, including convening a local technical or rulemaking advisory committee to provide input on TMDL revisions per OAR 340-042-0040(7).

7. Reasonable Assurance of Implementation

OAR 340-042-0030(9) defines Reasonable Assurance as "a demonstration that a TMDL will be implemented by federal, state or local governments or individuals through regulatory or voluntary actions including management strategies or other controls." OAR 340-042-0040(4)(l)(J) requires a description of reasonable assurance that management strategies and sector-specific or source-specific implementation plans will be carried out through regulatory or voluntary actions. As a factor in consideration of allocation distribution among sources, OAR 340-042-0040(6)(g) states that "to establish reasonable assurance that the TMDL's load allocations will be achieved requires determination that practices capable of reducing the specified pollutant load: (1) exist; (2) are technically feasible at a level required to meet allocations; and (3) have a high likelihood of implementation." This three-point test is consistent with EPA past practice on determining reasonable assurance in the Chesapeake Bay TMDL (EPA, 2010) and supports federal antidegradation rules and Oregon's antidegradation policy (OAR 340-041-0004).

The Clean Water Act Section 303(d) requires that a TMDL be "established at a level necessary to implement the applicable water quality standard." Federal regulations define a TMDL as "the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background" [40 CFR 130.2(i)]. For TMDL approval, EPA guidance documents and memos on the TMDL process requires determinations that allocations are appropriate to implement water quality standards and reasonable assurance that nonpoint source controls will achieve load reductions, when WLAs are based on an assumption that nonpoint source load reductions will occur (EPA, 1991, 2002 and 2012).

Although TMDL implementation is anticipated to improve rather than lower water quality, federal antidegradation rules at 40 CFR 131.12(a)(2), require states to "assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and cost-effective and reasonable best management practices for nonpoint source control," when allowing any lowering of water quality.

When a TMDL is developed for waters impaired by point sources only, the existence of the NPDES regulatory program and the issuance of NPDES permits provide the reasonable assurance that the wasteload allocations in the TMDL will be achieved. That is because federal regulations implementing the Clean Water Act require that water quality-based effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL [40 CFR 122.44(d)(1)(vii)(B)].

Where a TMDL is developed for waters impaired by both point and nonpoint sources, it is the state's best professional judgment as to the three-point test in OAR 340-042-0040(6)(g) on reasonable assurance that the TMDL's load allocations will be achieved.

Where there is a demonstration that nonpoint source load reductions can and will be achieved; a determination that reasonable assurance exists and allocation of greater loads to point sources is appropriate. Without a demonstration of reasonable assurance that relied-upon nonpoint source reductions will occur, reductions to point sources wasteload allocations are needed.

The Willamette Subbasins TMDLs were developed to address both point and nonpoint sources with TMDL load allocations set at levels that will attain the applicable temperature criteria. Allocations were developed with consideration of source contributions and opportunities for effective measures to reduce those contributions. There are several elements that combine to provide the reasonable assurance to meet federal and state requirements, including for antidegradation. Education, outreach, technical and financial assistance, permit administration, permit enforcement, responsible persons' including DMAs' implementation and DEQ enforcement of TMDL implementation plans will all be used to ensure that the goals of this TMDL are met.

7.1 Accountability framework

Reasonable assurance that needed load reductions will be achieved for nonpoint sources and antidegradation requirements and narrative water quality criteria will be met is based primarily on an accountability framework incorporated into the WQMP, together with the implementation plans of persons responsible for implementation. This approach is similar to the accountability framework adopted by EPA for the Chesapeake Bay TMDL, which was adopted in 2010 (EPA, 2010). Figure 6 presents the accountability framework elements, which are intended to work in concert to demonstrate reasonable assurance of implementation.

Figure 6: Representation of the reasonable assurance accountability framework led by DEQ.

Pollutant reduction strategies are identified in Section 2 and more specific strategies, practices and actions will be detailed in each required implementation plan, to be submitted per the timelines in Section 5.4. These strategies and actions are comprehensively implemented through a variety of regulatory and non-regulatory programs. Many of these are existing strategies and actions that are already being implemented within the watershed and demonstrate reduced pollutant loading. These strategies are technically feasible at an appropriate scale to meet the allocations. A high likelihood of implementation is demonstrated because DEQ reviews the individual implementation plans and proposed actions for adequacy and establishes a monitoring and reporting system to track implementation and respond to any inadequacies.

In Oregon, forestry and agricultural related nonpoint source best management strategies are implemented through the state Forest Practices Act and agricultural Water Quality Management Area Plans and Rules. In Sections 5.2.1 and 5.2.2 DEQ determined that ODF and ODA must also develop and implement TMDL implementation plans that describe strategies specific to the Willamette River Subbasins. This adds to the accountability for implementation of cost-effective and reasonable best management and further assures that antidegradation requirements and narrative criteria will be met.

Approximately 133 responsible persons including DMAs in Appendix A are responsible for implementation of pollutant reduction strategies. General timelines, milestones and measurable objectives are identified in Sections 3 and 4.2, respectively. More specific timelines, milestones and measurable objectives will be specified in each required implementation plan. Attaining the relevant water quality criteria are provided in Sections 3 and 4.2, respectively. These elements support timely action by both DEQ and other entities responsible for implementation so that enforcement and adaptive management actions can be triggered and evaluation of attainment of TMDL goals occurs.

DEQ periodically reviews reporting by persons and agencies responsible for implementing pollutant reduction strategies to track the management strategies being implemented and evaluate achievements against established timelines and milestones.

Following up on reviews to track progress of implementation plans, DEQ will take appropriate action if responsible persons including DMAs fail to develop or effectively implement their implementation plan or fulfill milestones. DEQ's actions can include enforcement or engagement in voluntary initiatives. DEQ uses both, as appropriate within the process, to achieve optimal pollutant reductions. In some cases, DEQ will also take enforcement actions where necessary based on authorities listed in Section 8 or raise the issue to the Environmental Quality Commission as provided in OAR 340-042-0080.

DEQ tracks water quality status and trends concurrently with implementation of management strategies. DEQ relies on a system of interconnected evaluations, which include DMAs meeting measurable objectives, effectiveness demonstration of pollutant management strategies, accountability of implementation, periodically assessing progress on Oregon's Nonpoint Source Program Five-Year Plan Goals (approved by EPA), discharge monitoring and instream monitoring. DEQ also periodically evaluates water quality data collected through ambient and specific monitoring programs, including monitoring plans developed specifically for the Willamette Basin, as presented in Section 6. The *Assessment and Monitoring Strategy to Support Implementation of Mercury Total Maximum Daily Loads for the Willamette Basin* is one such plan, which was developed in partnership with EPA. DEQ regularly prepares Status and Trends reports and conducts water quality assessments on status of all waterways in Oregon every two years, as required by the Clean Water Act for submittal to EPA for approval as DEQ's Integrated Report. Together, these data and evaluations allow refinement of focus on specific geographic areas or discharges and appropriate implementation of adaptive management actions to attain, over time, the objectives of the TMDL.

Human alteration of the earth's atmosphere has changed the timing, amounts, temperature, and quality of precipitation worldwide, This global phenomenon may produce localized changes to water quality in the Willamette Valley. Implementing policies and projects that reduce and mitigate GHG releases will support efforts to adapt to climate change and the goals of this temperature TMDL.

Oregon has goals to reduce GHG emissions 75 percent below 1990 levels by 2050. The Oregon Climate Action Commission is responsible for preparing detailed forecasts of GHG emissions and submits these data in a biennial report to the Legislature. The OCAC uses data provided from DEQ, and other state agencies, to track trends in GHG emissions and recommend strategies for meeting the state's emissions reduction goals.

Oregon Governor Kate Brown signed Executive Order 20-04 in 2020, directing state agencies to take action to reduce and regulate GHG emissions. Following this executive order, 24 state agencies participated in developing the 2021 State Agency Climate Change Adaptation Framework. This framework is meant to support planning and coordination between state agencies, and in collaboration with local government and community partners, in implementing actions to achieve climate change adaptation in Oregon.

DEQ continues to work toward the goals of Executive Order 20-04, and in 2024 DEQ's Environmental Quality Commission adopted the Climate Protection Program. The CPP is a climate mitigation program that sets an enforceable declining cap on GHG emissions from fossil fuels used throughout Oregon, including diesel, gasoline, and natural gas. The program is designed to reduce fossil fuel emissions by 50 percent by 2035 and 90 percent by 2050. As part of this program, DEQ is developing carbon emissions intensity targets for energy-intensive trade-exposed industries (EITEs are primarily manufacturing industries that release high amounts of GHG and face a lot of national and global competition for their products), and direct natural gas sources. The program also prioritizes equity by promoting benefits and alleviating burdens for communities of color, tribal communities, rural communities, and communities experiencing lower incomes. More information about this program and other DEQ Office of Greenhouse Gases programs can be accessed on DEQ's website. A comprehensive summary of Oregon's efforts related to climate change mitigation and adaption can be found in OCAC reports online.

While state level programs will reduce GHG emissions from within Oregon, the complex impacts of climate change on temperature loadings to Willamette Basin rivers and streams will require concurrent actions at multiple scales to address the causes and mitigate the effects of global climate change. Urgent and ongoing action is required at the federal level to support large scale and long-term reductions of GHG emissions. DEQ also recognizes that work around climate change can shift depending on the political environment and priorities of the federal administration.

7.2 Reasonable assurance conclusions

DEQ's implementation approach is multi-faceted and requires many targeted management practices across the entire basin to reduce anthropogenic pollutants, regardless of source origination.

The management strategies and practices that must be employed to reduce excess solar radiation loading are spatially distributed and involve multiple responsible persons including DMAs. Also, highly variable lag times are anticipated following the establishment of shade-producing vegetation to decrease solar radiation reaching streams. For these reasons, there is some uncertainty about the pace of achieving the needed reductions necessary in the Willamette Subbasins to attain water quality criteria. DEQ's WQMP addresses this uncertainty by including an extensive monitoring, reporting, and adaptive component that is designed to match the accountability framework used by EPA in its Chesapeake Bay TMDL (2010).

The rationale described in this document stems from robust evaluations, implements an accountability framework and provides opportunities for adaptive management to maximize pollutant reductions. In addition, DMAs and other groups have been continuing to implement on-the-ground actions since the establishment of the 2006 Willamette Basin Temperature TMDL.

Together this approach provides reasonable assurance to meet state and federal requirements, including for antidegradation, and attain the goals of the TMDL.

8. Legal Authorities

As required in Oregon Administrative Rule 340-042-0040(4)(l)(O), this section cites legal authorities relating to implementation of management strategies.

Clean Water Act, Section 303(d)

The DEQ is the Oregon state agency responsible for implementing the Clean Water Act in Oregon. Section 303(d) of the 1972 Federal Clean Water Act as amended requires states to develop a list of rivers, streams and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. These waters are referred to as “water quality limited.” Water quality limited waterbodies must be identified by the EPA or by a state agency which has this authority. In Oregon, the responsibility to delegate water quality limited waterbodies rests with DEQ and DEQ’s list of water quality limited waters is updated every two years. The list is referred to as the 303(d) list. Section 303 of the Clean Water Act further requires that TMDLs be developed for all waters on the 303(d) list. The Oregon Environmental Quality Commission granted DEQ authority to implement TMDLs through OAR 340-042, with special provisions for agricultural lands and nonfederal forestland as governed by the Agriculture Water Quality Management Act and the Forest Practices Act, respectively. The EPA has the authority under the Clean Water Act to approve or disapprove TMDLs that states submit. When a TMDL is officially submitted by a state to EPA, EPA has 30 days to take action on the TMDL. In the case where EPA disapproves a TMDL, EPA must issue a TMDL within 30 days. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to describe a strategy for reducing water pollution to the level of the load allocations and waste load allocations prescribed in the TMDL, which is designed to restore the water quality and result in compliance with the water quality standards. In this way, the designated beneficial uses of the water will be protected for all users.

Endangered Species Act, Section 6

Section 6 of the 1973 federal Endangered Species Act, as amended, encourages states to develop and maintain conservation programs for federally listed threatened and endangered species. In addition, Section 4(d) of the ESA requires the National Marine Fisheries Service to list the activities that could result in a “take” of species they are charged with protecting. With regard to this TMDL, NMFS’ protected species are salmonid fish. NMFS also described certain precautions that, if followed, would preclude prosecution for take even if a listed species were harmed inadvertently. Such a provision is called a limit on the take prohibition. The intent is to provide local governments and other entities greater certainty regarding their liability for take.

NMFS published their rule in response to Section 4(d) in July of 2000 (see 65 FR 42421, July 10, 2000). The NMFS 4(d) rule lists 12 criteria that will be used to determine whether a local program incorporates sufficient precautionary measures to adequately conserve fish. The rule provides for local jurisdictions to submit development ordinances for review by NMFS under one, several or all of the criteria. The criteria for the Municipal, Residential, Commercial and Industrial Development and Redevelopment limit are listed below:

1. Avoid inappropriate areas such as unstable slopes, wetlands, and areas of high habitat value;
2. Prevent stormwater discharge impacts on water quality;
3. Protect riparian areas;
4. Avoid stream crossings – whether by roads, utilities, or other linear development;
5. Protect historic stream meander patterns;
6. Protect wetlands, wetland buffers, and wetland function;
7. Preserve the ability of permanent and intermittent streams to pass peak flows (hydrologic capacity);
8. Stress landscaping with native vegetation;
9. Prevent erosion and sediment run-off during and after construction;
10. Ensure water supply demand can be met without affecting salmon needs;
11. Provide mechanisms for monitoring, enforcing, funding and implementing; and
12. Comply with all other state and federal environmental laws and permits.

Oregon Revised Statute Chapter 468B

DEQ is authorized by law to prevent and abate water pollution within the State of Oregon. Particularly relevant provisions of this chapter include:

ORS 468B.020 Prevention of pollution

(A) Pollution of any of the waters of the state is declared to be not a reasonable or natural use of such waters and to be contrary to the public policy of the State or Oregon, as set forth in ORS 468B.015.

(B) In order to carry out the public policy set forth in ORS 468B.015, the Department of Environmental Quality shall take such action as is necessary for the prevention of new pollution and the abatement of existing pollution by:

a) Fostering and encouraging the cooperation of the people, industry, cities and counties, in order to prevent, control and reduce pollution of the waters of the state; and

b) Requiring the use of all available and reasonable methods necessary to achieve the purposes of ORS 468B.015 and to conform to the standards of water quality and purity established under ORS 468B.048.

ORS 468B.110 provides DEQ and the EQC with authority to take actions necessary to achieve and maintain water quality standards, including issuing TMDLs and establishing wasteload allocations and load allocations.

NPDES and WPCF Permits

DEQ administers two different types of wastewater permits in implementing Oregon Revised Statute (ORS) 468B.050. These are: the NPDES permits for waste discharge into waters of the United States; and Water Pollution Control Facilities permits for waste disposal on land. The NPDES permit is also a federal permit and is required under the Clean Water Act. The WPCF permit is a state program.

401 Water Quality Certification

Section 401 of the CWA requires that any applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the state must provide the licensing or permitting agency a certificate from DEQ that the activity complies with water quality requirements and standards. These include certifications for hydroelectric projects and for 'dredge and fill' projects. The legal citations are: 33 U.S.C. 1341; ORS 468B.035 – 468B.047; and OAR 340-048-0005 – 340-048-0040.

USACE Dam Operation and Management

In association with other federal statues, including House Document No. 531 Volume V, the River and Harbor Act, the Flood Control Act, and the Water Resources Development Act, the USACE is charged with operating its projects in compliance with the federal Clean Water Act, and in accordance with all federal, State, interstate and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water quality pollution as per Title 1 Section 313 (33 U.S.C. 1323).

Oregon Forest Practices Act

The Oregon Department of Forestry is the designated management agency for regulating land management actions on non-federal forestry lands that impact water quality (ORS 527.610 to 527.992, and OAR 629 Divisions 600 through 665). The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 625, 630, and 635-660, which describe best management practices for forest operations. The Oregon Environmental Quality Commission, Board of Forestry, DEQ, and ODF have agreed that these pollution control measures will primarily be relied upon to result in achievement of state water quality standards. Statutes and rules also include provisions for adaptive management that provide for revisions to FPA practices where necessary to meet water quality standards. These provisions are described in ORS 527.710, ORS 527.765, OAR 629-035-0100, and OAR 340-042-0080.

Agricultural Water Quality Management Act

The Oregon Department of Agriculture is responsible for the prevention and control of water pollution from agricultural activities as directed and authorized through the Agricultural Water Quality Management Act, adopted by the Oregon legislature in 1993 (ORS 568.900 to ORS 568.933). It is the lead state agency for regulating agriculture for water quality (ORS 561.191). The Agricultural Water Quality Management Plan Act directs the ODA to work with local communities to develop water quality management plans for specific watersheds that have been identified as violating water quality standards and have agriculture water pollution contributions. The agriculture water quality management plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct the problems. Water Quality area rules for areas within the Willamette Basin include OAR 603-095-2100 to 1160, OAR 603-095-2300 to 2360, OAR 603-095-2600 to 2660, and OAR 603-095-3700 to 3760.

Local Ordinances

Local governments are expected to describe in their implementation plans their specific legal authorities to carry out the management strategies necessary to meet the TMDL allocations. If new or modified local codes or ordinances are required to implement the plan, the DMA will identify code development as a management strategy. Legal authority to enforce the provisions of a city's NPDES permit would be a specific example of legal authority to carry out specific management strategies.

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Appendix A: List of responsible persons including designated management agencies

No.	Designated Management Agencies/Responsible Persons	DMA Type	Total Acres in Subbasins	Acres 150ft from stream	DMA/RP Status	TMDL Plan Needed?
1	Adair Village	City	483	55	existing	yes
2	Albany	City	11,237	1,139	existing	yes
3	Aumsville	City	788	103	existing	yes
4	Aurora	City	315	45	existing	yes
5	Brownsville	City	834	96	existing	yes
6	Canby	City	3,185	123	existing	yes
7	Coburg	City	653	68	existing	yes
8	Corvallis	City	14,020	1,695	existing	yes
9	Cottage Grove	City	2,403	408	existing	yes
10	Creswell	City	1,432	123	existing	yes
11	Dallas	City	3,998	757	existing	yes
12	Detroit	City	661	132	existing	yes
13	Donald	City	283	18	existing	yes
14	Dundee	City	848	51	existing	yes
15	Estacada	City	1,434	207	existing	yes
16	Eugene	City	31,614	3,606	existing	yes
17	Fairview	City	1,773	343	existing	yes
18	Falls City	City	787	241	existing	yes
19	Gates	City	399	175	existing	yes
20	Gervais	City	308	19	existing	yes
21	Gladstone	City	1,578	163	existing	yes
22	Gresham	City	11,952	1,594	existing	yes
23	Halsey	City	259	36	existing	yes
24	Happy Valley	City	7,402	1,569	existing	yes
25	Harrisburg	City	826	129	existing	yes
26	Hubbard	City	444	29	existing	yes
27	Idanha	City	530	147	existing	yes
28	Independence	City	1,908	263	existing	yes
29	Jefferson	City	529	118	existing	yes
30	Junction City	City	1,992	280	existing	yes
31	Keizer	City	4,298	257	existing	yes

32	Lake Oswego	City	5,807	990	existing	yes
33	Lebanon	City	4,306	431	existing	yes
34	Lowell	City	534	76	existing	yes
35	Lyons	City	544	83	existing	yes
36	McMinnville	City	9.1	3	new	no
37	Mill City	City	526	158	existing	yes
38	Millersburg	City	2,804	423	existing	yes
39	Milwaukie	City	3,241	330	existing	yes
40	Molalla	City	1,642	74	existing	yes
41	Monmouth	City	1,462	135	existing	yes
42	Monroe	City	342	78	existing	yes
43	Mt. Angel	City	677	18	existing	yes
44	Newberg	City	3,692	318	existing	yes
45	Oakridge	City	1,241	153	existing	yes
46	Oregon City	City	6,437	597	existing	yes
47	Philomath	City	1,597	165	existing	yes
48	Portland	City	73,674	10,876	existing	yes
49	Salem	City	31,373	3,576	existing	yes
50	Sandy	City	1,768	197	existing	yes
51	Scappoose	City	2,098	212	new	yes
52	Scio	City	262	40	existing	yes
53	Scotts Mills	City	225	46	existing	yes
54	Silverton	City	2,455	597	existing	yes
55	Springfield	City	10,323	1,154	existing	yes
56	St. Helens	City	1,973	368	new	yes
57	St. Paul	City	184	6	existing	yes
58	Stayton	City	1,923	439	existing	yes
59	Sublimity	City	595	25	existing	yes
60	Sweet Home	City	3,441	753	existing	yes
61	Tangent	City	2,230	252	existing	yes
62	Tualatin	City	401	7	existing	no
63	Turner	City	911	124	existing	yes
64	Veneta	City	1,658	207	existing	yes
65	West Linn	City	4,335	933	existing	yes
66	Westfir	City	192	68	existing	yes
67	Wilsonville	City	4,869	549	existing	yes
68	Woodburn	City	3,596	276	existing	yes
69	Benton County	County	27,798	3,456	existing	yes
70	Clackamas County	County	79,838	13,994	existing	yes
71	Columbia County	County	15,374	3,499	new	yes
72	Curry County	County	3	0.5	new	no
73	Lane County	County	121,090	21,545	existing	yes
74	Lincoln County	County	89	43	new	no

75	Linn County	County	35,141	6,781	existing	yes
76	Marion County	County	43,290	6,267	existing	yes
77	Multnomah County	County	4,089	1,172	existing	yes
78	Polk County	County	20,855	4,102	existing	yes
79	Washington County	County	2,130	156	new	no
80	Yamhill County	County	10,131	1,401	new	yes
81	Bonneville Power Administration	Federal	1,018	270	new	no
82	U.S. Bureau of Land Management	Federal	351,837	110,432	existing	yes
83	U.S. Fish and Wildlife Service	Federal	10,912	1,604	existing	yes
84	U.S. Forest Service	Federal	2,201,208	549,814	existing	yes
85	U.S. Army Corps of Engineers	Federal	29,289	5,980	existing	yes
86	Pacific Power and Light	Private Utility	35	1	new	no
87	Eugene Water and Electric Board	Public Utility	not assessed	not assessed	existing	yes
88	Portland General Electric	Public Utility	not assessed	not assessed	new	yes
89	Albany & Eastern Railroad	Railroad	304	61	new	no
90	BNSF Railway	Railroad	148	9	new	no
91	Central Oregon & Pacific Railroad	Railroad	182	51	new	no
92	Oregon Pacific Railroad	Railroad	44	2	new	no
93	Port of Coos Bay	Transportation	315	57	new	no
94	Portland & Western Railroad	Railroad	1,898	279	new	no
95	Portland Terminal Railroad Company	Railroad	0.1	0.1	new	no
96	TriMet	Railroad	102	38	new	no
97	Union Pacific Railroad	Railroad	3,788	677	new	no
98	Vennel Farms Railroad Company	Railroad	2	0.2	new	no
99	Willamette Shore Trolley	Railroad	6	1	new	no
100	Willamette Valley Railway	Railroad	255	51	new	no
101	Ash Creek Water Control District	Responsible Person	not assessed	not assessed	new	no
102	Creswell Water Control District	Responsible Person	not assessed	not assessed	new	no
103	Creswell Irrigation District	Responsible Person	not assessed	not assessed	new	no
104	East Valley Water District	Responsible Person	not assessed	not assessed	new	no
105	Fertile Improvement District	Responsible Person	not assessed	not assessed	new	no

106	G A Miller Drainage District No 1	Responsible Person	not assessed	not assessed	new	no
107	Grand Prairie Water Control District	Responsible Person	not assessed	not assessed	new	no
108	Hawn Creek District Improvement Co.	Responsible Person	not assessed	not assessed	new	no
109	Junction City Water Control District	Responsible Person	not assessed	not assessed	new	no
110	Lacomb Irrigation District	Responsible Person	not assessed	not assessed	new	no
111	Lake Labish Water Control District	Responsible Person	not assessed	not assessed	new	no
112	Muddy Creeks Irrigation Project	Responsible Person	not assessed	not assessed	new	no
113	North Lebanon Water Control District	Responsible Person	not assessed	not assessed	new	no
114	Palmer Creek Water District Improvement Co.	Responsible Person	not assessed	not assessed	new	no
115	Urban Flood Safety and Water Quality District	Responsible Person	not assessed	not assessed	new	no
116	Santiam Water Control District	Responsible Person	not assessed	not assessed	new	no
117	Sauvie Island Drainage Improvement Company	Responsible Person	not assessed	not assessed	new	no
118	Scappoose Drainage Improvement Company	Responsible Person	not assessed	not assessed	new	no
119	Sidney Irrigation District	Responsible Person	not assessed	not assessed	new	no
120	West Labish Water Control District	Responsible Person	not assessed	not assessed	new	no
121	Metro (Portland Metropolitan Government)	Special District	not assessed	not assessed	existing	yes
122	Water Environment Services	Special District	not assessed	not assessed	existing	yes
123	Oak Lodge Water Services	Special District	not assessed	not assessed	existing	yes
124	Department of Geology and Mineral Industries	State	2,055	357	existing	no
125	Oregon Department of Agriculture	State	1,296,224	205,135	existing	yes
126	Oregon Department of Environmental Quality	State	0	0	existing	no
127	Oregon Department of Fish & Wildlife	State	10,080	1,588	new	yes
128	Oregon Department of Forestry	State	1,721,090	458,257	existing	yes
129	Oregon Department of State Lands	State	336	124	existing	no
130	Oregon Department of Transportation	State	31,007	5,525	existing	yes
131	Oregon Parks and Recreation Department	State	19,440	4,692	existing	yes

132	Port of Columbia County	Transportation	619	71	new	yes
133	Port of Portland	Transportation	5,497	558	existing	yes

Appendix B: Acres of jurisdiction, by HUC, within 150 feet of stream centerline for each entity

Landowner or Jurisdiction	Classification	Acres in HUC8 subbasin	Acres in HUC8 subbasin 150 feet from a stream centerline
Molalla-Pudding Subbasin - HUC 17090009			
Oregon Department of Forestry	State Agency	207,747	56,523
Oregon Department of Agriculture	State Agency	237,200	35,970
U.S. Bureau of Land Management	Federal Agency	54,013	16,403
Marion County	County	19,780	2,733
Clackamas County	County	11,823	2,594
Oregon Parks and Recreation Department	State Agency	9,197	2,073
U.S. Forest Service	Federal Agency	2,796	762
Water	Water	819	738
City of Silverton	Municipality	2,455	597
City of Salem	Municipality	3,245	388
City of Woodburn	Municipality	3,596	276
Oregon Department of Transportation	State Agency	2,255	252
U.S. Government	Federal Agency	315	108
State of Oregon	State Agency	569	85
City of Molalla	Municipality	1,642	74
City of Canby	Municipality	1,081	65
City of Scotts Mills	Municipality	225	46
City of Aurora	Municipality	315	45
City of Hubbard	Municipality	444	29
Willamette Valley Railway	Private	196	25
City of Gervais	Municipality	308	19
City of Mt. Angel	Municipality	677	18
Union Pacific Railroad	Private	276	18
Portland & Western Railroad	Private	51	2
Oregon Pacific Railroad	Private	41	2
City of Barlow	Municipality	33	0
City of Donald	Municipality	70	0

Oregon Department of Fish and Wildlife	State Agency	215	0
Middle Willamette Subbasin - HUC 17090007			
Oregon Department of Agriculture	State Agency	265,372	29,797
Oregon Department of Forestry	State Agency	40,322	12,687
Water	Water	6,007	5,346
Clackamas County	County	20,406	3,695
City of Salem	Municipality	27,830	3,023
Polk County	County	11,325	2,054
Marion County	County	18,823	1,910
U.S. Bureau of Land Management	Federal Agency	3,787	1,413
Yamhill County	County	10,131	1,401
City of Dallas	Municipality	3,998	757
Oregon Parks and Recreation Department	State Agency	3,699	591
Oregon Department of Transportation	State Agency	4,810	590
U.S. Fish and Wildlife Service	Federal Agency	5,092	549
City of Wilsonville	Municipality	4,869	549
City of Oregon City	Municipality	5,559	487
U.S. Forest Service	Federal Agency	1,033	363
City of West Linn	Municipality	2,191	362
City of Newberg	Municipality	3,692	318
City of Independence	Municipality	1,908	263
City of Keizer	Municipality	4,298	257
Washington County	County	2,094	152
City of Stayton	Municipality	1,200	146
State of Oregon	State Agency	306	145
City of Turner	Municipality	911	124
City of Monmouth	Municipality	1,433	120
City of Aumsville	Municipality	788	103
Union Pacific Railroad	Private	251	73
Portland & Western Railroad	Private	524	59
City of Canby	Municipality	2,102	57
City of Dundee	Municipality	848	51
U.S. Government	Federal Agency	91	29
Oregon Department of Geology and Mineral Industries	State Agency	329	26
Willamette Valley Railway	Private	59	26
City of Sublimity	Municipality	595	25
Oregon Department of Fish and Wildlife	State Agency	357	22
City of Donald	Municipality	213	18
City of Gladstone	Municipality	20	14
City of Tualatin	Municipality	327	7

City of St. Paul	Municipality	184	6
Bonneville Power Administration	Special District	22	5
City of McMinnville	Municipality	9	3
Oregon Military Department	State Agency	14	2
TriMet	Special District	10	1
City of Tigard	Municipality	15	0
Oregon Department of Aviation	State Agency	15	0
SP Fiber Technologies Railway	Private	1	0
North Santiam Subbasin - HUC 17090005			
U.S. Forest Service	Federal Agency	293,610	92,924
Oregon Department of Forestry	State Agency	94,279	33,850
Oregon Department of Agriculture	State Agency	57,498	15,423
U.S. Bureau of Land Management	Federal Agency	20,455	7,967
Marion County	County	4,648	1,618
U.S. Army Corps of Engineers	Federal Agency	4,060	1,223
Linn County	County	3,607	999
Water	Water	911	848
Oregon Department of Transportation	State Agency	1,877	693
City of Stayton	Municipality	723	293
Oregon Department of Fish and Wildlife	State Agency	419	222
City of Gates	Municipality	399	175
City of Salem	Municipality	298	165
Oregon Department of Geology and Mineral Industries	State Agency	420	159
City of Mill City	Municipality	526	158
City of Idanha	Municipality	530	147
City of Detroit	Municipality	661	132
City of Jefferson	Municipality	529	118
State of Oregon	State Agency	237	101
City of Lyons	Municipality	544	83
Oregon Parks and Recreation Department	State Agency	183	78
Bonneville Power Administration	Special District	153	42
U.S. Government	Federal Agency	98	33
Union Pacific Railroad	Private	61	31
Albany & Eastern Railroad	Private	94	25
Portland & Western Railroad	Private	12	5
Pacific Power and Light	Private	1	0
Confederated Tribes of Warm Springs	Tribal	717	0
Jefferson County	County	0	0
South Santiam Subbasin - HUC 17090006			
Oregon Department of Forestry	State Agency	310,035	98,467

U.S. Forest Service	Federal Agency	155,242	69,455
Oregon Department of Agriculture	State Agency	113,371	27,567
U.S. Bureau of Land Management	Federal Agency	59,501	21,585
Linn County	County	13,621	3,586
Water	Water	5,254	1,923
City of Sweet Home	Municipality	3,441	753
Oregon Department of Transportation	State Agency	1,519	492
City of Lebanon	Municipality	1,762	279
U.S. Army Corps of Engineers	Federal Agency	1,068	257
Oregon Parks and Recreation Department	State Agency	254	77
City of Scio	Municipality	262	40
State of Oregon	State Agency	49	37
Albany & Eastern Railroad	Private	164	30
Oregon Department of Geology and Mineral Industries	State Agency	107	25
Oregon Department of Fish and Wildlife	State Agency	41	19
City of Waterloo	Municipality	81	16
U.S. Government	Federal Agency	81	14
Pacific Power and Light	Private	1	0
Bonneville Power Administration	Special District	0	0
City of Sodaville	Municipality	7	0
Upper Willamette Subbasin - HUC 17090003			
Oregon Department of Forestry	State Agency	419,332	84,994
Oregon Department of Agriculture	State Agency	497,249	74,131
U.S. Bureau of Land Management	Federal Agency	48,530	14,570
Lane County	County	50,389	7,618
U.S. Forest Service	Federal Agency	14,684	4,164
Benton County	County	27,798	3,524
City of Eugene	Municipality	30,202	3,459
Water	Water	3,511	2,453
Linn County	County	17,912	2,196
Polk County	County	9,530	2,048
City of Corvallis	Municipality	14,020	1,695
U.S. Army Corps of Engineers	Federal Agency	11,988	1,423
Oregon Department of Transportation	State Agency	7,953	1,206
City of Albany	Municipality	11,237	1,139
U.S. Fish and Wildlife Service	Federal Agency	5,696	993
Oregon Parks and Recreation Department	State Agency	3,247	954
City of Springfield	Municipality	5,302	437
City of Millersburg	Municipality	2,804	423
Oregon Department of Fish and Wildlife	State Agency	2,551	292

City of Junction City	Municipality	1,992	280
City of Tangent	Municipality	2,230	252
City of Falls City	Municipality	787	241
City of Veneta	Municipality	1,658	207
City of Philomath	Municipality	1,597	165
City of Lebanon	Municipality	2,545	153
Portland & Western Railroad	Private	989	137
City of Harrisburg	Municipality	826	129
City of Brownsville	Municipality	834	96
Oregon Department of State Lands	State Agency	222	88
City of Monroe	Municipality	342	78
City of Coburg	Municipality	653	68
U.S. Government	Federal Agency	404	60
Union Pacific Railroad	Private	719	60
Port of Coos Bay	Special District	315	57
City of Adair Village	Municipality	483	55
Lincoln County	County	89	43
City of Halsey	Municipality	259	36
Bonneville Power Administration	Special District	118	35
U.S. Department of Defense	Federal Agency	601	35
State of Oregon	State Agency	219	26
City of Monmouth	Municipality	29	15
Oregon Department of Geology and Mineral Industries	State Agency	231	13
Albany & Eastern Railroad	Private	46	7
Oregon Military Department	State Agency	34	4
Central Oregon & Pacific Railroad	Private	22	3
Oregon Department of Aviation	State Agency	18	3
Pacific Power and Light	Private	24	0
Vennel Farms Railroad Company	Private	2	0
City of Sodaville	Municipality	182	0
Coos Bay Rail Link	Private	3	0
U.S. Department of Agriculture	Federal Agency	43	0
Clackamas Subbasin - HUC 17090011			
U.S. Forest Service	Federal Agency	413,482	87,423
Oregon Department of Forestry	State Agency	74,558	19,446
Oregon Department of Agriculture	State Agency	37,321	6,157
Clackamas County	County	33,208	5,790
U.S. Bureau of Land Management	Federal Agency	14,103	3,854
City of Happy Valley	Municipality	4,214	857
Water	Water	605	588

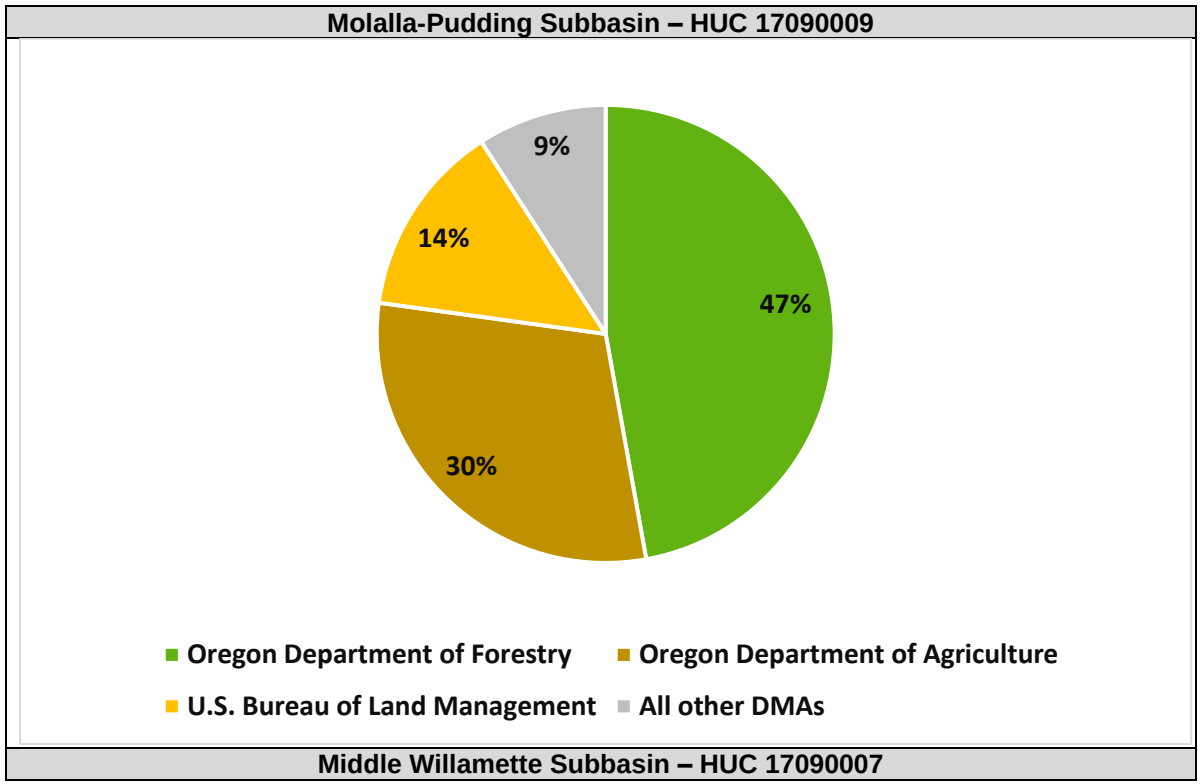
Oregon Department of Transportation	State Agency	1,630	392
Oregon Parks and Recreation Department	State Agency	1,179	374
City of Estacada	Municipality	1,434	207
City of Sandy	Municipality	1,768	197
U.S. Government	Federal Agency	518	152
City of Gladstone	Municipality	878	111
City of Oregon City	Municipality	878	110
U.S. Fish and Wildlife Service	Federal Agency	124	62
State of Oregon	State Agency	165	51
Union Pacific Railroad	Private	28	14
Confederated Tribes of Warm Springs	Tribal	17,168	11
Marion County	County	40	7
Bonneville Power Administration	Special District	209	6
City of Portland	Municipality	6	0
Wasco County	County	247	0
Coast Fork Willamette Subbasin - HUC 17090002			
Oregon Department of Forestry	State Agency	198,134	49,201
U.S. Forest Service	Federal Agency	86,827	27,997
U.S. Bureau of Land Management	Federal Agency	67,685	18,130
Lane County	County	31,815	5,976
Oregon Department of Agriculture	State Agency	32,053	5,438
Water	Water	3,194	1,052
City of Cottage Grove	Municipality	2,403	408
Oregon Department of Transportation	State Agency	1,535	310
Oregon Parks and Recreation Department	State Agency	523	251
U.S. Government	Federal Agency	486	128
City of Creswell	Municipality	1,432	123
City of Eugene	Municipality	811	52
Central Oregon & Pacific Railroad	Private	160	48
State of Oregon	State Agency	54	35
Bonneville Power Administration	Special District	42	26
Oregon Department of Aviation	State Agency	19	5
Oregon Department of Fish and Wildlife	State Agency	3	3
Oregon Department of State Lands	State Agency	3	3
Pacific Power and Light	Private	2	0
U.S. Army Corps of Engineers	Federal Agency	2	0
U.S. Department of Agriculture	Federal Agency	1	0
McKenzie Subbasin - HUC 17090004			
U.S. Forest Service	Federal Agency	545,195	123,717
Oregon Department of Forestry	State Agency	210,320	58,662

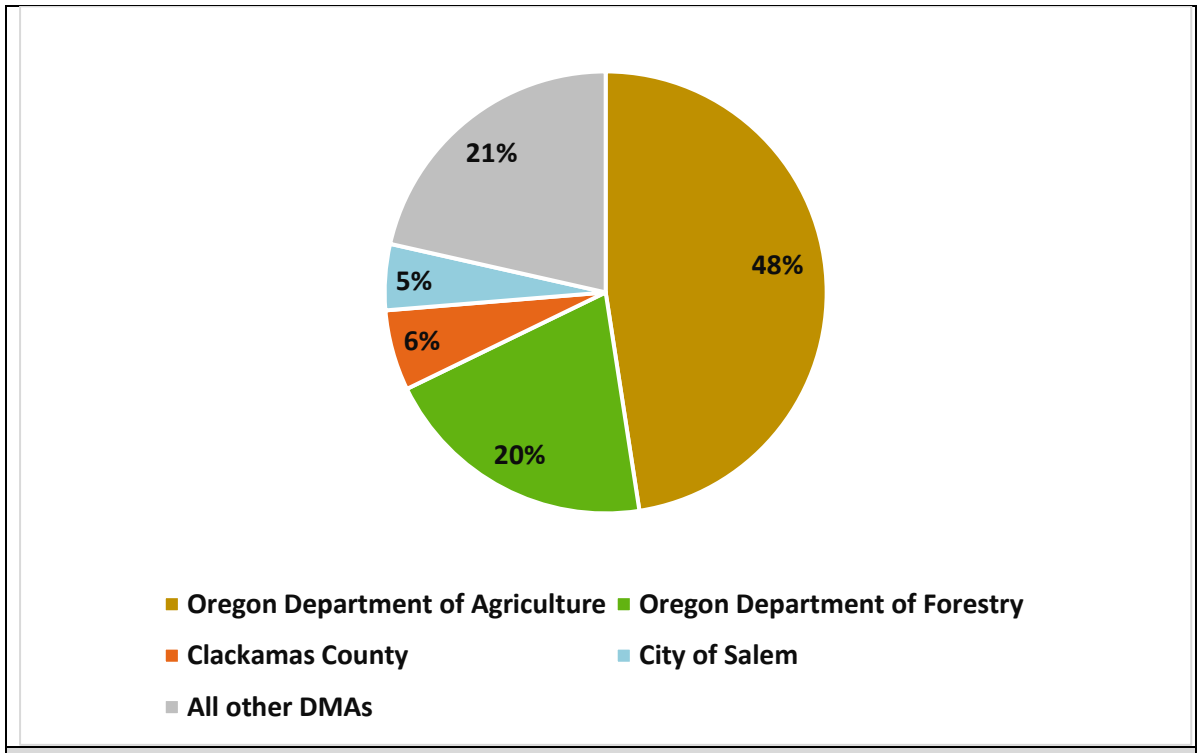
U.S. Bureau of Land Management	Federal Agency	52,470	16,244
Lane County	County	20,905	3,677
Oregon Department of Agriculture	State Agency	16,823	3,272
U.S. Army Corps of Engineers	Federal Agency	2,356	717
Water	Water	2,140	509
City of Springfield	Municipality	3,809	456
Oregon Department of Transportation	State Agency	1,864	281
City of Eugene	Municipality	601	94
U.S. Government	Federal Agency	315	68
Oregon Parks and Recreation Department	State Agency	86	29
Oregon Department of State Lands	State Agency	66	9
Bonneville Power Administration	Special District	22	6
Oregon Department of Fish and Wildlife	State Agency	5	1
Linn County	County	1	0
U.S. Department of Agriculture	Federal Agency	19	0
Union Pacific Railroad	Private	2	0
Lower Willamette Subbasin - HUC 17090012			
Oregon Department of Forestry	State Agency	57,427	16,392
City of Portland	Municipality	73,669	10,876
Oregon Department of Agriculture	State Agency	27,227	5,217
Columbia County	County	15,374	3,499
Clackamas County	County	14,401	1,915
U.S. Bureau of Land Management	Federal Agency	6,432	1,636
City of Gresham	Municipality	11,952	1,594
Water	Water	2,867	1,305
Multnomah County	County	4,089	1,172
Oregon Department of Fish and Wildlife	State Agency	6,491	1,029
City of Lake Oswego	Municipality	5,807	990
City of Happy Valley	Municipality	3,188	712
Oregon Department of Transportation	State Agency	5,141	678
City of West Linn	Municipality	2,144	571
Port of Portland	Special District	5,536	558
City of St. Helens	Municipality	1,973	368
City of Fairview	Municipality	1,773	343
City of Milwaukie	Municipality	3,241	330
City of Scappoose	Municipality	2,098	212
City of Troutdale	Municipality	1,230	166
Bonneville Power Administration	Special District	427	143
Oregon Department of Geology and Mineral Industries	State Agency	967	134
Portland & Western Railroad	Private	323	75

Union Pacific Railroad	Private	560	72
Port of St. Helens	Special District	619	71
Oregon Parks and Recreation Department	State Agency	495	52
City of Gladstone	Municipality	679	38
TriMet	Special District	92	36
City of Wood Village	Municipality	563	18
City of Johnson City	Municipality	43	13
State of Oregon	State Agency	99	11
BNSF Railway	Private	148	9
Washington County	County	35	4
U.S. Government	Federal Agency	11	3
Willamette Shore Trolley	Private	6	1
City of Canby	Municipality	2	1
Curry County	County	3	0
Pacific Power and Light	Private	7	0
Oregon Pacific Railroad	Private	3	0
Portland Terminal Railroad Company	Private	0	0
City of Clatskanie	Municipality	1	0
City of Maywood Park	Municipality	83	0
City of Tualatin	Municipality	74	0
Peninsula Terminal Company	Private	13	0
Middle Fork Willamette Subbasin - HUC 17090001			
U.S. Forest Service	Federal Agency	688,782	143,011
Oregon Department of Forestry	State Agency	108,936	28,037
U.S. Bureau of Land Management	Federal Agency	24,864	8,631
Lane County	County	17,982	4,273
U.S. Army Corps of Engineers	Federal Agency	9,815	2,360
Oregon Department of Agriculture	State Agency	12,110	2,163
Water	Water	3,695	1,638
Oregon Department of Transportation	State Agency	2,422	631
Union Pacific Railroad	Private	1,891	410
City of Springfield	Municipality	1,212	261
Oregon Parks and Recreation Department	State Agency	577	213
City of Oakridge	Municipality	1,241	153
City of Lowell	Municipality	534	76
City of Westfir	Municipality	192	68
U.S. Government	Federal Agency	102	40
State of Oregon	State Agency	69	40
Oregon Department of State Lands	State Agency	45	23
U.S. Department of Agriculture	Federal Agency	36	16

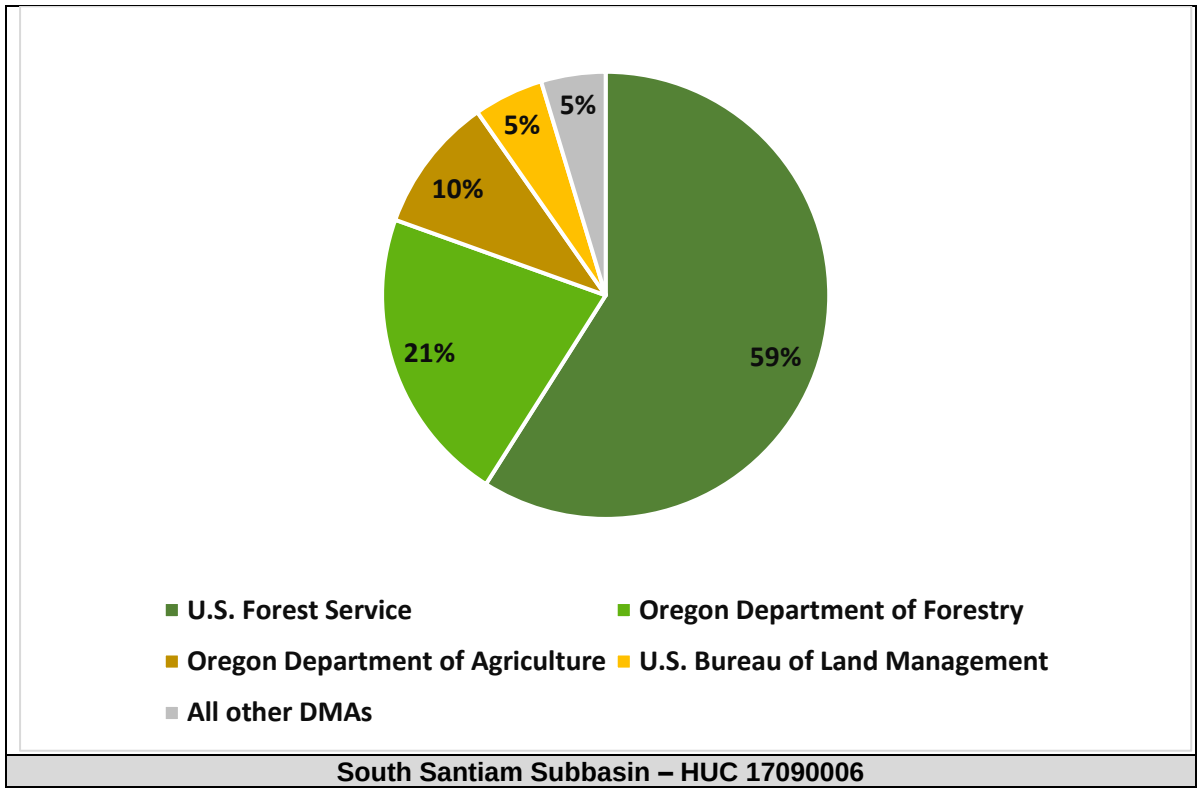
Bonneville Power Administration	Special District	25	8
Oregon Department of Aviation	State Agency	18	0

Appendix C: Percent of acres by HUC, within 150 feet of stream centerline





North Santiam Subbasin – HUC 17090005



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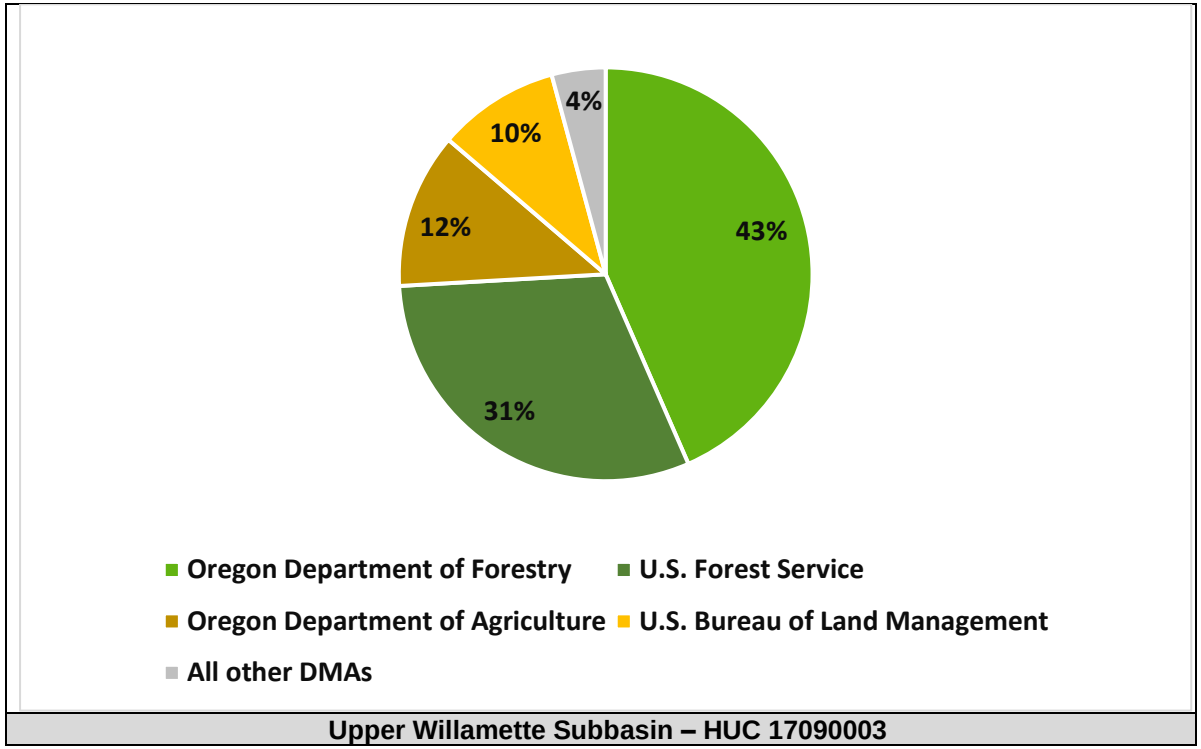
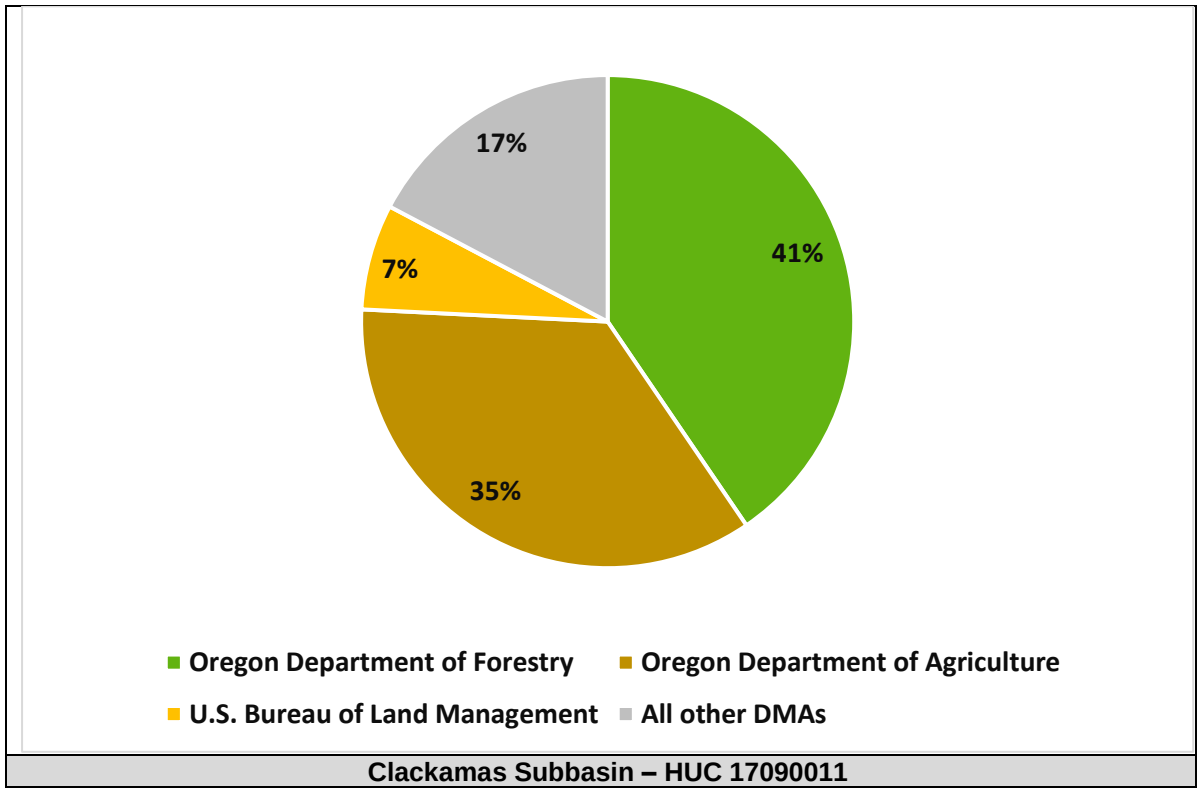
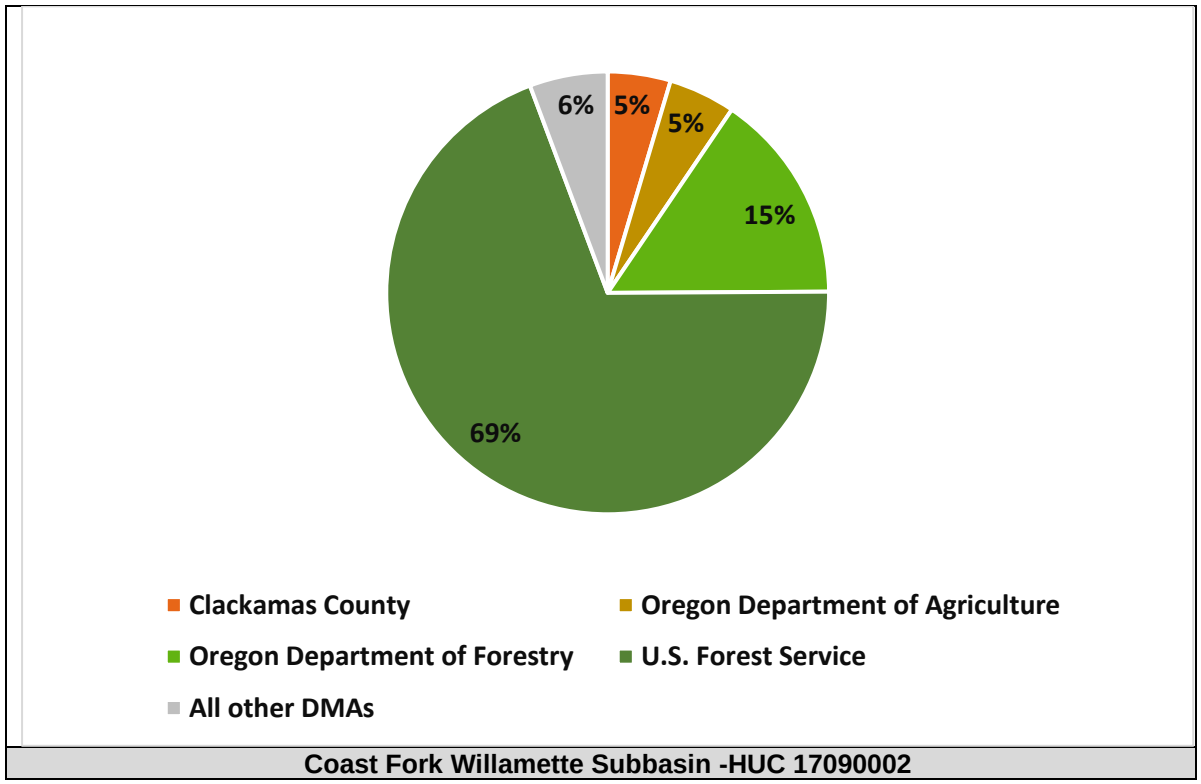


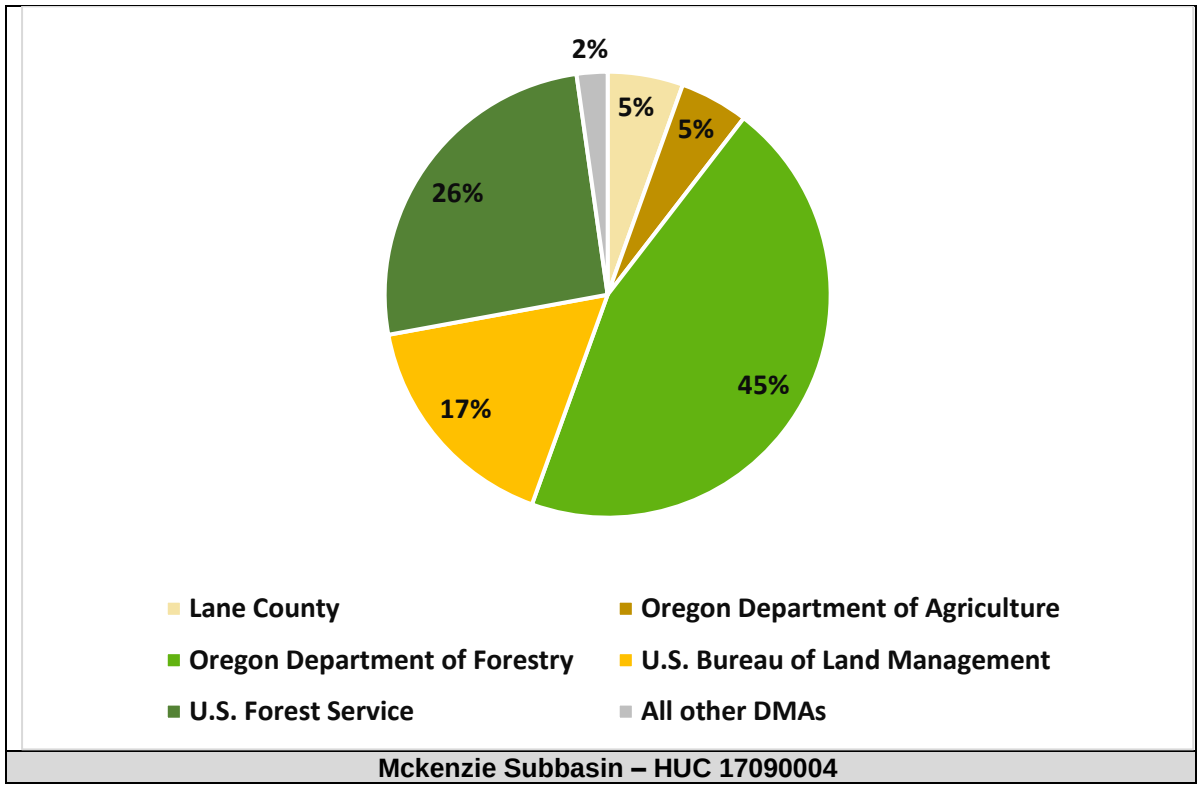
Upper Willamette Subbasin – HUC 17090003



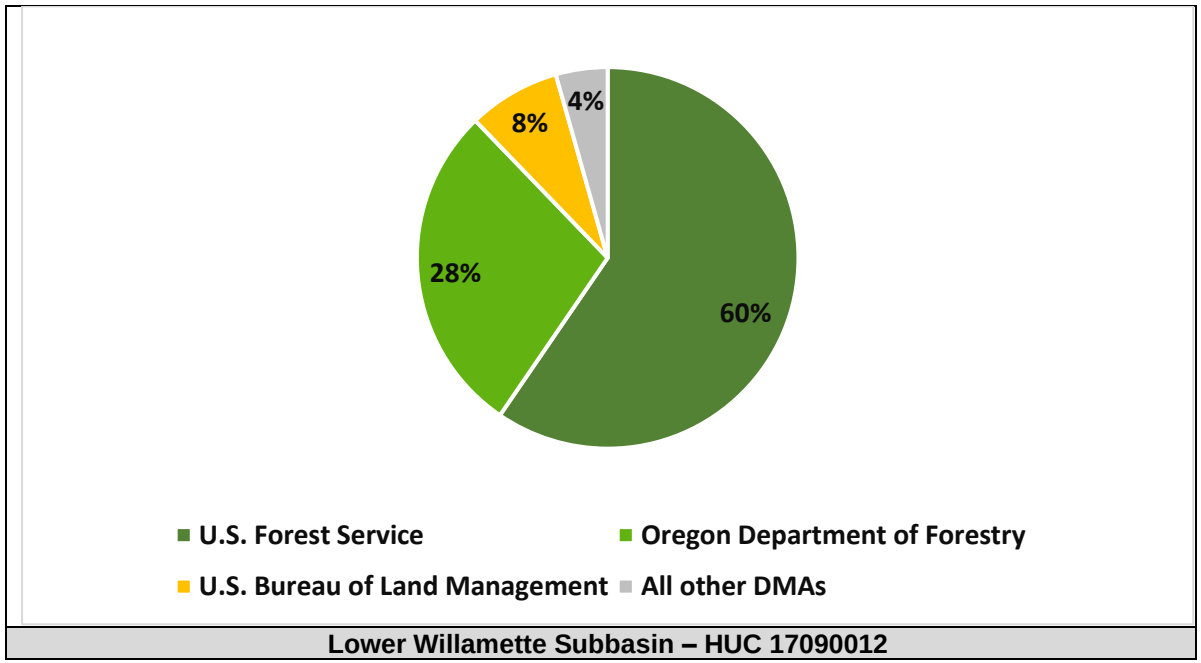
Clackamas Subbasin – HUC 17090011



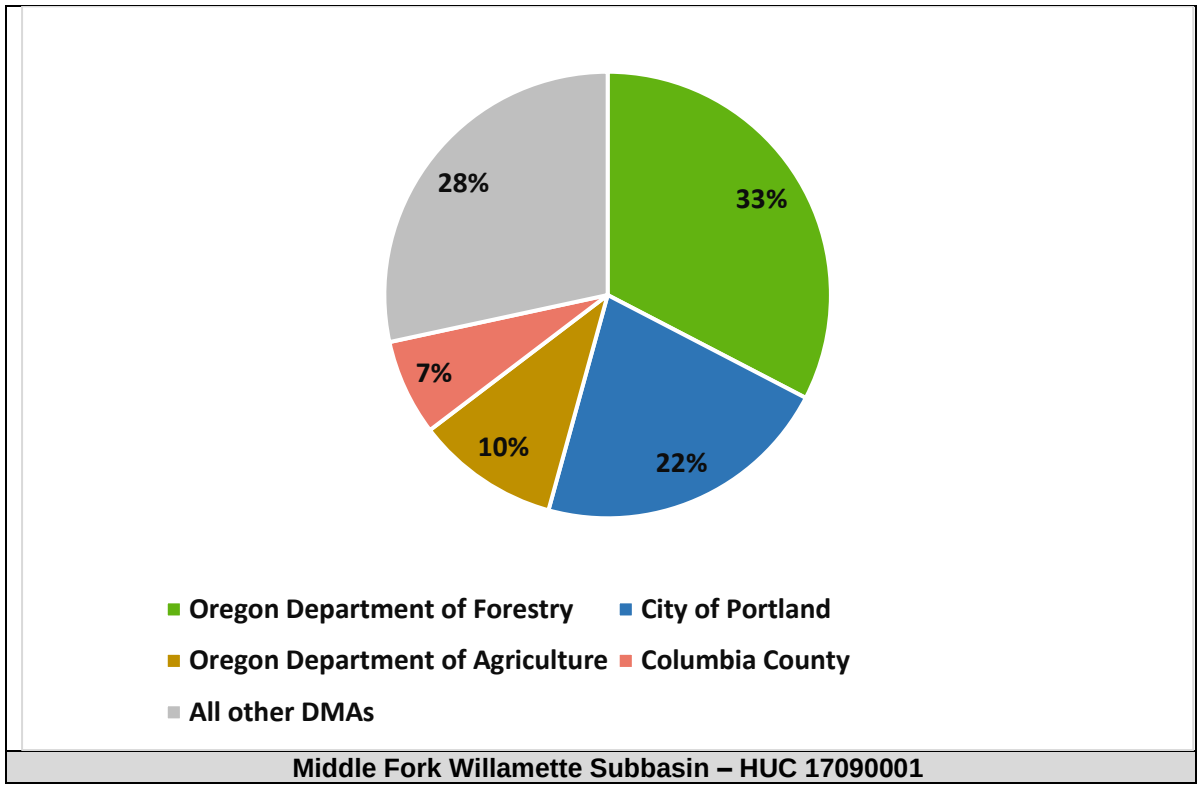
Coast Fork Willamette Subbasin -HUC 17090002



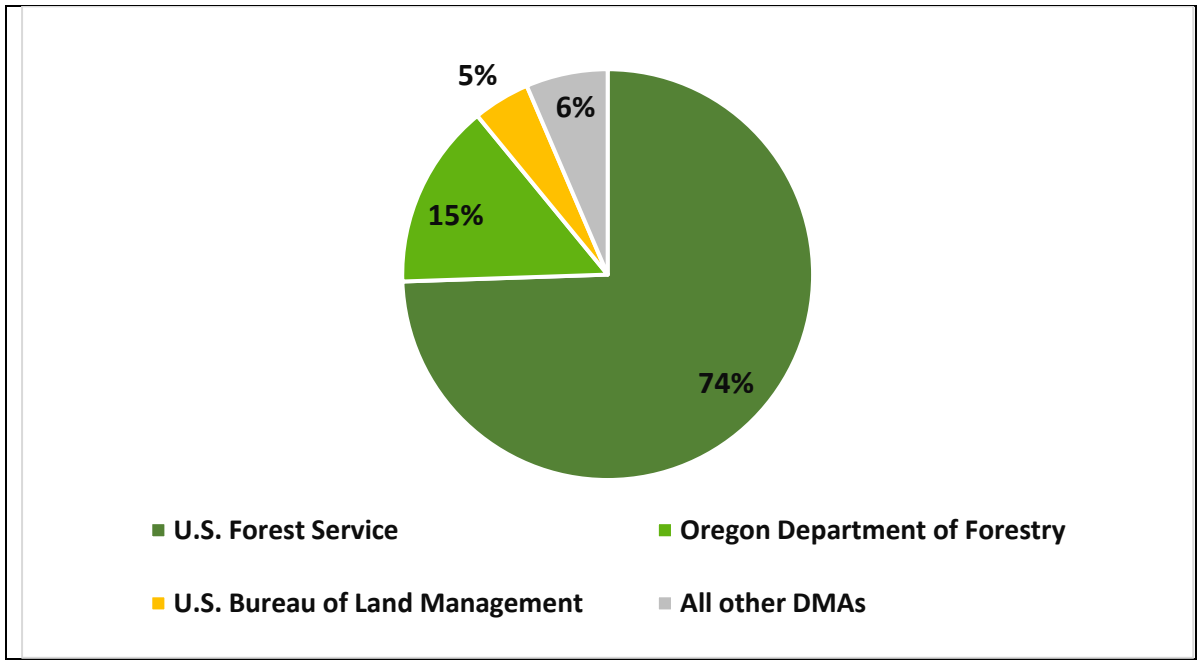
Mckenzie Subbasin – HUC 17090004



Lower Willamette Subbasin – HUC 17090012



Middle Fork Willamette Subbasin – HUC 17090001


5%
6%
15%
74%
U.S. Forest Service
Oregon Department of Forestry
U.S. Bureau of Land Management
All other DMAs

Appendix D: List of Large Reservoirs in the Willamette Subbasins TMDL Project Area

DEQ compiled this list of 206 dams located within the Willamette Subbasins temperature TMDL project area from the U.S. Army Corps of Engineers National Inventory of Dams (NID) database and a similar database maintained by the Oregon Water Resources Department, dam safety program (i.e. large dams 10 feet or higher, or store 9.2 acre-feet or more (OAR 690-020-0000)). DEQ requires the 33 **bolded** dams in the table below to conduct monitoring related to temperature (see Section 5.3.7). Depending on analytical or modeling results, reservoir owners or operators may be required to develop a TMDL plan for temperature.

No.	Reservoir Name	NID/DAM ID	Owner Names	Owner Types	Primary Purpose	NID Reservoir Storage (Acre-Ft)
1	**Big Cliff Dam**	OR00003	U.S. Army Corps of Engineers	Federal	Hydroelectric	5930
2	**Blue River Dam**	OR00013	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	89000
3	**Cottage Grove Dam**	OR00005	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	50000
4	**Cougar Dam**	OR00015	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	220000
5	**Detroit Dam**	OR00004	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	455000
6	**Dexter Dam**	OR00006	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	29900
7	**Dorena Dam**	OR00008	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	131000
8	**Fall Creek Dam**	OR00007	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	125000
9	**Fern Ridge Dam**	OR00016	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	121000
10	Fern Ridge Dam - Dike 1	OR00016	U.S. Army Corps of Engineers	Federal	unknown	9774

11	Fern Ridge Dam - Dike 2	OR00016	U.S. Army Corps of Engineers	Federal	unknown	56647
12	**Foster Dam**	OR00012	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	61000
13	**Green Peter Dam**	OR00010	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	430000
14	**Hills Creek Dam**	OR00014	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	356000
15	**Lookout Point Dam**	OR00009	U.S. Army Corps of Engineers	Federal	Flood Risk Reduction	477700
16	Cackler Marsh Dam/Basket Slough - South	OR03834	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	964
17	Dusky Marsh Dam	OR03835	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	299
18	Moffitti Marsh Dam	OR04062	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	184
19	Morgan Brothers Dam	OR00576	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	720
20	Parvipes Marsh Dam	OR04063	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	250
21	Taverner Marsh Dam	OR03852	U.S. Fish & Wildlife Service	Federal	Fish and Wildlife Pond	287
22	Upper Display Pond	OR03774	U.S. Fish & Wildlife Service	Federal	unknown	17.3
23	Findlay Reservoir-Ankeny Natl. Wildlife Refuge	OR00971	U.S. Fish & Wildlife Service	Federal	unknown	9.5
24	Timber Lake	OR00281	U.S. Forest Service	Federal	Recreation	390
25	**Plywood Products Reservoir**	OR02700	City of Adair Village	Local Government	unknown	39
26	**North Fork**	OR00348	City of Corvallis	Local Government	Water Supply	305
27	**Mercer**	OR00524	City of Dallas	Local Government	Water Supply	1550
28	**Binford Dam**	OR00725	City of Gresham	Local Government	Irrigation	30
29	Gresham Stormwater Retention Basin (Lagoon)	OR04021	City of Gresham	Local Government	Stormwater Treatment	38

30	Oakridge Mill Log Pond	OR00168	City of Oakridge	Local Government	Other	380
31	Smith-Bybee Lakes	OR00680	City of Portland	Local Government	Fish and Wildlife Pond	4100
32	**Silver Creek**	OR00622	City of Silverton	Local Government	Water Supply	2500
33	**Salmonberry Reservoir**	OR02958	City of St. Helens	Local Government	Water Supply	61.22
34	Three Creeks Natural Area	OR04083	Clackamas Water Environment Services	Local Government	unknown	57
35	Sullivan Pond 3	OR04077	A & D Sullivan Enterprises Inc.	Private	unknown	65
36	Spada Reservoir #1 (Champoeg)	OR00462	A&R Spada Nursery and Farms	Private	Irrigation	329
37	Fisher, James O Reservoir	OR00515	A.F. Grabhorn	Private	Irrigation	36
38	Aamodt Flashboard Dam	OR00645	Aamodt Dairy Inc.	Private	Irrigation	120
39	Stevens	OR03191	Allen E. Stevens	Private	unknown	11
40	Siegmund Parcel No. 1	OR03058	Andrew Seigmund	Private	unknown	25
41	Qualey Reservoir 1	OR02750	Arthur Qualey	Private	unknown	14
42	Zehner	OR03369	Arthur R. Zehner	Private	unknown	14.3
43	Funrue	OR00519	Aurora; Dan Funrue	Private	Irrigation	126
44	Walker (Bryan Creek)	OR00289	Bailey Nurseries, Inc.	Private	Irrigation	209
45	Baker West Nursery Dam	OR03789	Baker West, Inc.	Private	Fish and Wildlife Pond	16.8
46	Barkdoll Dam	OR03803	Barkdol, Inc.	Private	unknown	9.917
47	Sherman Stock Reservoir #2	OR03041	Bart Grabhorn	Private	unknown	14
48	Mompano	OR00500	Beaverlake Owners Assoc.	Private	Other	780
49	Elmer Farms Dam	OR03367	Ben Elmer Farms	Private	unknown	28.4
50	Polehn Dam	OR03377	Bernard Vancil	Private	unknown	9.5
51	Beyer Reservoir	OR00476	Beyer Lake, Inc	Private	Irrigation	280
52	Rose Reservoir	OR00708	Bill Rose	Private	Irrigation	550
53	Carroll Reservoir	OR01340	Black Berry Hills Ranch LLC	Private	Irrigation	355
54	Herring Reservoir	OR00821	Bland Herring	Private	unknown	12

55	Robert Kuenzi	OR03998	Bob Simmons	Private	unknown	22
56	Stadeli	OR03394	Brooke Craeger-Stadeli	Private	Irrigation	167
57	Hendrickson	OR03728	Bruce & Gayle Farmer	Private	Recreation	24.5
58	Baker, Er	OR00507	Camp Tillicum	Private	Irrigation	250
59	Orchard Heights	OR03165	Carl R. Staats	Private	unknown	12
60	Hills Reservoir (Polk)	OR01925	Chuck & Maxime Dehn	Private	Irrigation	73
61	Koinenia Lake Dam	OR00621	Cindy Jerger	Private	Irrigation	125
62	Bentz Bros. Pond 3	OR01157	Clint Bentz	Private	unknown	31.7
63	S-M-S No. 1	OR00417	Cody & Barbara Duerst	Private	Recreation	57
64	Meridian Reservoir	OR03725	Columbia Trust Co.	Private	Irrigation	95
65	Eola Hills Reservoir	OR01657	Contact Allen Holstein	Private	Irrigation	37
66	Cooper Creek Vineyards	OR04065	Cooper Creek LLC	Private	unknown	100
67	Porter Cc Reservoir (Clackamas)	OR00644	Dan Myrick	Private	Recreation	80
68	Hays Reservoir	OR01894	Daniel & Stacee Hurst	Private	unknown	25
69	Mt. Pisgah	OR03964	David And Bette Mckibben Trust	Private	unknown	45
70	Neil Creek Reservoir	OR00266	Dean Yeager	Private	Irrigation	81
71	P.M. Delaubenfelds Dam	OR00494	Delaubenfeld And Osu Found	Private	Recreation	130
72	Bottem Reservoir #5	OR03779	Dennis & Judy Bottem	Private	unknown	19.9
73	Murry Pond #3	OR03860	Dennis Bottem	Private	unknown	35.7
74	Hickory Hill Farm	OR00231	Dick Day	Private	Irrigation	65
75	Stewart Reservoir #2	OR03799	Don & Alberta Stewart	Private	unknown	16.6
76	Teasel Creek	OR00489	Don Deardorff	Private	Other	90
77	Henderer Reservoir	OR01905	Dorothy Fairchild	Private	unknown	13.9
78	Deardorff, Betty Jane	OR00497	Doubletrees Farms	Private	Other	1300
79	Case Creek Dam 1	OR00504	Douglas & Patricia Krahmer	Private	Irrigation	352
80	Duck Pond Dam	OR03816	Douglas Fries	Private	Recreation	94.6
81	Schewnke	OR00939	Dr. Glenn Schwenke	Private	unknown	10
82	Pettit Reservoir	OR00396	Dr. Virgil E. Pettit	Private	Other	290
83	Abe Ediger Reservoir	OR01009	Dudley And Lauri Walters	Private	Irrigation	85

84	Neil Reservoir	OR02514	E.R. Neil	Private	unknown	9.5
85	Kennel Reservoir	OR00617	Earl Kennel	Private	Irrigation	160
86	Eder	OR03967	Eder Farms Inc	Private	unknown	30.1
87	Kronke	OR03961	Elke Kronke	Private	unknown	14.5
88	Barnes Bros. Reservoir	OR00392	Eric And Pamela Barnes	Private	Irrigation	100
89	Thompson (Benton)	OR00294	Eric Thompson	Private	Recreation	450
90	Peterson, Floyd	OR02665	Erik Rodgers	Private	Recreation	19
91	Fairview Lake	OR03713	Fairview Lake Property Owners Association (FLPOA)	Private	unknown	411
92	Tangen-A. L. Irig Reservoir	OR03256	Flying Feather Orchards, Inc.	Private	unknown	25
93	Ford Farms Reservoir	OR00251	Ford Farms, Inc.	Private	Irrigation	60
94	Silver Falls Log Pond (Marion)	OR00273	Gelco Investment LLC	Private	Irrigation	68
95	Gibson and Gibson Waste Lagoon	OR01793	Gibson & Gibson	Private	unknown	36
96	Whispering Winds	OR00527	Girls Scouts of Oregon & SW Washington	Private	Recreation	100
97	Marcott Reservoir	OR02331	Goldie Marcott	Private	unknown	24.3
98	Circle S Reservoir	OR01383	Gordon and Catherine Tibbitts	Private	unknown	16
99	Lorence Lake	OR00384	Greg & Kara Pilcher	Private	Other	160
100	Skylane Farms Reservoir 3	OR03079	Gregory R & Deborah D Cochell	Private	unknown	13.5
101	Mulkey, Gryland Reservoir	OR02485	Gylan Mulkey	Private	Irrigation	50
102	Bryant Dam (Marion)	OR03786	H. Richard Bryant	Private	unknown	27.7
103	Winters (Lower)	OR03764	H.E. Winters Sanders Family Farm LLC	Private	unknown	9.4
104	Kuehne Dam	OR00216	Harold Kuehne	Private	Irrigation	110
105	Golliday, Paul	OR00954	Harold Schipporeit	Private	unknown	13
106	Buche (Clackamas)	OR00766	Harvey Buche	Private	Recreation	81
107	Deep Creek Reservoir	OR01518	Hays/Shainsky and Judas Crop	Private	unknown	10
108	Schindler Reservoir	OR02980	Henry & Albert Schindler	Private	unknown	15
109	Kyllo Reservoir	OR02124	Henry Kyllo	Private	unknown	44

110	Berger Lake	OR01158	Hidden Lakes Recreation Association Attn: Dan Schlottmann	Private	Irrigation	45
111	Hull-Oakes Lumber Company Reservoir	OR01986	Hull-Oakes Lumber Company	Private	unknown	
112	Kreder Reservoir	OR00478	Jack Platt	Private	Irrigation	162
113	Maple Grove	OR03773	Jackson Family Wines	Private	Irrigation	210
114	Payne Lake No. 1	OR02137	James L. Payne	Private	unknown	30
115	River Bend No. 2	OR00434	James L. Payne	Private	Irrigation	50
116	Heater Reservoir #2	OR00729	James M. Heater	Private	Irrigation	42.5
117	Borris Reservoir	OR01234	James Swanek	Private	unknown	22
118	Sherman Stock Reservoir #1	OR03040	Jeff Heller	Private	Irrigation	36
119	Moore-Emory	OR00382	Jerald and Carol Bush	Private	Irrigation	166
120	Isakson Reservoir	OR00674	Jerry Isakson	Private	Recreation	29
121	Mission Creek Dam and Reservoir Company	OR00520	Jerry Mullen	Private	Irrigation	1590
122	Heater Dam	OR01899	Jim Heater	Private	Irrigation	32
123	Evans Pro. Company Sawmill Reservoir	OR00927	Jimmy W. Evans	Private	unknown	11
124	Drescher Reservoir	OR01574	John Drescher	Private	Irrigation	21
125	Schwartz Reservoir	OR02978	John Inda	Private	Irrigation	20
126	Jyn Dam	OR03807	Jyn Inc	Private	unknown	13.8
127	Adkins "B" Reservoir	OR03749	Kathryn J Adkins	Private	unknown	12
128	Tribbett Reservoir	OR00687	Kelly Farms	Private	Recreation	31
129	Knudsen Reservoir #2	OR03775	Knudson Vineyards	Private	unknown	11.5
130	Kraemer Farms Dam	OR03781	Kraemer Farms, Inc.	Private	Irrigation	125
131	Waldo Lake	OR00349	Krautmann Family Nursery, LLC	Private	Irrigation	56
132	Westbrook Dam	OR03805	Krautmann Family Nursery, LLC	Private	Fish and Wildlife Pond	141.2
133	Youngblood Dam	OR00811	Kyle R & Lori J Sherman	Private	unknown	30
134	Little Pudding	OR04073	Lake Labish Water Control Dist	Private	unknown	
135	Oswego Lake Dam	OR00237	Lake Oswego Corporation	Private	Hydroelectric	9800

136	Lakewood Estates	OR03731	Lakewood Homeowners, Inc.	Private	unknown	78
137	Lakewood Estates Sewage Lagoon	OR03918	Lakewood Utilities, Ltd.	Private	unknown	17
138	O.E.Loe Dam 2 Porter Place	OR02721	Larie Loe	Private	Irrigation	25
139	Kuenzi, Lee A.	OR03392	Lee A. Kuenzi	Private	unknown	15
140	Ed Zach A	OR01635	Lee Wallace	Private	unknown	33.5
141	Veterans Reservoir	OR00102	Lincoln Memorial Cemetery	Private	Irrigation	18
142	Griffith Reservoir	OR01832	LSH Investments	Private	unknown	45
143	Manton Carl Dam	OR03987	Manton Carl	Private	unknown	11.5
144	Fredericks Pond	OR00620	Maple Leaf Lake Homeowners Association	Private	Irrigation	48
145	Johnson Creek Reservoir (Linn)	OR02051	Marion Cota	Private	unknown	10.5
146	Gehring Reservoir (Towery Dam)	OR00314	Mark Gehring	Private	Irrigation	50
147	Mueller	OR04018	Mark Herkamp	Private	unknown	12.7
148	Mckay Acres Dam	OR00484	Mark Mckay	Private	Irrigation	510
149	Peyralans Reservoir	OR02671	Marpol Ridge HOA	Private	esthetics	12
150	Anderson - Roy Reservoir	OR00710	MBK 35803 LLC	Private	Recreation	32
151	Powell Reservoir (Lane)	OR00829	Michael Fix	Private	unknown	24
152	Rogers - Joseph Reservoir	OR00492	Michael P. Warn	Private	Irrigation	40
153	Marx Reservoir #1	OR00389	Mike Sweeney, Cherry Hill Winery	Private	Irrigation	85
154	Helms Reservoir	OR00455	Miller Forests, Inc.	Private	Irrigation	120
155	Marx, Emil #2	OR02340	Mountain Spring Farms, LLC	Private	unknown	35
156	Foster Log Pond	OR00159	Murphy Company Foster Veneer	Private	Other	375
157	Neal Miller	OR03395	Neal Miller	Private	unknown	31.3
158	Haberlach Dam	OR00880	Old North State Trust, LLC	Private	Irrigation	15
159	Fleshman Reservoir 2	OR01722	Orval & Margaret Fleshman	Private	unknown	10.6
160	Forcia and Larsen Log Pond	OR00099	Peggy Kraft, Don Merkle	Private	Other	90
161	Bye Reservoir	OR01317	Perl Bye	Private	unknown	13
162	Zenczak Reservoir	OR03637	Piotr Zenczak	Private	unknown	13

163	**Faraday Diversion**	OR00551	Portland General Electric Company	Private	Hydroelectric	1200
164	**Faraday Forebay**	OR00245	Portland General Electric Company	Private	Hydroelectric	550
165	**Harriet Lake**	OR00546	Portland General Electric Company	Private	Hydroelectric	400
166	**North Fork**	OR00550	Portland General Electric Company	Private	Hydroelectric	18630
167	**River Mill**	OR00552	Portland General Electric Company	Private	Hydroelectric	2300
168	**Timothy Lake**	OR00545	Portland General Electric Company	Private	Hydroelectric	69000
169	Bull Frog Lake	OR01296	Ray Derby, President	Private	unknown	21.5
170	Schaefer, Ray Reservoir	OR03380	Ray Schaefer	Private	Irrigation	18
171	Mitchell - Stanley Reservoir	OR00706	Richard Satnick	Private	Irrigation	42
172	Vandecoevering	OR03863	Ron Vandecoevering	Private	Irrigation	87
173	Vaughn Log Gibson Reservoir Pond	OR00198	Rosboro, LLC	Private	Other	132
174		OR00672	Roserock West 2, LLC	Private	unknown	32
175	Cedar Grove Lake	OR01351	Ryan J Dissen	Private	Irrigation	14.2
176	Sandy Farms No. 1-A	OR00709	Sandy Farms, C/O Bob Underwood	Private	Irrigation	49
177	Spring Lake Estates	OR00532	Spring Lake Estates	Private	Recreation	120
178	Delaubenfels	OR03944	Starker Forests, Inc	Private	Irrigation	84
179	Tadmore Lake Dam	OR03252	Steve Ellingboe	Private	unknown	29
180	Alderwood	OR01020	Swanson Bros. Lumber Company	Private	unknown	12
181	Willards Pool	OR00179	Terry Caster	Private	Recreation	680
182	Devers Reservoir 1	OR01538	Todd Bartlem	Private	unknown	9.7
183	FOX NO. 2	OR01756	Tom Fox	Private	unknown	21
184	Fox Reservoir	OR00236	Tom Fox	Private	Irrigation	120
185	Croft	OR00415	Waldensee LLC	Private	Irrigation	137
186	Zielinski Farm Reservoir	OR00711	Wally Zelinski	Private	Irrigation	41

187	Bremer Reservoir	OR01253	Warren W. Bremer	Private	unknown	27
188	Bohemia Pond C	OR02715	Weyerhaeuser Company	Private	unknown	47
189	Day Reservoir	OR03411	William Day	Private	Irrigation	12.2
190	Fry Reservoir	OR01775	William Fry	Private	unknown	15.7
191	Woodburn Nursery	OR03862	Woodburn Nursery And Azaleas, Inc.	Private	Other	40
192	Serres Reservoir	OR03010	Woodburn Organic Farms, LLC	Private	unknown	10
193	**Carmen Diversion**	OR00539	Eugene Water and Electric Board	Public Utility	Hydroelectric	260
194	**Leaburg**	OR00553	Eugene Water and Electric Board	Public Utility	Hydroelectric	345
195	**Leaburg Canal and Forebay**	OR00553	Eugene Water and Electric Board	Public Utility	Hydroelectric	459
196	**Smith**	OR00541	Eugene Water and Electric Board	Public Utility	Hydroelectric	17530
197	**Trail Bridge**	OR00540	Eugene Water and Electric Board	Public Utility	Hydroelectric	2263
198	Trail Bridge Saddle Dike	OR00540	Eugene Water and Electric Board	Public Utility	Hydroelectric	2263
199	**Walterville Forebay**	OR00600	Eugene Water and Electric Board	Public Utility	Hydroelectric	275
200	**Walterville Storage Pond**	OR00267	Eugene Water and Electric Board	Public Utility	Hydroelectric	345
201	Adair Pond	OR01012	Oregon Dept. of Fish & Wildlife	State	unknown	43
202	Petes Slough	OR00643	Oregon Dept. of Fish & Wildlife	State	Recreation	2000
203	**Lebanon Dam**	OR04067	City of Albany	Local Government	Water Supply	149
204	Multnomanh Channel Dam #2	OR03823	Metro Parks & Greenspaces	Private	Fish and Wildlife Pond	240
205	Willamette Falls	OR00596	Portland General Electric Company	Private	Hydroelectric	17000
206	Willamette Falls Locks	OR00596	USACE - Portland District	Federal	Navigation	17000