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NON-POINT SOURCE TOTAL MAXIMUM DAILY LOAD
IMPLEMENTATION PLAN FOR THE TUALATIN, WILLAMETTE, MOLALLA-PUDDING, AND
SANDY RIVER WATERSHEDS

Clackamas County, Clackamas Water Environment Services,
and the Cities of Happy Valley and Rivergrove

October 2023

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List of Abbreviations

BO	Endangered Species Act Biological Opinion
CIP	capital improvement project
CWR	cold water refugia
DEQ	Department of Environmental Quality
DTD	Department of Transportation and Development
DMA	Designated Management Agency
DO	dissolved oxygen
EPSC	erosion prevention and sediment control
HCA	Habitat Conservation Area
IDDE	Illicit Discharge Detection and Elimination
IP	Non-Point Source TMDL Implementation Plan
LA	load allocations
LIDA	low impact development approach
mg/L	milligrams per liter
mL	milliliter
MS4	Municipal Separate Storm Sewer System
NCPRD	North Clackamas Parks & Recreation District
NPDES	National Pollutant Discharge Elimination System
NPS	non-point source
O&M	operation and maintenance
OAR	Oregon Administrative Rule
ODA	Oregon Department of Agriculture
ODOT	Oregon Department of Transportation
Onsite Program	Septic and Onsite Wastewater Program
ORS	Oregon Revised Statutes
PES	percent effective shade
SCAP	Storm Drain Cleaning Assistance Program
SVS	settleable volatile solids
SWM	Surface Water Management
SWMACC	Surface Water Management Agency of Clackamas County
TMDL	total maximum daily load
TSS	total suspended solids
UGB	urban growth boundary
USEPA	United States Environmental Protection Agency
WES	Water Environment Services
WQMP	Water Quality Management Plan
ZDO	Zoning and Development Ordinance

1. Introduction

The federal Clean Water Act, section 303, requires states to develop water quality standards to support beneficial uses of public water bodies. A water body, or portion of that water body that does not meet water quality standards is listed as impaired for that parameter on the 303(d) list of water quality limited water bodies. The State of Oregon, through the Oregon Department of Environmental Quality (DEQ), is required to develop total maximum daily loads (TMDLs) to determine how to meet water quality standards for that parameter. Each TMDL identifies the maximum amount of a specific pollutant that can enter a water body so that it can meet water quality standards. After extensive water quality monitoring and modeling efforts, TMDLs establish the difference between the loading capacity and the current pollutant load. TMDLs are expressed as numeric standards or percent pollutant reductions that need to be met to bring water bodies into compliance with water quality standards. The difference between the current load and the loading capacity is known as excess load (DEQ, 2006). The excess load is divided between the different sources of pollution according to their contribution to the overall pollution load. Any difference between the waterway's loading capacity and the current pollutant load must be mitigated by pollution reduction activities. The DEQ develops wasteload allocations for permitted point sources, such as wastewater treatment plants, stormwater runoff from larger urbanized areas, and industrial discharges, and load allocations (LA) for non-point source (NPS) pollution from agricultural, rural residential, and forestry lands; the smaller non-permitted urbanized areas are also regulated as an NPS.

The Oregon Administrative Rule (OAR) 340-042 regulates TMDL creation and implementation and requires local governments and other agencies to develop and implement TMDL Implementation Plans for non-point sources. Please see Chapter 13 in this Implementation Plan for the full set of the OARs that pertain to "Implementing a TMDL," found in 340-042-0080. Point sources are covered by a TMDL through requirements in their National Pollutant Discharge Elimination System (NPDES) permits. This Non-Point Source TMDL Implementation Plan (IP) has been developed to identify management strategies and activities that will be implemented to protect and improve surface water quality in the Sandy, Tualatin, Molalla-Pudding, and Willamette River watersheds. Responsible parties, such as state agencies, counties, cities, and other organizations that implement pollution reduction strategies, are classified as Designated Management Agencies (DMAs).

According to OAR 340-042-0080, TMDL IPs must include the following five elements:

- Management strategies that will be used to reduce pollutant loading and eventually achieve load allocations
- A timeline for implementing management strategies and a schedule for completing measurable milestones
- Performance monitoring with a plan for periodic review and revision of the implementation plan
- Evidence of compliance with applicable statewide land use requirements
- Any other analyses or information as specified in the TMDL's Water Quality Management Plan (WQMP)

1.1 Co-Owners of this Implementation Plan

This IP for the Sandy, Tualatin, Molalla-Pudding, and Willamette River watersheds is co-owned by the following four DMAs:

- The Water Environment Services Partnership (WES), which is an intergovernmental entity organized under Oregon Revised Statutes (ORS) 190. Clackamas Water Environment Services, a Dept. of Clackamas County, administers the WES Partnership. The WES Partnership includes two separate Clackamas County Service Districts: the Surface Water Management Agency of Clackamas County (SWMACC) and Clackamas County Service District #1 (CCSD #1), which together comprise the WES Surface Water Management (SWM) Service Area. Because Clackamas Water Environment Services administers the WES Partnership, the name Clackamas WES will often be used in this document when references are made to this area and to this intergovernmental entity.
- Clackamas County, including but not limited to, the Business and Community Services Department, the Department of Transportation and Development (DTD), and the North Clackamas Parks and Recreation District
- City of Happy Valley
- City of Rivergrove

Note: This October 2023 IP replaces the September 2022 DEQ-approved IP, which was submitted to DEQ on Sept. 2, 2022. This October 2023 version of the IP fully complies with the DEQ’s requirement for DMAs to assess and revise their IP as a product of the DMA’s five-year review.

In this IP, these units of local government are collectively referred to as the Co-Owners of the IP. In previous years, going back to 2003 in the case of the Tualatin River TMDL IP, the Co-Owners of this IP have maintained four separate IPs, each of which only applied to one watershed. In this IP, the Co-Owners of the IP chose to address their non-point source TMDL obligations for all four TMDL watersheds in one shared IP.

For the previous and current IPs, the jurisdiction associated with each IP, in addition to the specific TMDLs, is summarized in Table 1.

Table 1. TMDL IP Jurisdiction and Important Dates				
	Tualatin River Watershed TMDL IP	Willamette River Watershed TMDL IP	Molalla-Pudding River Watershed TMDL	Sandy River Watershed TMDL IP
TMDL IP Original Submission and Revision Dates	<ul style="list-style-type: none"> • August 7, 2003 • Revised March 31, 2008 • Revised January 6, 2011 • Revised February 2014 • Revised September 2022 • Revised 2023 	<ul style="list-style-type: none"> • June 8, 2009 • Revised January 7, 2011 • Revised September 2022 • Revised 2023 	<ul style="list-style-type: none"> • February 2012 • Revised September 2022 • Revised 2023 	<ul style="list-style-type: none"> • March 25, 2008 • Revised September 2022 • Revised 2023
Designated Management Agencies for each watershed	<ul style="list-style-type: none"> • SWMACC • Clackamas County • City of Rivergrove 	<ul style="list-style-type: none"> • Clackamas County • Clackamas County Service District No. 1 • City of Happy Valley 	<ul style="list-style-type: none"> • Clackamas County 	<ul style="list-style-type: none"> • Clackamas County

1.2 Management Strategies

This IP’s management strategies, which are contained within this IP’s Chapter 7, are expected to reduce TMDL pollutants from non-point sources to address LAs.

Efforts to reduce TMDL pollutants from point sources, such as a wastewater treatment plant effluent or NPDES-permitted municipal separate storm sewer systems (MS4), to achieve wasteload allocations are addressed separately in NPDES permits issued by the DEQ to one or more of the Co-Owners of this IP.

To comply with DEQ requirements for TMDL IPs (provided in OAR 340-042-0080(4)), the management strategies and other information provided herein address each parameter within the following TMDLs over which Clackamas County, Clackamas WES SWM service area, and the Cities of Happy Valley and/or Rivergrove have jurisdiction:

- **Tualatin River TMDL:** water temperature, *E. coli* (bacteria), total phosphorus, dissolved oxygen (DO), and mercury.
- **Willamette River TMDL:** water temperature, *E. coli* (bacteria), mercury, and DDT/Dieldrin (only in the Johnson Creek watershed).
- **Molalla-Pudding River TMDL:** water temperature, *E. coli* (bacteria), mercury, and DDT/Dieldrin and iron (only in the Pudding River).
- **Sandy River TMDL:** water temperature. An *E. coli* TMDL also applies in the Cedar Creek watershed, which is a tributary to the Sandy River.

1.3 Revised Willamette River Mercury TMDL

The February 2021 revised mercury TMDL replaced the original 2006 mercury TMDL for the Willamette River. The 2021 revised mercury TMDL fully applies throughout the Willamette River Basin, including in the Tualatin River and Molalla-Pudding sub-basins. The adoption of this revised TMDL by the United States Environmental Protection Agency (USEPA) initiated a requirement for DMAs in the watershed, including this IP's Co-Owners, to update their IP to address the new requirements within the 2021 revised mercury TMDL. See Section 9 for a summary of mercury management strategies to address the revised Willamette River Mercury TMDL requirements.

2. Clackamas County Surface Water Overview

This section includes a summary of this IP's TMDL watersheds, the organizational structure of the IP Co-Owners related to TMDL implementation, and TMDL implementation responsibilities.

2.1 Watersheds

This TMDL IP incorporates efforts to improve water quality for the Sandy River and the Willamette River and their tributaries in Clackamas County.

The major watersheds of Clackamas County are shown in Figure 1 and summarized in Table 2. A large portion of Clackamas County is drained by the Willamette River and its tributaries, including the Clackamas, Molalla, Pudding, and Tualatin River and Johnson Creek (Table 2).

The remaining lands are drained by the Sandy River, which enters the Columbia River in the City of Troutdale, and a small portion of Clackamas County appears to be located in a section of the Santiam River's watershed; however, these lands are owned by the United States Forest Service, so Clackamas County is not required to address them in any TMDL IP.

Table 2. Clackamas County Watersheds			
Clackamas County Watersheds	Total acres in Watershed	Watershed in Clackamas County, acres	Percent of Watershed in Clackamas County
Clackamas	602,634	542,940	90
Molalla-Pudding	560,301	305,056	54
Tualatin	453,675	12,335	3
Lower Columbia-Sandy	559,568	235,524	42
Middle Willamette	455,040	74,276	16
Lower Willamette	412,165	33,576	8
Total	3,044,113	1,203,707	40
Sub-watershed of Lower Willamette			
Johnson Creek	60,159	33,305	55

2.2 Organizational Summary

Clackamas WES plays a leading role in implementing portions of this IP as the administrator of the WES SWM service area; however, others also play a role in implementation. General responsibilities of WES, each county department, and the Cities of Happy Valley and Rivergrove related to this TMDL are outlined in Table 3.

The SWMACC is a Clackamas County Service District administered by Clackamas WES, a department of Clackamas County, which was created in 1992 for the specific purpose of addressing the Tualatin TMDLs. Its boundaries include the following areas:

- All the properties in the Tualatin River Watershed that are unincorporated in Clackamas County.
- The portion of the City of Rivergrove that is in Clackamas County.

Other than the Cities of Happy Valley and Rivergrove, this TMDL IP does not address or include lands that are located in cities. Those cities address their own NPS TMDL requirements.

Table 3. WES, County, and City Responsibilities		
Jurisdiction	Jurisdictional Area	TMDL Implementation Plan Responsibility
Clackamas WES	Limited to WES' SWM service area	Administers SWMACC and CCSD #1, both of which are all-purpose stormwater management entities. ^a
Clackamas County—DTD	County-wide	Includes planning and road maintenance and engineering. Examples include riparian area land use and other private property land uses, county-maintained road maintenance, and illegal dumping of solid waste on private property.
Clackamas County—Business and Community Services Dept.	County-wide	Department of Clackamas County, which includes Economic Development, surplus real estate management, Dump Stoppers (an illegal solid waste dumping prevention program), Clackamas County Parks (e.g., Barton Park), the library service district, and the county fair.
Clackamas County—Facilities Management Dept.	County-wide	Maintains many county-owned buildings and some county-owned lands.
Clackamas County—North Clackamas Parks & Recreation District (NCPRD)	On NCPRD-owned and operated parks only	NCPRD is a department of Clackamas County that is also a Clackamas County service district that provides parks services.
City of Rivergrove	Within city limits only	Limited to land use authority. Most other stormwater management functions are provided by WES/SWMACC on behalf of the City. ^a
City of Happy Valley	Within city limits only	Roads, erosion control permitting, tree ordinance, and land use. Most other stormwater management functions are provided by WES on behalf of the city.

^a Clackamas WES does not provide SWM services in the portion of the City of Rivergrove that lies within Washington County or in the Boring, Fisher's Forest Park, and Hoodland subunits of CCSD #1.

2.3 Surface and Stormwater Management Responsibilities

Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove have responsibilities as DMAs for these TMDLs and have cooperated in the development of this IP. Each entity has ongoing programs that provide for overall management of surface and groundwater quality that contribute to improved watershed health.

2.3.1 Stormwater

Stormwater enters portions of these rivers and tributaries in the TMDL geographic area from areas regulated by the NPDES MS4 Permit program as well as from areas that are not regulated under the NPDES MS4 program. Figure 2 illustrates the MS4 permit area in the northwestern portion of Clackamas County (i.e., incorporated cities or service areas of WES that are located within the Portland metro area's urban growth boundary [UGB]). These MS4-permitted storm sewer systems are point sources, and as a result, they are not addressed in this IP for NPSs. The Clackamas County MS4 permit was originally issued to Clackamas County and several co-permittees (including SWMACC) in December 1995. It was subsequently renewed in March 2004 (and modified in July 2005), March 2012, and, most recently, in October 2021.

Tualatin River Watershed

Stormwater enters the Tualatin River and tributaries in the Tualatin TMDL's geographic area from areas regulated by the NPDES MS4 Permit program as well as from areas that are not regulated under the NPDES MS4 program. Figure 2 illustrates the NPDES MS4 permit area in Clackamas County (i.e., incorporated cities or service areas of WES within the UGB). The DEQ considers these MS4-permitted storm sewer outfalls as point sources, and as a result, they are not addressed in this IP for NPSs. WES is aware of five outfalls that are regulated by the Clackamas County MS4 Permit that are located in the SWMACC's/Rivergrove's MS4 permitted area. SWMACC's boundaries are shown in Figure 3. It is our

understanding that a few pockets of rural unincorporated land in the SWMACC area, which are within the Portland metro area's UGB, are also regulated by the Clackamas County MS4 Permit. SWMACC's land uses in the Tualatin River Watershed are shown in Figure 4.

Willamette Watershed

Stormwater enters the Willamette River and tributaries (in the TMDL geographic area) from areas both regulated and not regulated by the MS4 program, as shown in Figures 1 and 2. Land uses within the Willamette River watershed are shown in Figure 5.

Molalla-Pudding River Watershed

There are no Clackamas County owned NPDES MS4 permitted stormwater outfalls within the Molalla-Pudding sub-basin. Land uses within the Molalla-Pudding Watershed are shown in Figure 6.

Sandy River Watershed

The Sandy River watershed is not included in the Clackamas County NPDES MS4 permit area. Land uses within the Sandy River Watershed are shown in Figure 7.

Clackamas River Watershed

Stormwater enters the Clackamas River and tributaries from areas both regulated and not regulated by the MS4 program, as shown in Figures 1 and 2. Land uses within the Clackamas River watershed are shown in Figure 8.

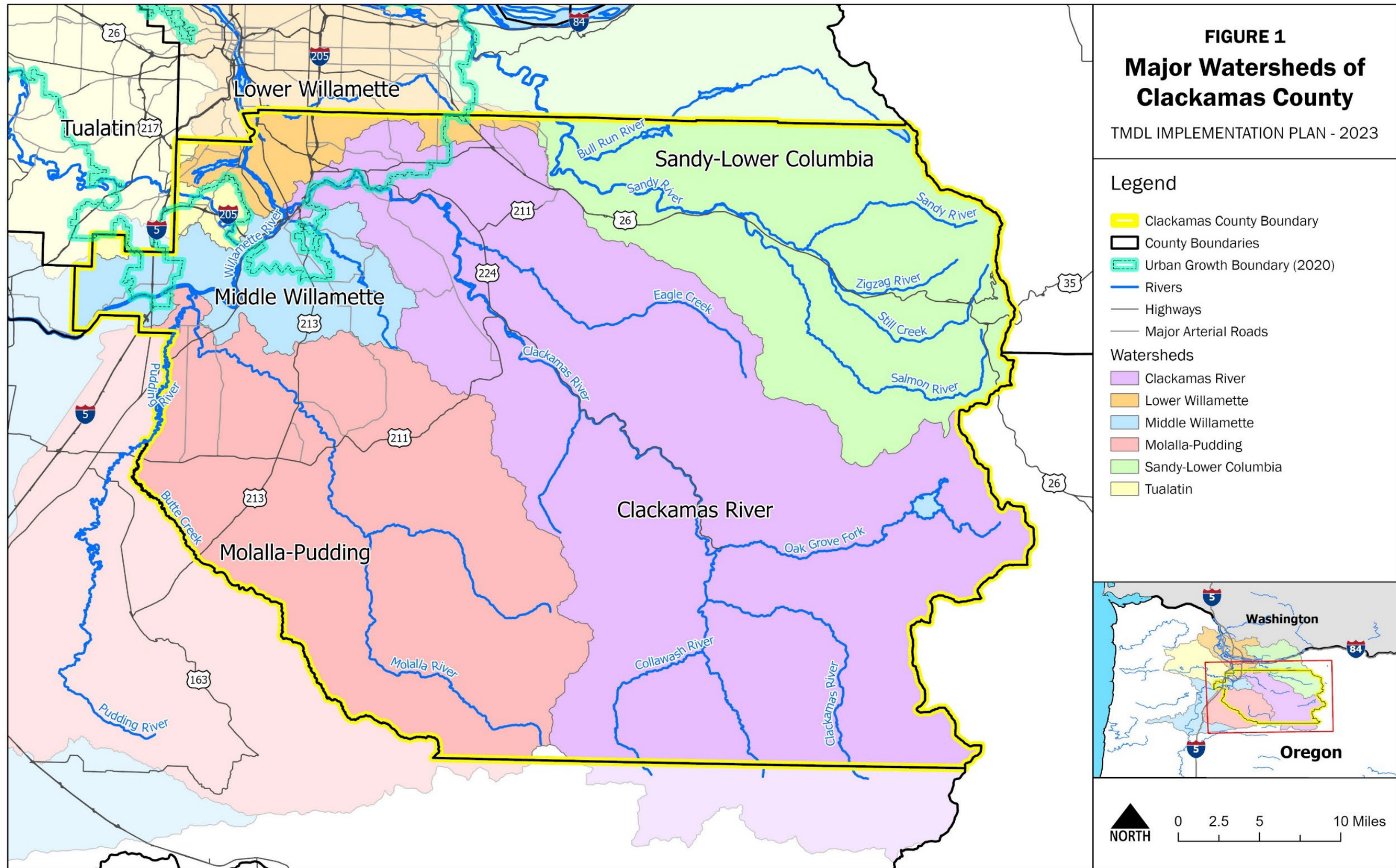


Figure 1. Major Watersheds of Clackamas County

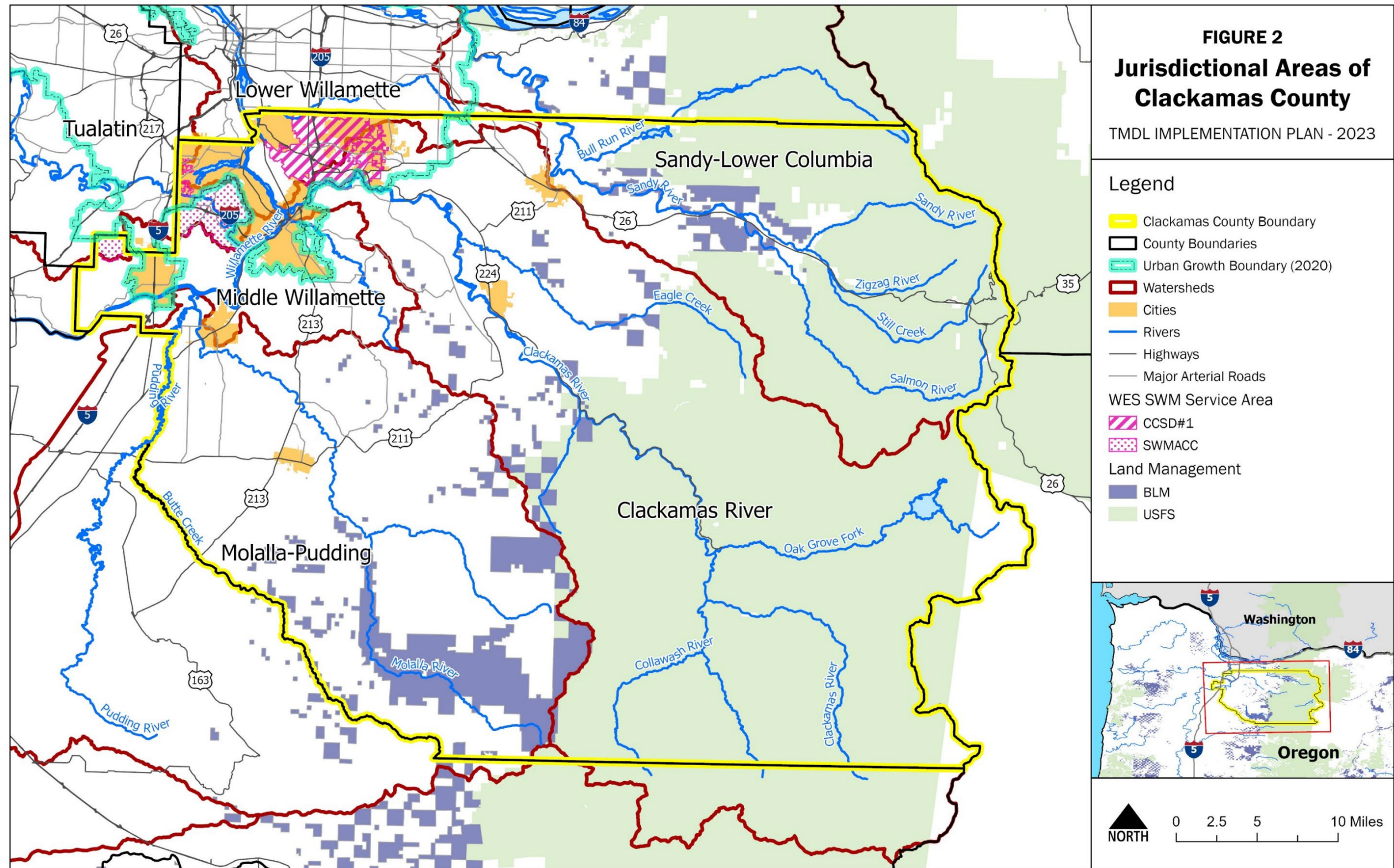


Figure 2. Jurisdictional Areas of Clackamas County

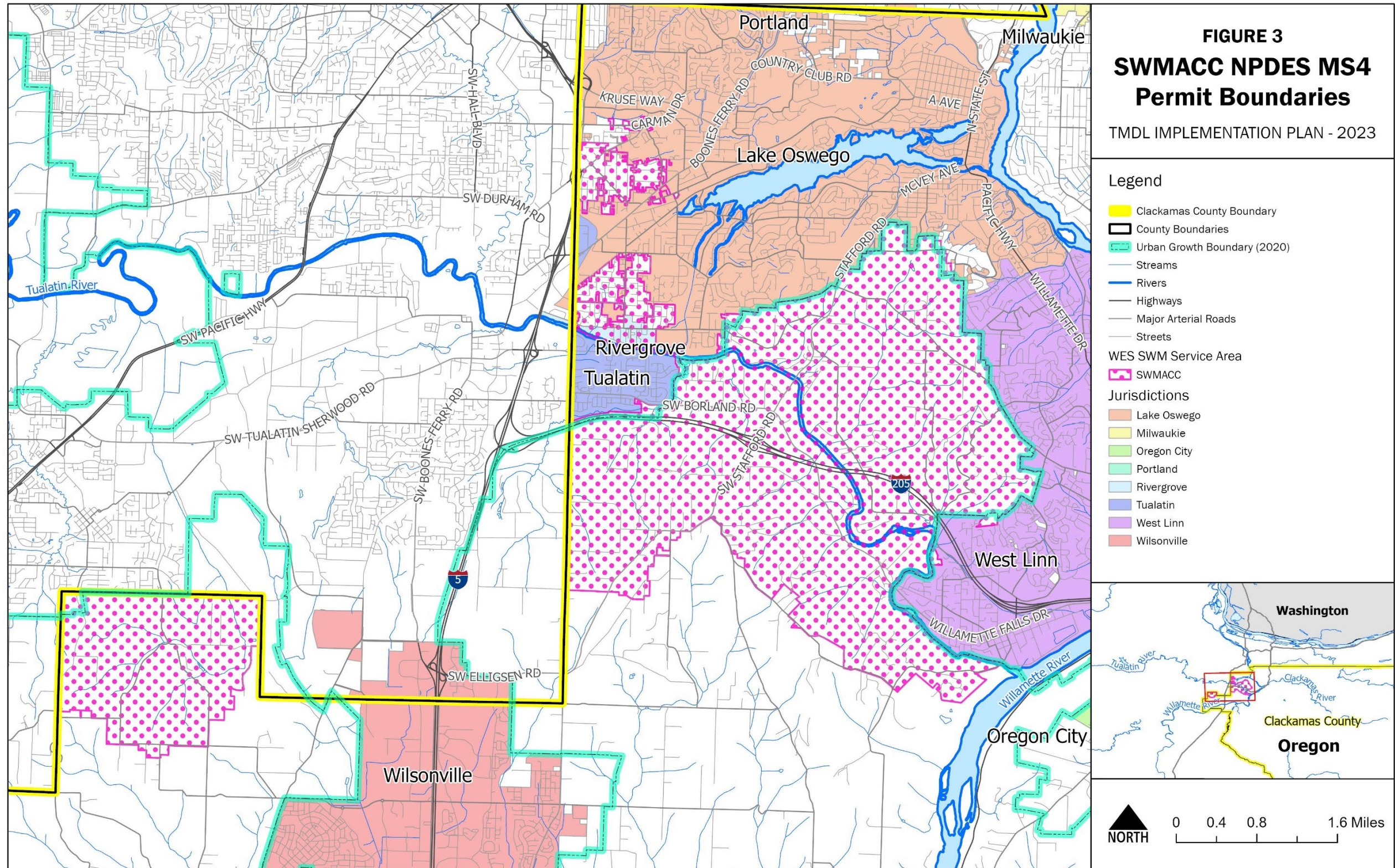


Figure 3. SWMACC NPDES MS4 Permit Boundaries

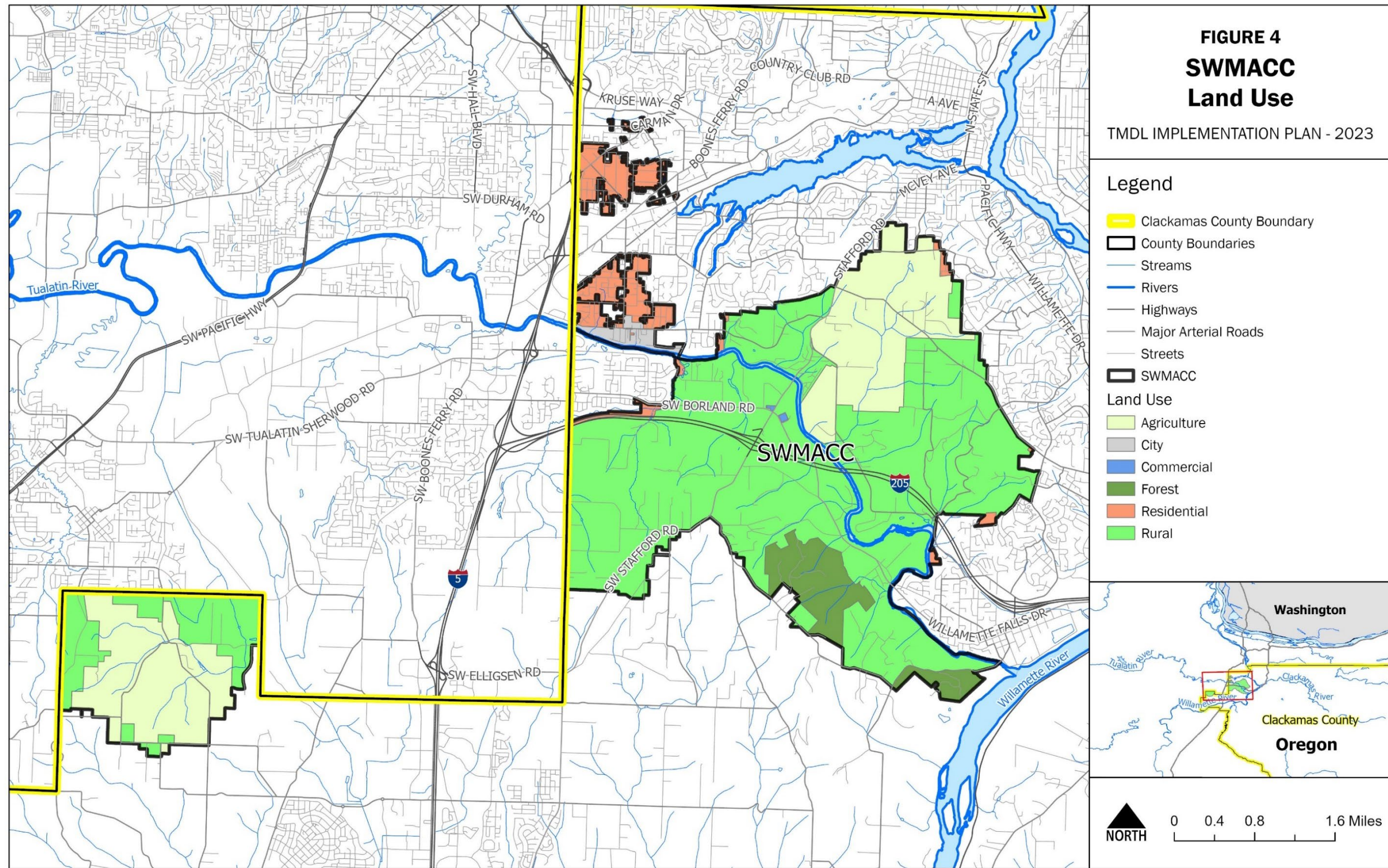


Figure 4. SWMACC Land Use

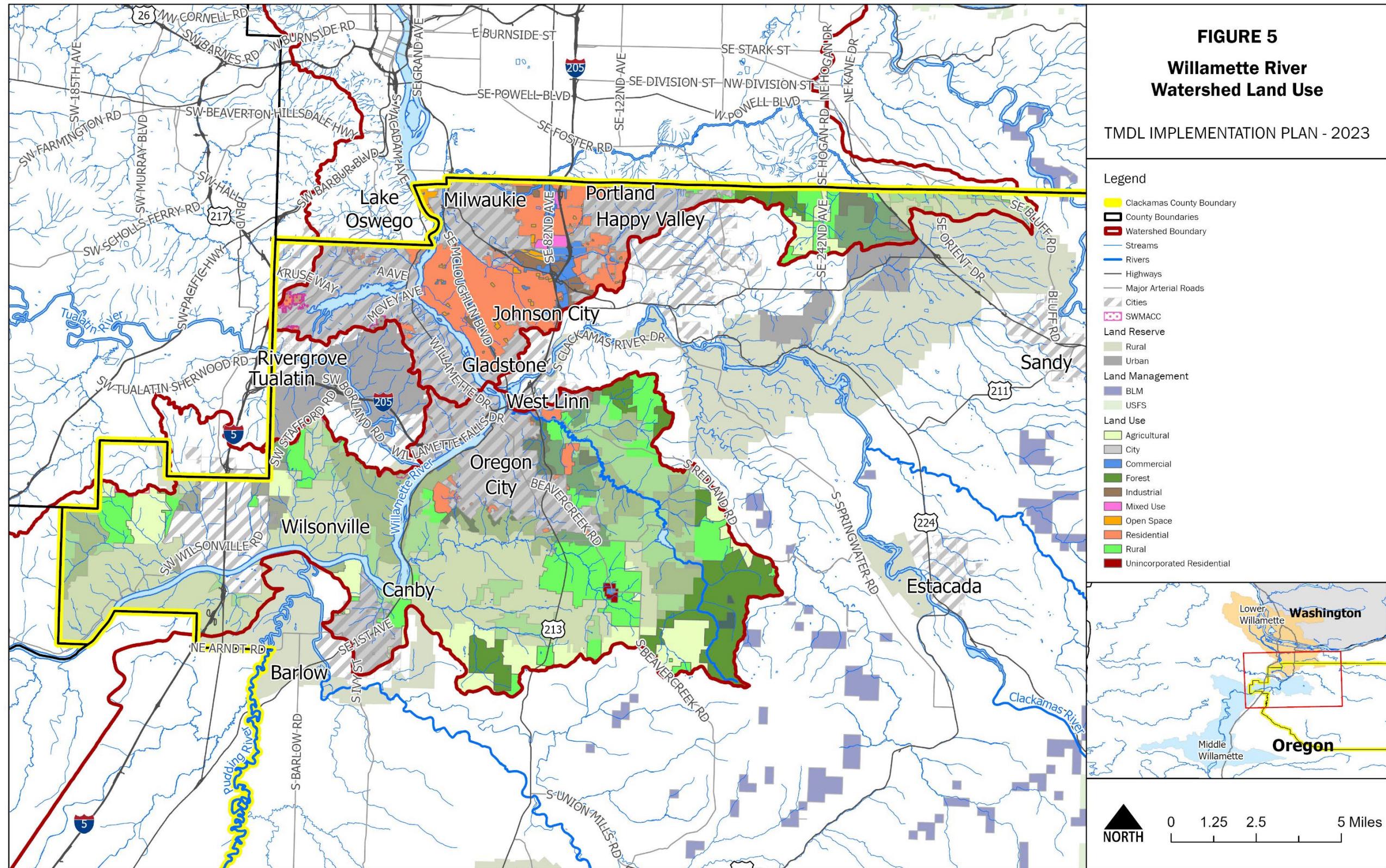


Figure 5. Willamette River Watershed Land Use

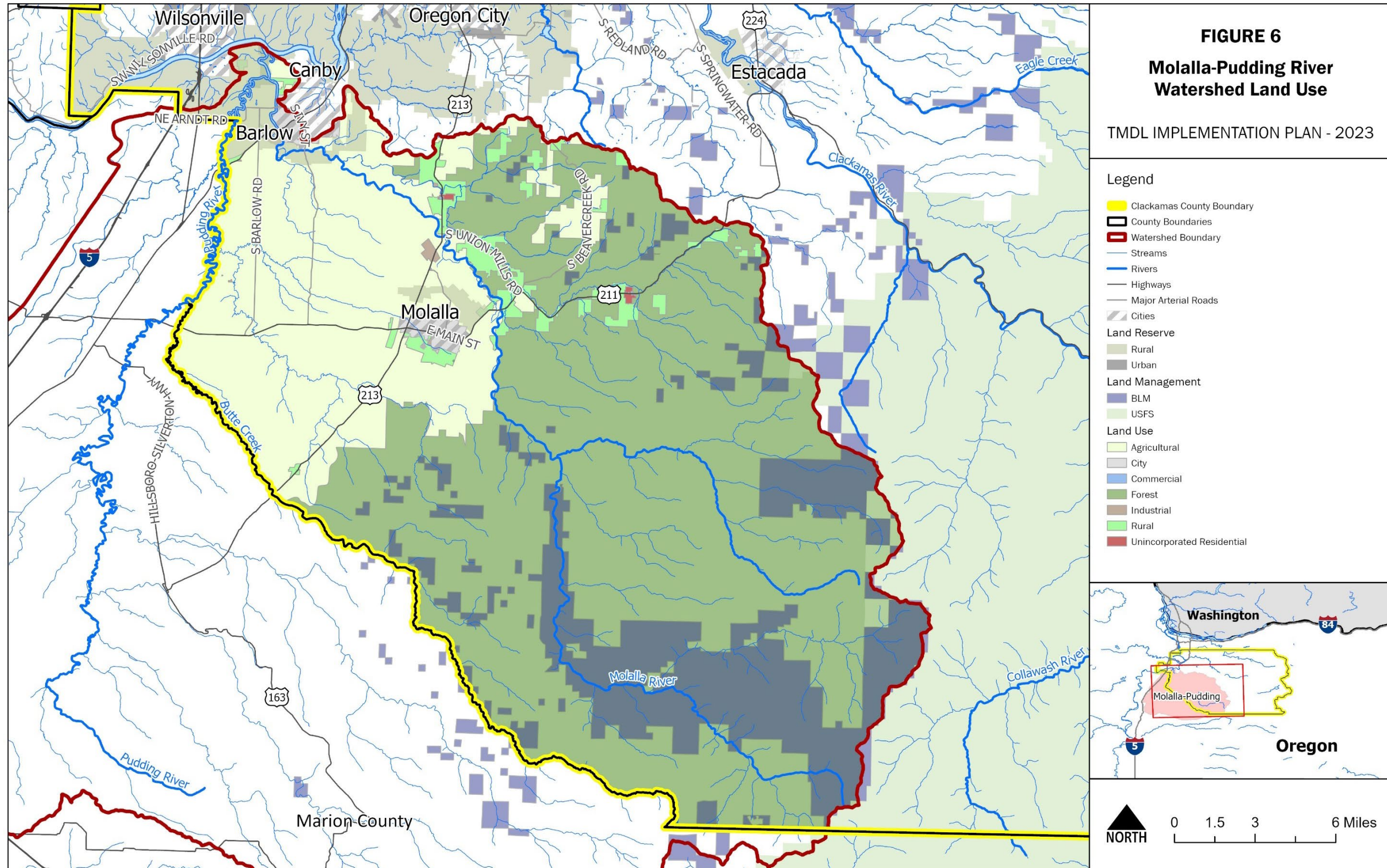


Figure 6. Molalla-Pudding River Watershed Land Use

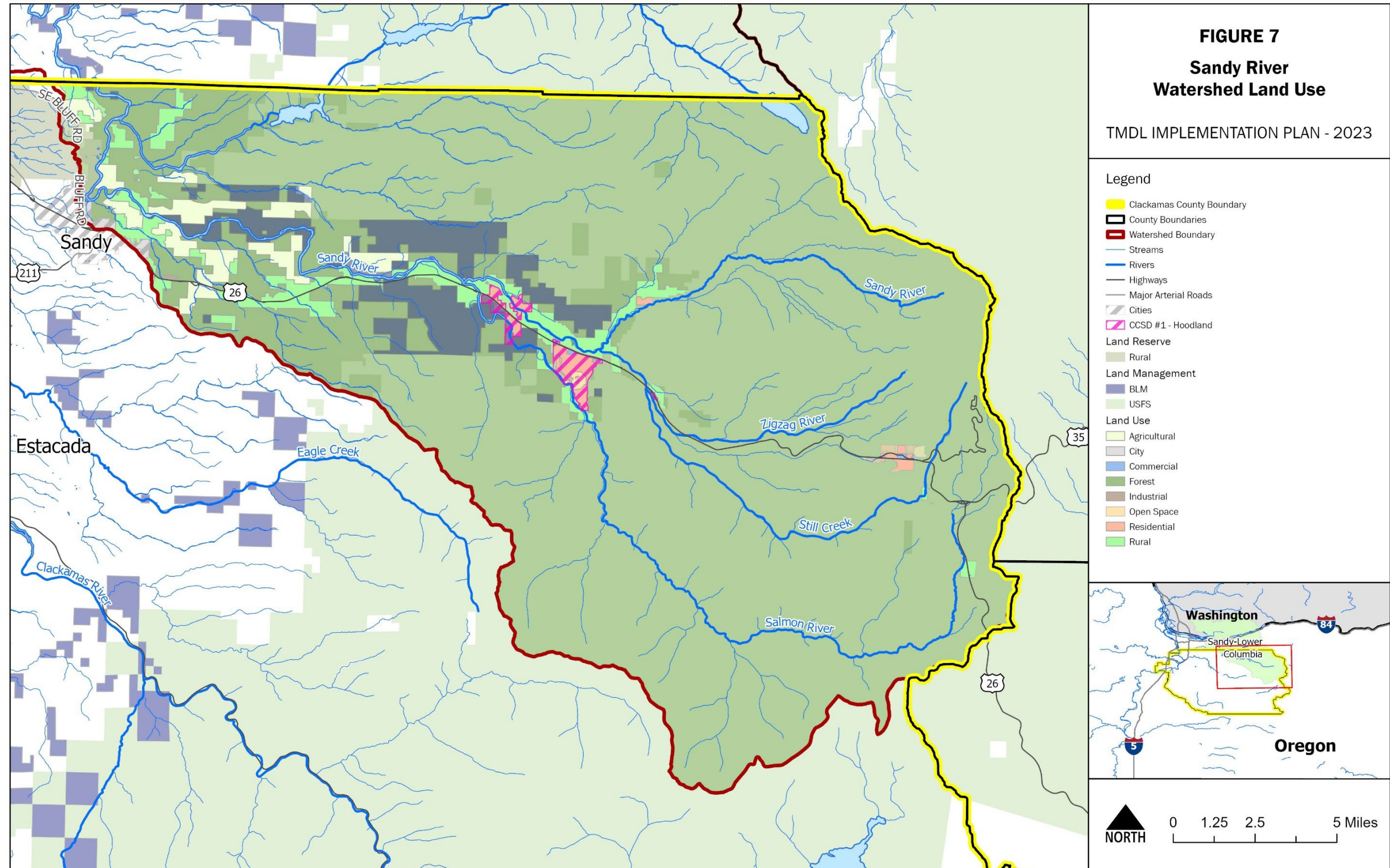


Figure 7. Sandy River Watershed Land Use

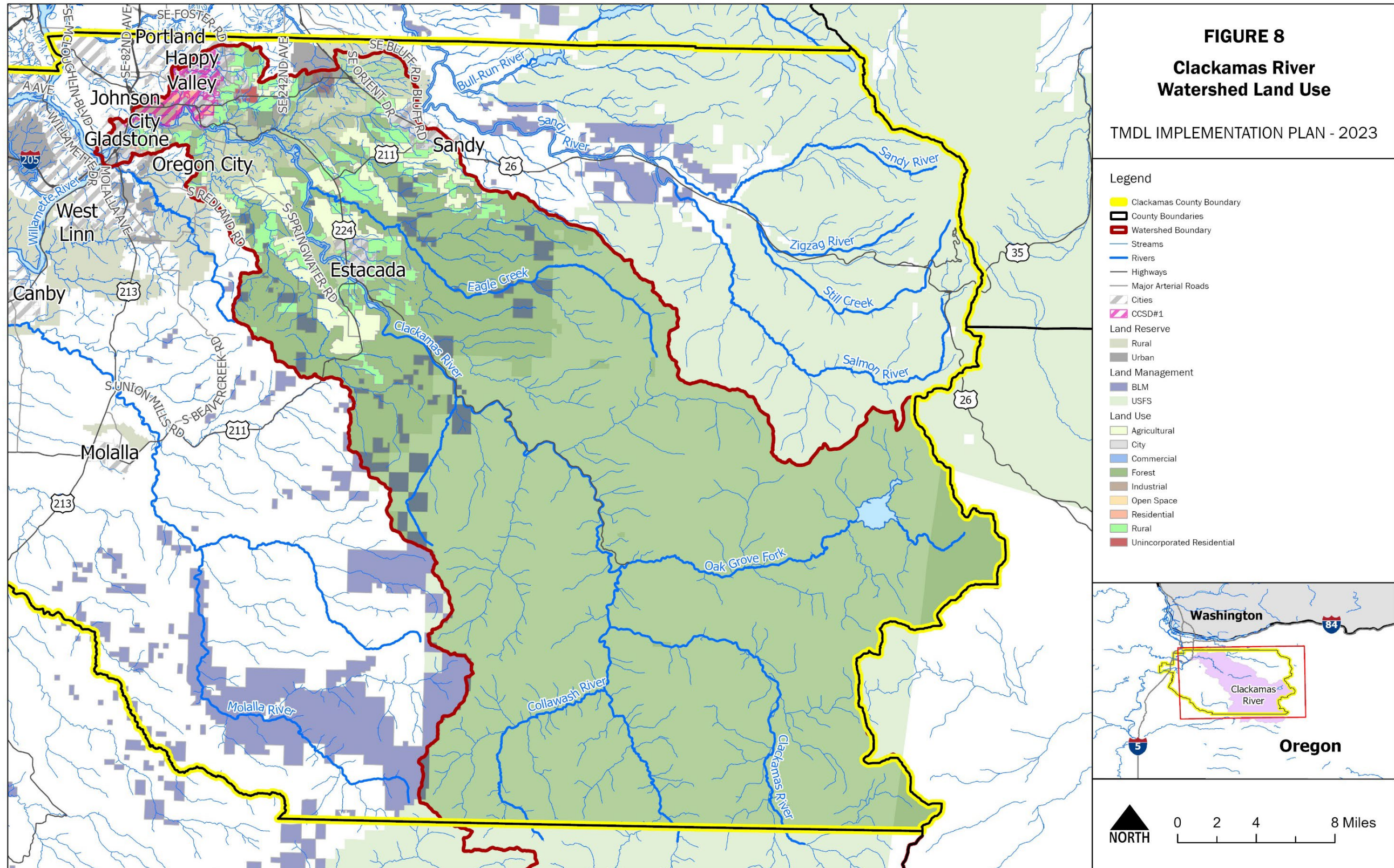


Figure 8. Clackamas River Watershed Land Use

3. TMDL Parameters and Allocations

Water quality impairments have been identified in the Willamette, Tualatin, Molalla-Pudding, and Sandy River Watersheds, which prompted the development of TMDLs addressed in this IP for each of the watersheds as summarized in Table 4.

Table 4. TMDL Summaries Affected Waters				
	Tualatin River Watershed TMDL	Willamette River Watershed TMDL	Molalla-Pudding River Watershed TMDL	Sandy River Watershed TMDL
TMDL Parameters	<ul style="list-style-type: none"> • Temperature • <i>E. coli</i> (bacteria) • Mercury • pH and chlorophyll A (total phosphorus) • DO 	<ul style="list-style-type: none"> • Temperature • <i>E. coli</i> (bacteria) • Mercury • Dichlorodiphenyltrichloroethane [DDT] and dieldrin in the Johnson Creek watershed • Cold water refugia in the Willamette River 	<ul style="list-style-type: none"> • Temperature • <i>E. coli</i> (bacteria) • Mercury • DDT and dieldrin • Nitrates^a • Iron 	<ul style="list-style-type: none"> • Temperature • <i>E. coli</i> (bacteria) only in the Cedar Creek sub-watershed

^a The nitrate TMDL applies only to Zollner Creek. None of Zollner Creek, nor any portion of the contributing area, is within the Clackamas County boundary. Therefore, nitrate will not be addressed as part of this TMDL implementation plan.

Table 5 summarizes each TMDL parameter, LA, measurement method, and DMA relevant to this plan.

Table 5. TMDL Parameters and Load Allocations for Affected Waters					
Affected Waters	Parameters	Measurement Method	Allocation Type	LA	DMA
Tualatin River TMDL					
All	<i>E. coli</i>	<i>E. coli</i> .	LA	Summer (May 1–Oct 31): 12,000 colonies/100 mL during storms AND 406 colonies/100 mL during all other times. Winter (Nov. 1–April 30): 5,000 colonies/100 mL during storms AND 406 colonies/100 mL during all other times.	Clackamas County, SWMACC (a member of the WES Partnership) and Rivergrove
	Total phosphorus (pH and chlorophyll A)	Lab: total phosphorus.	LA	0.14 mg/L in most instances. Only applies from May 1 to Oct. 31.	Clackamas County, SWMACC (a member of the WES Partnership), and Rivergrove
	DO	Lab: Winkler method or field meter. A surrogate (TSS) may be used.	LA	20% or 50% reduction in "settleable volatile solids in runoff."	Clackamas County, SWMACC (a member of the WES Partnership), and Rivergrove
	Mercury	Lab: mercury.	LA	97% reduction from NPSs: runoff, soil erosion, air deposition, etc.	Clackamas County, SWMACC (a member of the WES partnership), and Rivergrove
	Instream temperature	Surrogate: shade.	LA	Attaining "system potential vegetation" conditions.	Clackamas County, SWMACC (a member of the WES partnership) and Rivergrove

Table 5. TMDL Parameters and Load Allocations for Affected Waters

Affected Waters	Parameters	Measurement Method	Allocation Type	LA	DMA
Willamette River TMDL					
All ^a	Instream temperature	Surrogate: shade.	LA	Attain "system potential vegetation" conditions.	Clackamas County, CCSD #1 (a member of the WES Partnership), Happy Valley
Mainstem Willamette River (river mile 50 to river mile 0)	Cold water refugia	Restoration of refugia.	None	Restore where feasible.	Clackamas County
All ^a	<i>E. coli</i>	Direct.	LA	78% reduction (83% and 89% in Bargfield and Delano).	Clackamas County, CCSD #1 (a member of the WES partnership), Happy Valley
Johnson Creek	DDT/dieldrin	Surrogate: TSS.	LA	94% reduction in DDT (< 15 mg/L TSS).	Clackamas County, CCSD #1 (a member of the WES partnership), Happy Valley
All ^b	Mercury	Direct.	LA	Lower and Middle Willamette: 97% reduction. Clackamas: 88% reduction.	Clackamas County, CCSD #1 (a member of the WES partnership), Happy Valley
Molalla-Pudding TMDL					
Molalla-Pudding: Beaver Creek, Butte Creek, Drift Creek, Molalla River, Pine Creek, Pudding River, Silver Creek, S. Fork Silver Creek, Table Rock Fork Creek, Teasel Creek, Zollner Creek*	Instream temperature	Surrogate: shade.	LA	Attain "system potential vegetation" conditions.	Clackamas County
Molalla, Pudding, W. Fork Little Pudding River*	<i>E. coli</i>	Direct.	LA	Variable. ^d	Clackamas County
Little Pudding River*, Pudding River, Zollner Creek*	DDT	Surrogate: TSS.	LA	TSS < 15 mg/L (Pudding and Zollner); TSS < 7 mg/L (Little Pudding).	Clackamas County
Pudding River, Zollner Creek*	Dieldrin	Surrogate: TSS.	LA	TSS < 15 mg/L (Pudding and Zollner).	Clackamas County
Little Pudding*, Zollner Creek*	Chlordane	Surrogate: TSS.	LA	TSS < 15 mg/L (Pudding and Zollner); TSS < 7 mg/L (Little Pudding).	Clackamas County
Zollner Creek*	Nitrates	Direct.	LA	Loading capacity minus 10% for margin of safety.	Clackamas County
Pudding River, Zollner Creek*	Iron	Surrogate.	LA	79% reduction for iron (Pudding), 96% reduction for Iron (Zollner).	Clackamas County
All	Mercury	Direct.	LA	88% reduction.	Clackamas County
Sandy River TMDL					
All	Instream Temperature	Surrogate: shade.	LA	Attain "system potential vegetation" conditions.	Clackamas County
Cedar Creek	<i>E. coli</i>	Direct.	LA	86% reduction.	Clackamas County

^a Does not include the Tualatin, Molalla, and Pudding Rivers.

^b Does not include the Molalla and Pudding Rivers

^c Assigned to broad categories of discharges, not to individual cities or counties.

^d Percent reductions vary for each compliance point and/or land use.

*No portion of the Zollner Creek watershed and the Little Pudding River watershed is in Clackamas County.

mg/L = milligrams per liter

mL = milliliter

3.1 *E. coli*

Bacteria has been implicated in water quality impairments throughout the watersheds covered in this IP. LAs for *E. coli* are described in the following sections.

Tualatin River

According to the January 2001 Tualatin TMDL, the following *E. coli* LAs (expressed as stormwater concentrations) apply to all river and tributary segments in SWMACC:

- Summer (May 1–Oct 31): 12,000 colonies/100 mL during storms AND 406 colonies/100 mL during all other times
- Winter (Nov. 1–April 30): 5,000 colonies/100 mL during storms AND 406 colonies/100 mL during all other times

Willamette River

The LAs in the Willamette TMDL specify that a 78 percent reduction in *E. coli* loads is needed in stormwater runoff discharges to all streams and tributaries in the portion of the Lower Willamette sub-basin that is in Clackamas County, including the Clackamas River watershed. The only exceptions are Bargfield and Delano Creeks in the Clackamas River watershed where the LAs call for 83 percent and 89 percent reductions, respectively.

Molalla-Pudding

Stream specific percent load reductions were determined for each 303(d) listed stream in the Molalla-Pudding sub-basin, which apply to their tributaries as well. Reduction requirements for streams within Clackamas County are outlined below by compliance point:

- Pudding River at Hwy. 211 (river mile 21): 75 percent reduction in NPS stormwater discharges
- Pudding River at 99E (river mile 7.3): 70 percent reduction in NPS stormwater discharges
- Molalla River at Knights Bridge Road (river mile 2.8): 81 percent reduction in NPS stormwater discharges

Sandy River

The LA for NPSs of *E. coli* (see Table 4.6 on page 113 in the TMDL) calls for an 86 percent reduction in *E. coli* loads in three creeks in the Sandy River watershed: Beaver, Kelly, and Cedar. The Sandy River watershed *E. coli* TMDL only applies to these three creeks. The Beaver and Kelly Creek watersheds do not drain any portion of Clackamas County. The DEQ combined the *E. coli* loading data from Beaver, Kelly, and Cedar Creeks, then calculated that an 86 percent reduction in *E. coli* loading was required based on the combined data set. Cedar Creek is close to being in compliance with Oregon's instream bacteria standards (see Table 4.4 of the TMDL—page 105—for more information). The DEQ's dataset showed that *E. coli* loading is much higher in Beaver and Kelly Creeks, which may be because they drain densely developed sections of the Cities of Gresham and Troutdale. If Cedar Creek's *E. coli* loading data had been addressed separately by the DEQ in the TMDL's Allocations section (Table 4.6), it is estimated that the required *E. coli* loading reduction in Cedar Creek would have only been about 10 percent.

3.2 Dissolved Oxygen

The DEQ established a TMDL in 2001 for DO, with the primary goal of reducing the levels of settleable volatile solids (SVS) in the Tualatin River watershed. Levels of SVS are believed to play a role in contributing to the amount of instream DO that bed sediments take up as organic material is consumed or decomposes. The DO TMDL's LAs that were issued are for SVS.

The DO TMDL's LAs are expressed in terms of a required percent reduction of SVS in NPS stormwater runoff. For the roughly 27 acres of lands in the SWMACC that drain into Carter Creek, a Fanno Creek tributary, the required SVS reduction is 50 percent from May 1 to October 31. For all other streams in SWMACC, including the mainstem Tualatin River, the required reduction is 20 percent in NPS stormwater runoff from May 1 to October 31.

3.3 Mercury

The Willamette River watershed's mercury TMDL was recently revised and was approved by the USEPA in 2021. This revised TMDL replaced the previous one that was issued in 2006. The Willamette TMDL for mercury also applies to the Tualatin River and the Molalla-Pudding River because they are tributaries of the Willamette River.

The stated objective of the mercury TMDL is to reduce average fish tissue mercury concentrations in the Willamette River so that all fish species will eventually be safe for human consumption. The fish consumption advisories for mercury in the Willamette Basin show that this beneficial use is not currently being met.

The 2021 update established the following LAs from NPSs (agricultural; forest; shrub; developed; other, which includes runoff and sediment) as applicable to DMAs:

- Lower and Middle Willamette River and the Tualatin River: 97 percent reduction in NPS stormwater discharges
- Molalla-Pudding and Clackamas Rivers: 88 percent reduction in NPS stormwater discharges

3.4 Temperature

Temperature impairment affects each of the watersheds covered by this IP. TMDLs are described below for each watershed.

Tualatin River

All stream and river reaches in SWMACC are regulated by the Tualatin River's temperature TMDL. The DEQ has established percent effective shade (PES), a measurement of the shade-yielding capacity of a riparian area, as the TMDL's surrogate for instream heat load. PES relies on the restoration and protection of "system potential vegetation" conditions. These "system potential vegetation" conditions are considered by the DEQ to be necessary to achieve "system potential effective shade," which is defined by the DEQ as "the potential near-stream vegetation that can grow and reproduce on a site, given the climate, elevation, soil properties, plant biology, and hydrologic processes." Shade curves, developed by the DEQ for the Willamette basin, based on potential vegetation growth under different soil conditions, display the shade coverage that could potentially be present at given locations; these curves could be useful for efforts to increase riparian shade in the SWMACC, which includes a portion of the City of Rivergrove (the portion that is located in Washington County is not in the SWMACC).

Willamette River

Numerous stream and river reaches in Clackamas County are part of the Willamette temperature TMDL, including the Willamette and Clackamas Rivers and Johnson and Cow Creeks. The DEQ has established PES as the TMDL's surrogate for instream heat load. PES relies on the restoration and protection of "system potential vegetation" conditions. Shade curves, developed by the DEQ for the Willamette basin, based on potential vegetation growth under different soil conditions, display the shade coverage that could potentially be present at given locations without consideration of adjacent development that may be present.

Molalla-Pudding River

Several stream and river reaches in Clackamas County are part of the Molalla-Pudding sub-basin temperature TMDL, including the Molalla River, Pine Creek, Table Rock Fork Creek, Beaver Creek, Butte Creek, and Teasel Creek. The DEQ has established PES as the TMDL's surrogate for instream heat load. PES relies on the restoration and protection of "system potential vegetation." The Molalla-Pudding sub-basin TMDL establishes site-specific shade targets for the Molalla and Pudding Rivers, and basin-wide "shade curves" that can be used to establish shade targets for all other streams in the basin.

Sandy River

The DEQ has established PES as the TMDL's surrogate for instream heat load. PES relies on the restoration and protection of "system potential vegetation." The Sandy TMDL establishes site-specific shade targets for the mainstem of the Sandy River and major tributaries and basin-wide "shade curves" that can be used to establish shade targets for all other streams in the basin. The DEQ's analyses showed that streams in the Sandy River basin, especially those on public lands, are well-shaded with mature stream side vegetation. Computer modeling showed that increasing streamside vegetation would not result in significantly cooler water temperatures in most major Sandy basin tributaries. However, smaller streams, particularly in the lower portions of the basin (e.g., Beaver Creek), would most likely show significant temperature improvements by increasing mature streamside vegetation.

Cold Water Refugia

As a requirement of the 2006 Willamette River TMDL, DMAs located along the mainstem Willamette River from river mile 50 downstream to the confluence with the Columbia River need to address cold water refugia (CWR) within their TMDL IPs. This reach of the river has been designated as a migration corridor for salmonids. CWR are needed along this reach to offer migrating salmonids relief from the warmer river temperatures found in the summer months. Plans shall look at identifying existing CWR and provide options for protecting or enhancing such areas. Wherever localized CWR have been altered through channel modification or by other means, consideration should be given to exploring options for restoring or enhancing these areas of CWR where feasible. See Management Strategy 7.12 for more information.

3.5 Total Phosphorus (pH and Chlorophyll A)

Total phosphorus is implicated in eutrophication and is elevated due to agricultural activities, septic systems, and other sources, in addition to naturally phosphorus rich groundwater. The Tualatin River basin is the only Clackamas County watershed with a TMDL for total phosphorus.

Tualatin River

The USEPA approved TMDLs for total phosphorus in the Tualatin River in 1988, 1994, 2001, and again in 2012. The 2012 TMDL LAs are for total phosphorus, which are expected to benefit instream pH and reduce the levels of chlorophyll a.

In the 2012 total phosphorus TMDL, the summer (May 1 to October 31) median concentration representing the LA for total phosphorus discharges from the SWMACC is 0.14 or 0.13 milligrams per liter (mg/L), depending on the specific location. The summer median concentration for total phosphorus in discharges to the Tualatin River at SW Stafford Road, which is also in the SWMACC, is 0.10 mg/L.

3.6 DDT and Dieldrin in Johnson Creek

This DDT and dieldrin TMDL is specific to the Johnson Creek watershed, which drains a small portion of Clackamas County near the cities of Milwaukie and Happy Valley. Fewer than 1,000 acres (less than 3 percent) out of a total watershed area of about 55 square miles of the entire Johnson Creek watershed are within CCSD #1 and/or the City of Happy Valley. Additional acreage in Clackamas County's portion of the watershed lies in a rural area in the Boring, Oregon, area.

The TMDL has assigned an LA for all NPSs in the watershed: a 94 percent reduction in discharges over time from current DDT levels. The DEQ has assumed that reducing DDT levels will also yield sufficient reductions in the level of dieldrin (and breakdown products) within Johnson Creek.

Dieldrin and DDT, when they are present in stormwater or creek water, may be attached to or associated with small, suspended solid particles. As part of the Willamette TMDL development, the DEQ has established a reduction of total suspended solids (TSS) as a measurement of overall DDT reduction. The TMDL's TSS target is 15 mg/L for NPSs; thus, if stormwater runoff contains 15 mg/L or less TSS, it is assumed that the level of DDT has been reduced by 94 percent or more. Complying with the DDT LA constitutes compliance with the dieldrin TMDL as well.

3.7 Pesticides (DDT, Dieldrin, Chlordane)

This DDT and dieldrin TMDL is specific to the Pudding River and Zollner Creek. The chlordane TMDL applies only to Zollner Creek. Approximately 20 miles of the Pudding River are located within Clackamas County, and approximately 7 miles of the Pudding River are located along the county boundary (Figure 7). No portion of Zollner Creek's watershed is within Clackamas County. Therefore, chlordane will not be addressed as part of this TMDL IP.

The Molalla-Pudding sub-basin TMDL has assigned a 30 percent reduction in long-term average total DDT concentrations for all NPSs discharging to the Pudding River watershed to meet the target. This reduction is based on attaining the fish tissue criteria but does not meet water column criteria. The reductions of DDT metabolite long-term average concentrations are 61 percent (4,4'DDE) and 97 percent (4,4'DDT) to meet human health water column criteria.

Dieldrin and DDT, when they are present in stormwater or creek water may be attached to or associated with small, suspended solid particles. As part of the TMDL development, the DEQ has established reduction of TSS as a surrogate measurement of overall DDT and dieldrin reduction. The TMDL's TSS target is 15 mg/L for NPS discharges. The 15 mg/L TSS target for discharges to the Pudding River is sufficient to meet total DDT water column targets and prevent exceedances of fish tissue action levels in the Pudding River.

3.8 Nitrate

The nitrate TMDL applies only to Zollner Creek. None of Zollner Creek, nor any portion of the contributing area, is within Clackamas County. Therefore, nitrate will not be addressed as part of this TMDL IP.

3.9 Metals (Iron, Manganese, Arsenic)

The iron and manganese TMDL is specific to the Pudding River and Zollner Creek. The arsenic TMDL applies only to Zollner Creek. As previously mentioned, none of Zollner Creek is within Clackamas County. Therefore, arsenic will not be addressed as part of this TMDL implementation plan.

As indicated in the Molalla-Pudding TMDL report, based on the manganese analyses, the DEQ concluded that a TMDL for manganese is not necessary and recommended delisting. Therefore, manganese will not be addressed as part of this TMDL IP. Iron in the Pudding River is addressed in this TMDL IP.

4. Goal and Objective of the Plan

The goal of this IP is to identify the ongoing and planned management strategies to improve watershed health and address requirements of the applicable TMDLs related to the NPSs of TMDL pollutants. The objective of this IP is to apply the plan's management strategies for water pollution reduction and prevention (e.g., erosion control program for construction sites).

To achieve this goal and objective, this IP's Co-Owners (Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove) will be implementing the portions of this plan that they are responsible for in a coordinated fashion. A single annual report to the DEQ is expected to be submitted by these DMAs each year.

5. Potential Sources of Pollutants

According to the DEQ, specific known or suspected NPSs of TMDL pollutants should be noted in this IP. The potential sources of TMDL parameters in the Clackamas County watersheds are discussed below.

5.1 *E. coli* (Willamette, Molalla-Pudding and Tualatin River Watersheds, and the Sandy River's Cedar Creek sub-watershed)

E. coli bacteria can enter surface water bodies from many sources, including the feces of wild mammals, tame and wild waterfowl, wild songbirds, pets, livestock, and from improperly functioning (i.e., failed) septic systems.

Studies conducted in the Clarks Creek watershed in Puyallup, Washington (Brown and Caldwell, 2005), and the Tualatin River watershed in Oregon (Clean Water Services, 2005) indicated that stormwater washing over fecal matter that had been deposited by a variety of wild animals, including birds and rodents, appeared to be the main sources of most *E. coli* contamination in urban stormwater. As a result, it may be unattainable and prohibitively expensive to achieve LAs. In addition, removing wild birds and mammals as a source would not be a desirable management practice.

In rural areas where no public sanitary sewer infrastructure exists, failed or failing septic systems and cesspools can also be a significant source of *E. coli* bacteria given the right circumstances. *E. coli* bacteria in rural areas include the following potentially significant sources:

- Livestock waste
- Wild bird and mammal feces
- Pet waste

5.2 Dissolved Oxygen (Tualatin River Watershed only)

A DO test measures the amount of oxygen that is dissolved in the water. Low DO levels can be harmful or even fatal to many forms of aquatic life.

The DEQ established a TMDL for DO in 2001 with a goal of reducing the levels of SVS in the Tualatin River watershed. Levels of SVS are believed to play a role in contributing to the amount of instream DO that bed sediments take up as organic material is consumed or decomposes. The DO TMDL's LAs are for SVS.

Examples of materials which do, or can, contain SVS include, but are not limited to, leaves and other pieces of vegetation, the upper organic layer of soil, and discarded food. Programs that reduce the instream presence of SVS, such as sweeping leaves from roadsides, are expected to yield lower SVS levels in stormwater runoff.

Since a laboratory method does not exist for SVS, documenting compliance with this requirement is unusually complex. A combination of the following alternative water quality measurements can be used: TSS, volatile solids, and direct measurements of DO instream using a DO meter in the field or using the Winkler method for laboratory analysis.

Levels of lower DO in stream water can be affected by pollutants discharged by human activities that exert oxygen demand on the oxygen dissolved in surface waters. An example would be rinsing a lawn mower in the street with a garden hose after mowing the lawn. If grass clippings are washed into the nearest stream, their decomposition will reduce the amount of oxygen that is dissolved in the water of the stream.

Another example might involve fertilizer, which contains phosphorus, that is washed into the creek by a storm event. This additional phosphorus can increase instream algal populations. A larger instream algae population tends to have a larger adverse impact on the oxygen levels that are dissolved in surface waters.

The level of DO in stream/river water is affected by many other factors and processes, including water temperature, photosynthesis, and plant respiration. For example, daily variations in DO can occur in streams and rivers having significant algal populations, with the highest values usually occurring in the afternoon after the sun has been up for many hours and the lowest values usually occurring in the early morning after it has been dark for many hours. Prolonged periods of darkness slow the oxygen-producing photosynthetic process to its lowest levels, while algal respiration, the oxygen-consuming process that burns sugars, continues.

The DO levels in stream water also tend to be diminished when water flows slowly without turbulence. Turbulence (i.e., water flowing over rocks) increases the rate of mixing of water and air, increasing DO levels.

5.3 Mercury (Willamette, Molalla-Pudding, and Tualatin River Watersheds)

Mercury is a naturally occurring element found in high concentrations in mercury (II) sulfide deposits, also known as cinnabar. The intent of reducing mercury is to protect aquatic life and human health from mercury exposure from fish consumption. The two most common sources of mercury are listed below:

- Soil erosion and resuspension of mercury-laden sediment
- Atmospheric deposition

In Oregon, mercury was mined commercially and used extensively in gold and silver amalgamation (Brooks, 1971; Park and Curtis, 1997). Mercury is present in other rock types and soil types in Clackamas County, given the role that volcanoes have played in the geologic history. Mercury is also naturally present in geothermal areas and in many types of native vegetation; significant amounts can be released into the atmosphere during forest fires.

Mercury was historically included in fungicide formulations and can still be found in many commercial products, including fluorescent lights, thermometers, automobile switches, and dental amalgam. Illegal dumping of solid waste containing mercury can also be a source.

Mercury is in fossil fuels such as coal, natural gas, diesel fuel, and heating oil. The mercury present in these fuel sources is often released into the atmosphere upon combustion. Atmospheric mercury can be transported great distances and is known to be deposited on the landscape via either wet or dry deposition (Sweet et al., 1999, 2003). Research has shown that a majority of the mercury that enters the Willamette River was deposited in the watershed from the atmosphere. It is Clackamas County's, Clackamas County WES', and the City of Happy Valley and Rivergrove's understanding that they are not legally responsible for preventing and/or controlling the portion of the mercury load that has been deposited by the atmosphere.

Mercury can be present in various physical and chemical forms in the environment (Ullrich et al., 2001; USEPA, 2001b). Most of the mercury found in the environment is in the form of inorganic or elemental mercury, but these forms of mercury can be converted to organic or methyl mercury by sulfate reducing bacteria. Methyl mercury production is affected by a host of physical and chemical factors, including temperature, redox potential, DO levels, organic carbon, sediment particle size, alkalinity, sulfate concentration, and pH. Methyl mercury, once formed, represents the most bioaccumulative form of mercury in fish tissue and the most toxic form of mercury for human consumers (USEPA, 2001a). The primary route of human exposure to mercury is via the consumption of freshwater fish, saltwater fish, and other seafood containing mercury (USEPA, 2001a).

Mercury can enter surface water bodies in many ways. For example, the DEQ estimated in the 2021 Willamette River mercury TMDL that 8 percent of the mercury in the Tualatin River is contributed from groundwater. Another way that mercury can be transported to surface waters is through stormwater runoff. Some of the mercury in stormwater runoff may be washed from impervious surfaces after having been deposited on the surface from the atmosphere. Stormwater runoff can also carry mercury if it erodes mercury-containing soils.

Given that Clackamas County's portion of the watershed possesses many land uses in large rural and urban areas, numerous agencies share jurisdiction over some of the activities that may cause instream mercury contamination. Other activities, such as those that cause the atmosphere to deposit substantial amounts of mercury in the watershed, or certain ways that mercury-containing soil is disturbed and eroded, such as row crop agriculture, only receive minimal regulation. Unfortunately, unregulated and thinly regulated sources of mercury appear to account for the vast majority of the Willamette River's annual mercury loading. For comparison, discharges from wastewater treatment plants are tightly regulated, and all of the publicly owned wastewater treatment plants in the entire watershed combined discharge only about 0.8 percent of the Willamette River's annual mercury loading; any additional reduction in the mercury discharged from wastewater treatment plants will only have a minimal impact on the total amount of mercury discharged into the river each year.

At this time, Clackamas County, WES, and the City of Rivergrove are not aware of any specific known NPSs of mercury, although suspected or general (i.e., non-specific) sources are listed below:

- Erosion of soils, including from lands used for agricultural, forest, and urban/commercial/industrial purposes
- Illegal dumping of some solid wastes
- Spills and illicit discharges of certain materials

5.4 Temperature (Willamette, Molalla-Pudding, Tualatin, and Sandy River Watersheds)

Stream temperature is influenced by many factors. Heat energy is transferred to and from streams by the following processes:

- Short-wave radiation (primarily direct solar radiation, also known as radiant heat)
- Long-wave radiation (thermal radiation emitted from the Earth's surface)
- Convective mixing with the air
- Evaporation
- Streambed advection
- Advective mixing with inflow from groundwater and tributary streams
- Advective mixing with point source inputs, such as wastewater effluent

There are varying scientific opinions about the relative importance of the above listed processes as sources for temperature increases in streams. While it is known that all of the above processes interact to produce the temperature regimes observed in streams and rivers and it is also known that the relative importance of each process differs among locations, there is disagreement regarding the dominant processes.

Some scientific literature indicates that in small- to intermediate-sized streams of forested regions, incoming solar radiation represents the dominant form of energy input to streams during summer. Groundwater inputs are important in small streams where they constitute a large percentage of the overall discharge, particularly during periods of the year when flows are low. As streams become larger and wider, riparian vegetation shades a progressively smaller proportion of the water surface, diminishing the effects of riparian shading and advective mixing on water temperature and increasing the importance of evaporative heat-loss.

Other scientific literature considers air temperature over the stream to be the most influential factor in stream temperature. Alteration of the riparian canopy, even well back from the stream, can open air flow and change the microclimate over the stream. Increasing airflow, particularly in areas with high summer air temperatures, can increase heat exchange with the stream and thereby elevate water temperatures. Thus, even where direct shade is retained over streams, alteration of riparian stands and adjacent upland areas may result in increased stream warming due to changes in the microclimate over the stream.

Riparian vegetation modifies convective and evaporative heat-exchange losses by creating a microclimate of relatively high humidity, moderate temperatures, and low wind speed compared with surrounding uplands. These microclimate conditions tend to reduce both convective and evaporative energy exchange by minimizing temperature and vapor-pressure gradients.

Potential or actual types of NPS instream heat loading are listed below:

- Alteration of the riparian and upland canopy and removal of streambank vegetation
- Filling and drying of wetlands
- Interception and rerouting of groundwater inputs
- Withdrawal of water (for agricultural irrigation, for example)
- Release of water from the upper warmer layer of reservoirs and man-made ponds
- Reduction of groundwater recharge (via paving land and building homes/structures, and then directing the stormwater runoff directly to a nearby surface water body in the wet season, for example), which then could reduce, or even eliminate, the flow from one or more springs that had been fed by the infiltrating stormwater and replenishing surface waters during the dry season

Although scientific studies indicate that water temperature is affected by a variety of processes, the DEQ's analysis of temperature sources in the TMDL contains a simplified assessment of non-point temperature sources. The TMDL states that elevated summertime stream temperatures attributed to non-point sources result from increased solar radiation heat loading. The TMDL attributes NPS temperature increases to the disturbance/removal of near stream vegetation that has reduced levels of stream shading and exposed streams to higher levels of solar radiation (i.e., reduction in stream surface shading via decreased riparian vegetation height, width, and/or density increases the amount of solar radiation reaching the stream surface). As a result, management strategies to address elevated water temperature in this IP are focused on increasing the percent effective shade in the watershed and other reasonable steps to reduce elevated stream temperatures.

It will take many years for enough new trees to be planted and many more decades for those trees to grow to full height to develop effective riparian shading where it is lacking. Even if every degraded riparian area were to be planted with native trees within 10 years, which is exceedingly unlikely, it would take at least 60 more years for the trees in all of these areas to reach sufficient size to yield system potential shade conditions. System potential shade conditions cannot be attained within 100 percent of the riparian area on non-Oregon Department of Agriculture (ODA)/Oregon Department of Forestry privately owned lands due to private property rights, historical land use decisions, and other factors. It is expected that the eventual attainment of improved riparian area condition will be the product of a series of partnerships between Clackamas County, Clackamas WES, the Cities of Happy Valley and Rivergrove, the State of Oregon, and partners such as citizens, non-profit organizations (the watershed councils, Friends of Trees, etc.), the for-profit companies that own land in the watershed, and the Clackamas County Soil and Water Conservation District.

CWR are areas within rivers and creeks that maintain cooler temperatures in summer when water temperature elsewhere in the river increases. These areas are regulated by the 2006 Willamette temperature TMDL in the lower mainstream Willamette River. CWR offer migrating salmonids and other native fish and aquatic species relief from the warmer river temperatures. Alteration to river channel and riparian structure, including removal or lack of large woody debris and modifications to deep pools and overhanging bank areas, can diminish the size and/or quality of the CWR. Reductions in stormwater infiltration and groundwater inputs, and the resulting reduction in discharges from springs that feed tributary streams, can also diminish the size and/or quality of the CWR.

5.5 Total Phosphorus (pH and Chlorophyll A) (Tualatin River Watershed only)

Phosphorus enters the waters of the Tualatin River and tributaries in various ways. At this time, Clackamas County, Clackamas WES, and the City of Rivergrove are not aware of any specific known excessive sources of phosphorus in the Tualatin River watershed, although general (i.e., non-specific) sources are listed below:

- Stormwater runoff from agricultural, forested, and rural residential lands (e.g., soil erosion from new development and redevelopment).
- Illegal dumping of some types of solid waste.
- Illicit discharges of some types of wastewaters, such as sewage from a failed septic system.
- Groundwater, that feeds the Tualatin River and creeks through springs, is known to contain a significant concentration of total phosphorus.

Until summer 2008, excessive phytoplankton growth (i.e., algal blooms) had not been observed in the Tualatin River during the summer and autumn seasons for many years. Scientific review of the very substantial bloom in summer 2008 indicated that phosphorus-rich waters pumped into the Tualatin River from Wapato Lake's bed near Gaston in Washington County was the primary factor. During a bloom, algae become much more abundant due to a variety of factors. One factor that contributes to algal blooms is the presence of phosphorus-containing molecules (including phosphate) in the water column where algae are present. Algal blooms are aesthetically unpleasant; they also can result in elevated pH levels and very low levels of DO.

Naturally occurring (i.e., background) levels of phosphorus in the waters of the Tualatin River Watershed are known to be relatively high due to the large amount of phosphorus-rich groundwater that enters the river and tributaries from springs. According to Tables 42 and 48 in the 2001 TMDL document's total phosphorus section (as referenced in the 2012 TMDL), the estimated background levels of phosphorus in the watershed are identical to the LAs that were granted by the DEQ to NPSs (e.g., stormwater running off of a field into the creek), so there is no allowance in the TMDL for additional discharge of phosphorus beyond background levels.

It is expected to take longer to attain the LAs in areas where a large share of the instream total phosphorus loading enters the stream in phosphorus-rich spring water. The total phosphorus LA will be exceedingly difficult and expensive to attain during the TMDL season if large amounts of phosphorus-rich groundwater continue to enter the Tualatin River and tributaries. This difficulty is due, in part, to the small amount of rain that typically falls during these months.

5.6 DDT and Dieldrin (Johnson Creek of the Willamette River Watershed)

DDT and dieldrin are organochlorine insecticides that were banned in the 20th century. Historically, DDT and dieldrin were both used extensively. Examples of typical usage included killing mosquitoes in urban areas and killing insects in farmed lands. Both compounds are long-lived in soils and can be toxic to animals. They are also highly hydrophobic, which means they tend to bind to soil particles and the fatty tissues of animals and do not readily dissolve in water. Due to the extensive past use and the long-lived nature of these compounds, these materials are ubiquitous in the environment and have been detected in virtually all media (e.g., water, soil, and animal tissue).

The use of dieldrin in the United States was restricted in 1970, and all uses of products containing dieldrin were banned in 1983. In addition to being an insecticide, dieldrin is also a long-lived oxidation breakdown product of aldrin, another organochlorine pesticide. Aldrin is known to quickly break down—

typically within a matter of days—into dieldrin in an animal's body or in the environment. Thus, the concentration of dieldrin in the environment is often a cumulative result of the historical use of both aldrin and dieldrin. Dieldrin is very stable in the environment and, unfortunately, does not easily break down into harmless by-products. Since dieldrin and aldrin are no longer being used, the transport of dieldrin to surface water bodies is believed to be due, in large part, to stormwater runoff. It is believed that dieldrin is also dispersed in the environment by wind and volatilization. In upland areas, these molecules preferentially bind to soil.

DDT was banned from use in the United States in 1972. Over time, DDT breaks down to form the metabolites DDE and DDD, which are also associated with toxicological effects in animals. Transport of these molecules (DDD, DDT, and DDE) to surface water bodies is believed to be due, in part, to stormwater runoff. They can also be dispersed in the environment by wind and volatilization. In upland areas, these molecules preferentially bind to soil. In water, they tend to bind to sediment, volatilize, photodegrade, or be taken up into the food chain.

Several studies have been conducted in the Johnson Creek watershed by the United States Geological Survey and by the Inter-Jurisdictional Committee for Johnson Creek; WES is an Inter-Jurisdictional Committee member. These studies have resulted in the following estimations:

- The bulk of the loading of DDT (and breakdown products) and dieldrin was already in the creek at the point where it entered Gresham's city limits. The watershed above this point is rural, dominated by agricultural and rural residential land uses. Much of the time, the concentration of these insecticides in the creek's water is actually diluted as it flows through the urban portion of the watershed.
- DDT (and breakdown products) can be discharged into Johnson Creek from publicly owned, MS4-permitted storm sewer systems in the urban area, although in many instances, DDT cannot be detected, or if present, the concentration is so low that the instream water quality standard isn't exceeded.
- Dieldrin can be discharged into Johnson Creek from publicly owned, MS4-permitted storm sewer systems in the urban area, although in nearly all instances, dieldrin is either undetectable or is only present at low levels that do not exceed the instream water quality standard.

At this time, Clackamas County, Clackamas WES, and the City of Happy Valley are not aware of any specific known sources of DDT and dieldrin in the Johnson Creek watershed, although suspected or general (i.e., non-specific) sources include stormwater runoff from agricultural, forest, and rural residential lands if this runoff includes any eroded soil. Prevention and control of erosion is believed to be the most effective strategy for reducing these discharges.

5.7 DDT, Dieldrin, and Iron (only the Pudding River in the Molalla-Pudding River Watershed)

Iron is a naturally occurring substance and particularly prevalent in soils deriving from eroded volcanic rocks. Iron enters surface water bodies primarily through stormwater runoff and eroding stream banks. Although a naturally occurring material, iron concentrations in groundwater and surface water, stream flow, and precipitation may be contributed in unnatural concentrations through runoff and erosion (DEQ, 2008). At this time, Clackamas County is not aware of any specific known sources of iron in the Molalla-Pudding sub-basin, although suspected or general (i.e., non-specific) sources are listed below:

- Stormwater runoff from agricultural, forest, and rural residential lands
- Soil erosion from new development and redevelopment

For dieldrin, please see Section 5.6 above. At this time, Clackamas County is not aware of any specific known sources of dieldrin anywhere in the Molalla-Pudding River watershed, although suspected or general (i.e., non-specific) sources include stormwater runoff from agricultural, forest, and rural residential lands if this runoff includes any eroded soil.

6. TMDL Implementation Responsibilities

Responsibility for implementing NPS pollution control programs in response to these TMDLs has been assigned by the DEQ to several DMAs, including the four Co-Owners of this IP: the Cities of Happy Valley and Rivergrove, Clackamas WES (i.e., SWMACC and CCSD #1), and Clackamas County.

6.1 City of Happy Valley

The City of Happy Valley has held a DEQ-issued MS4 Permit since 1995. As a TMDL DMA, the City of Happy Valley provides many services that can be regulated by this IP, including erosion control permitting for construction sites, parks, and land use planning. Because Happy Valley holds an MS4 permit, some other services that the city provides, such as road maintenance, are regulated by the MS4 permit. Because any city-owned road is defined by the MS4 Permit as being part of the MS4, there cannot be any NPS stormwater pollution from the roadways.

6.2 City of Rivergrove

The City of Rivergrove has held a DEQ-issued MS4 Permit since 1995. As a TMDL DMA, the City of Rivergrove provides only a few services, such as land use planning, that are regulated by this IP. Some of the other relevant services, such as erosion control permitting for construction sites, are provided by Clackamas WES. And the remaining services, such as road maintenance, are provided by Clackamas County. Given that the City of Rivergrove holds an MS4 Permit, there are, by definition, few types of NPSs of water pollution here.

6.3 Clackamas County

Clackamas County has held a DEQ-issued MS4 Permit since 1995. But the County's MS4-permitted geographic area is small compared to the large, mostly rural unincorporated area in the county that is regulated by the TMDLs. As an NPS TMDL DMA, Clackamas County has many programs and departments that are, or could be, involved in implementing portions of this IP:

DTD

- Land use planning
- Transportation maintenance and engineering
- Code compliance
- Solid waste management and recycling

Business and Community Services

- Economic development
- Clackamas County's parks, such as Barton Park (note that the thousands of acres of county-owned forest land are NOT addressed in this IP; any NPS water pollution on these lands is regulated by Oregon's Department of Forestry)

- Property Resources, which manage “surplus” lands (for example, they manage several pieces of submerged and riparian area lands which extend for at least a mile of the length of the Tualatin River in the SWMACC)
- Dump Stoppers illegal solid waste dumping program

Clackamas WES

- Clackamas WES is a department of Clackamas County that administers three Clackamas County service districts, including the two districts which comprise WES’ SWM service area.

Clackamas County’s Facilities Management Department

- This department operates and maintains many county-owned buildings and some county-owned lands as well.

North Clackamas Parks & Recreation District

- The North Clackamas Parks & Recreation District (NCPRD) is a Department of Clackamas County. It is also a Clackamas County service district, which provides parks and recreation services in the Willamette River’s watershed.

6.4 Clackamas WES’ SWM Service Area

Clackamas WES’ SWM service area, which is composed of SWMACC and CCSD #1, two Clackamas County service districts, is the fourth DMA.

6.5 Implementation Plan Exclusions

This IP only addresses NPSs of water pollution.

Discharges from and into surface-discharging storm sewer systems that are regulated by the MS4 Permit are not addressed by this IP.

Stormwater runoff directed to 1) subsurface discharge through shallow injection systems, such as drywells, and 2) infiltration systems are not addressed by this IP.

Lands subject to Oregon Department of Forestry and ODA’s jurisdiction are not addressed by this IP.

This IP does not address runoff from lands owned by the state (including state highways and their storm sewer systems) or the federal government. See Chapters 1 and 2 for previous discussion on jurisdictional authority and responsibility coverage.

6.6 Areas where this Implementation Plan Applies

This IP addresses stormwater runoff-related TMDL pollutants that are discharged by these three types of stormwater drainage systems:

- Clackamas County, Happy Valley, Rivergrove, and Clackamas WES-owned/maintained surface-discharging storm sewer systems that are not subject to the MS4 Permit requirements. (See the areas outside the MS4 Permit boundaries in Figures 2 and 3). These storm sewer systems, which are defined as NPSs of pollution, are typically ditches that serve Clackamas County-maintained/owned roads in rural areas. Note that Clackamas County’s, Clackamas WES’, and the City of Happy Valley and Rivergrove’s authority to control sources of pollution from storm sewer systems that they own is limited, especially when these systems are in rural areas, but reasonable efforts will continue to be made to control and reduce their discharge of TMDL pollutants.

- Privately-owned storm sewer system outfalls if they do not drain agricultural and timber management areas. These outfalls, unless they are permitted by an NPDES permit such as a 1200Z, are NPSs of pollution. Note that Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove often have no authority whatsoever to control sources of pollution from storm sewer systems that they do not own if these systems discharge directly to waters of the State of Oregon, but reasonable efforts will continue to be made to control and reduce their discharge of TMDL pollutants.
- Overland sheet flow of stormwater that does not flow through any type of storm sewer system. These are also defined as NPSs of pollution and are found on lands with every type of land use. These flows, which are not found in agricultural and timber management areas, are addressed in this IP. Note that Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove typically have no authority whatsoever to control pollution in these types of flows on private property, but reasonable efforts will continue to be made to control and reduce their discharge of TMDL pollutants.

If Clackamas County, Clackamas WES, and/or the Cities of Happy Valley or Rivergrove are aware of a discharge that does not flow through a storm sewer system that they own, which is a significant known or suspected source of TMDL pollution, the matter will be referred to the DEQ if public education and/or technical assistance fail to yield the necessary water quality improvement.

Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove cannot and do not accept sole responsibility for reducing TMDL pollutant loads in any river or tributary in order to attain any TMDL LA. All of the sources of a TMDL pollutant need to do their part to solve the problem if the LA will ever be attained.

Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove do accept some of the responsibility for reducing the following fractions of the TMDL pollutant loading:

- The amount that originates on those private lands that they have the authority to regulate
- The amount that is generated by the specific land uses or activities that they have the authority to regulate
- The amount that originates on land they own

This IP also addresses riparian areas on lands owned by Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove. One exception is the acres of timberland that Clackamas County owns; NPS water pollution on these lands is regulated by Oregon Department of Forestry and is not addressed in this IP. Finally, this IP addresses riparian areas on privately owned land that are not in an agricultural or timber management area, and reasonable effort will be made by the public education program to try to persuade these private property owners to protect and enhance their riparian areas. Refer to Management Strategies 7.4 and 7.11 for more information about this IP's role in managing riparian areas on privately owned lands.

7. Management Strategies

A variety of management strategies are employed by Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove to improve and protect water quality and overall watershed health. This portion of the IP complies with OAR 340-042-0080(4)(a)(A) and (B), which state, *“The implementation plan must...Identify the management strategies the DMA or other responsible person will use to achieve load allocations and reduce pollutant loading”* and *“(B) Provide a timeline for implementing management strategies and a schedule for completing measurable milestones.”*

The management strategies that are implemented or planned for implementation to address NPSs of TMDL parameters in the area covered by this plan are listed below:

- 7.1 Stormwater Regulations for New/Redevelopment and for Capital Improvement Projects (CIPs)
- 7.2 Operation and Maintenance for Publicly Owned Storm Sewer Systems
- 7.3 Regulated Private Storm Sewer System Inspection and Maintenance Program
- 7.4 Riparian Area Shade: Other Development-Related Regulations
- 7.5 Erosion Prevention and Sediment Control
- 7.6 Public Education
- 7.7 Septic System Management
- 7.8 Illegal Dumping Management
- 7.9 Respond to Reports of Impaired Stormwater Quality
- 7.10 Illicit Discharge, Detection, and Elimination Program, which includes Spill Response
- 7.11 Riparian Area Assessment and Management
- 7.12 Cold Water Refugia Assessment and Management

These management strategies are described in detail in the sections below. A summary of these management strategies and associated pollutants addressed and milestones is provided in Table 6 at the end of this section.

7.1 Stormwater Regulations for New/Redevelopment and for Capital Improvement Projects

Stormwater policies, regulations, and administrative procedures are essential for implementing the TMDL. This portion of the IP describes the planning procedures for developing, implementing, and enforcing controls to reduce the discharge of TMDL parameters from storm sewers that collect stormwater runoff from lands that have been significantly developed or redeveloped.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Total phosphorus and DO in the Tualatin River watershed
- ✓ Mercury
- ✓ DDT and dieldrin in the Johnson Creek watershed
- ✓ Dieldrin and iron in the Pudding River watershed

Description of the potential sources: After construction has been completed on a property, the storm sewer system and landscaping-related planning procedures and regulations that are followed during site design and construction can influence the amount of non-point sediment-bound and other pollutants that are washed from the property into the nearest surface water body over the lifetime of the property's improvements.

Description of the management strategy: This management strategy refers to the planning procedures for developing, implementing, and enforcing controls to reduce the discharge of TMDL parameters from storm sewers that collect runoff from areas that experience land development or

redevelopment. Specific strategies are described below. These post-construction controls are applied to the following:

- Development on private property
 - CIPs, including road and building construction projects, that are funded by the Co-Owners of this IP
- Erosion control permitting for construction site runoff is addressed in Section 7.5.

Geographic area where this management strategy is implemented

- **Properties within the 1) WES SWM Service Area, 2) Rural Portion of the City of Happy Valley, and 3) CCSD #1's Boring, Hoodland, and Fischer's Forest Park Subunits**

Within the WES SWM service area and these three CCSD #1 subunits, new/redevelopment construction projects are expected to infiltrate (if possible), treat, and detain stormwater runoff generated. Unless a waiver is granted, significant new/redevelopment is required to infiltrate most of the runoff that is generated in any given year (the requirement is to infiltrate 100 percent of the first 0.5 inch of rain in every 24-hour period). This requirement reduces potential pollutant loads, limits the increase in runoff volume that is created by development, and provides groundwater recharge. Full credit towards satisfying the infiltration requirement is routinely granted by WES for projects that use shallow below surface injection, such as through drywells, instead of surface infiltration. Reducing stormwater runoff volumes appears to be among the most effective techniques to reduce in-stream loading of TMDL parameters, such as *E. coli*, from upland areas.

WES' stormwater treatment requirements also apply unless a waiver is granted. Most stormwater treatment technologies that are generally designed to reduce TSS are also expected to reduce discharges of some other pollutants, such as mercury and phosphorus. Many treatment technologies also reduce the loading of *E. coli* through filtration and/or infiltration provided by many rain gardens, bioswales, and pervious pavement.

Properties in the rural portion of the City of Happy Valley that receive rural-style development (these properties do not have public sanitary sewer service) are authorized by the City of Happy Valley. The City of Happy Valley has adopted WES' stormwater standards for use in the rural area outside WES' service district. Where soils in Happy Valley tend to have low or no infiltration, rain gardens and bioswales, which provide filtration that reduces pollutants, are typically used.

Much of the WES SWM service area, plus the rural portion of Happy Valley, fall within the MS4 Permit's geographic coverage area. Happy Valley and Clackamas WES apply their stormwater management controls on all real estate development sites in their service areas whether or not they discharge to their MS4. For detailed information about management strategy 7.1, please see the MS4 Permit Stormwater Management Program document for more information about these controls. The current Stormwater Management Program document was approved by the DEQ in February 2023. Finally, for the three CCSD #1 subunits, although they are not in the WES SWM service area, WES also implements management strategy 7.1 in these areas.

Other properties NOT within these areas

- **The Oak Lodge Water Services District.** For NPS stormwater runoff generated by real estate development in the Oak Lodge Water Services District see the Oak Lodge Water Services District's TMDL IP.

- **Real Estate Development in Unincorporated Rural Areas.** For development in unincorporated rural areas, Clackamas County prescribes the stormwater management requirements. In June of 2020, Clackamas County made improvements related to low impact development and onsite stormwater management requirements for areas outside of the MS4 Permit geographic area.

Per Clackamas County Roadway Standards section 420.1 (Best Management Practices and Low Impact Development Approaches), Clackamas County engineering acknowledges the need for best management practices and/or low impact development approaches (LIDAs) for land development and encourages engineers to submit LIDA designs for review to meet the water quality and infiltration requirements outlined in Clackamas WES' stormwater standards. Calculations are required to illustrate how a given LIDA provides water quality benefits. Private improvements in rural areas may work with DTD to provide a simplified approach to stormwater management that uses vegetation and infiltration if the site conditions warrant it. The City of Portland's simplified approach for infiltration testing and typical details for stormwater management may be used in the rural area.

Additionally, Clackamas County Roadway Standards section 420.2 allows for the use of acreage as a best management practice. Development outside of the MS4 permitted area is predominated by larger lot sizes. The applicant must demonstrate that water quality, detention, and/or infiltration requirements are met using the acreage best management practice if this approach is proposed. Clackamas County Roadway Standards section 420.3 (Surface Water Management Applicability) requires surface water management plans for any of the following instances:

- When 5,000 square feet or more of new or reconstructed impervious surface is proposed within the Portland metro area's UGB.
 - When 10,000 square feet or more of new or reconstructed impervious surface is proposed outside the Portland metro area's UGB.
 - When grading or any new or reconstructed impervious surface is proposed or replaced within 50 feet of a perennial stream, creek, wetland, or lake, or within 10 feet of a property line.
- **Capital Improvement Projects funded by the Co-Owners of this IP.** When a CIP, including road and building construction projects, funded by one or more of the Co-Owners of this IP, is designed, it must comply with the stormwater management requirements—infiltration (if possible), water quality treatment, and detention—of the community in which the CIP is proposed. For example, when a CIP is proposed to be constructed in the WES SWM service area, it is expected to comply with the same stormwater management requirements and riparian area setback/buffer requirements that would be applied to development on any nearby piece of private property.

Measurable milestones (if any): None.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.2 Operation and Maintenance for Publicly Owned Storm Sewer Systems

A key strategy for protecting receiving water quality from NPS pollution is thorough adequate operation and maintenance (O&M) of publicly owned stormwater infrastructure to confirm that systems are functioning properly and issues are addressed before they become problematic.

TMDL parameters addressed:

- ✓ Mercury
- ✓ Total phosphorus
- ✓ DO (i.e., SVS) in the Tualatin River watershed
- ✓ DDT and dieldrin in Johnson Creek
- ✓ Dieldrin/DDT and iron in the Pudding River Watershed

Description of the management strategy: The O&M of publicly owned storm sewer systems in this TMDL IP's geographic area reduces the amount of NPS pollution that is discharged to creeks, wetlands, and rivers from these systems. Typically, these storm sewer systems are roadside ditches along the edges of Clackamas County-maintained/owned roads in rural areas. Potential sources of pollution could be the road itself (e.g., automotive fluids dripped onto the road as the vehicle drives by), but most of the pollution is believed to be from adjacent and nearby properties, which are typically privately owned. This management strategy encourages the optimization of the water pollution removal and stormwater infiltration functions of these storm sewer systems (i.e., ditches). Examples of this strategy may include the following activities:

- Retrofitting one or more ditches through the addition of one or more rock "check dams" to trap some sediment that can be removed later and properly disposed of.
- Cleaning the few catch basins and other types of storm sewer system structures in the geographic area covered by this IP on an as-needed basis.
- Installing erosion control measures (such as a hydroseed mulch), where appropriate, after the ditch has been cleaned with a Gradall machine.

The Clackamas County DTD Transportation Maintenance Division occasionally disturbs soil in their road rights-of-way while performing routine road maintenance and repair work. The DTD adheres to the Oregon Department of Transportation's (ODOT) Routine Road Maintenance, Water Quality, and Habitat Guide, Best Management Practices, Revised June of 2020 (ODOT Guide). Proper erosion prevention and sediment control methods are addressed under several activities within the ODOT Guide, including, but not limited to, Activity #120 (Ditch Shaping and Cleaning), Activity #112 (Shoulder Rebuilding/Blading/Erosion Repair), and Activity #081 (Stockpiling). In addition, DTD has been issued a 1200-CA permit (a version of the 1200-C permit that is solely for local agencies). CIPs are performed by DTD in accordance with the requirements of the 1200-CA.

Geographic area where this management strategy is implemented: The City of Happy Valley-owned surface-discharging storm sewer systems are regulated by the MS4 Permit. Therefore, this management strategy only applies to those Clackamas County-maintained/owned surface-discharging storm sewer systems that are not regulated by the MS4 Permit. Note: If Clackamas WES owns or operates any surface-discharging storm sewer systems in the rural portion of the SWMACC subsection of the WES SWM service area, this management strategy will also apply to these systems because they are also not regulated by the MS4 Permit.

Measurable milestones:

- Consider installing one or more new rock check dams in one or more ditches. If any are installed, provide in that year's TMDL IP annual report the road mile(s) or mile point(s), as well as the road's name(s), where one or more new rock check dams were installed. An example could be, *"Clackamas County installed check dams on XX miles of road in 2023–24. They were installed in ditches along sections of ACME Street, Anvil Court, and Roadrunner Blvd."*

- Clackamas County’s Transportation Maintenance Division can perform “skip-ditching,” which is when solids and vegetation are only removed from a section of ditch, while the adjacent sections of ditch are left untouched. In the untouched sections, the vegetation and soil are left undisturbed, which provides potentially significant treatment for stormwater runoff and potentially better infiltration and/or evapotranspiration of stormwater runoff. This measurable milestone is the annual number of miles of ditches that were skip-ditched during the July 1 to June 30 TMDL IP year.
- If any section of ditch is discovered to provide a reasonably good stormwater infiltration rate, provide this information in that year’s TMDL IP annual report.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.3 Regulated Private Storm Sewer System Inspection and Maintenance Program

Inspection of privately owned storm sewer systems helps improve receiving water quality by ensuring that detention, infiltration, and water quality treatment facilities are being maintained and are functioning properly.

Geographic area where this management strategy is implemented: This management strategy, which is only provided within the WES SWM service area, is expected to reduce stormwater runoff rates, volume, and pollution by verifying that regulated privately-owned storm sewer systems are operated to maintain their pollutant removal, stormwater infiltration/retention, and flow control functions. This strategy applies to privately owned storm sewer systems with a signed WES Maintenance Agreement, which typically include those that serve multi-family residential properties, commercial and industrial properties, or institutions (religious, civic, etc.). This management strategy has been included in this TMDL IP because some of these privately owned storm sewer systems discharge directly to waters of the state, and as a result, are NPSs of pollutants.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Mercury
- ✓ Total phosphorus and DO in the Tualatin River watershed
- ✓ DDT/dieldrin in the Johnson Creek Watershed

Description of the management strategy: The maintenance agreements require operators/owners to inspect and maintain the property’s stormwater facilities and to report their activities annually to Clackamas WES.

Stormwater from commercial, industrial, residential, or institutional land uses can be NPSs of TMDL pollutants such *E. coli*, phosphorus, or mercury. Potential sources of contamination at these sites include land deposition of air pollutants, spills, fertilizer applied to landscaped areas, poor housekeeping practices, and leachate that leaks from solid waste dumpsters. The most common sources of *E. coli* at these sites may be feces deposited on impervious and landscaped surfaces from wild birds and mammals.

WES participates in the voluntary regional Storm Drain Cleaning Assistance Program (SCAP) with its partners in the Portland metro area. This program uses voluntary measures paired with an inspection

and enforcement program to verify and track maintenance of regulated private stormwater systems. This management strategy contains two elements, SCAP and inspection/enforcement, that WES may use interchangeably or in combination at its discretion.

Storm Drain Cleaning Assistance Program

WES will continue to cooperate with partners to implement the SCAP to help regulated private system operators maintain their storm sewer system catch basins. SCAP implementation will include notification, cleaning assistance, and report tracking. SCAP partner agencies will negotiate with vendors, the companies that would actually clean the catch basins, and obtain the lowest qualifying price quote for inspection and cleaning of catch basins. WES will send an annual maintenance reminder and SCAP invitation to its private facility maintenance agreement holders and other commercial and industrial facilities that operate regulated storm sewer systems. This reminder/invitation may or may not include the name of the selected vendor and its quoted price per catch basin cleaned. The reminder/invitation may list the types of storm sewer system structures on the property that are not included in the SCAP offer, such as ponds, swales, and low impact development features, such as a vegetated stormwater infiltration box, that must also be maintained.

Property owners who respond to WES' reminder/invitation will be referred to the vendor. The vendor will inspect and clean structures and report the number of facilities visited, number, and type of structures maintained, and the volume of material removed.

Inspection and Enforcement

WES implements an inspection and enforcement program to verify O&M of regulated privately owned storm sewer systems. WES' Watershed Protection group inspects regulated private storm sewer systems at selected sites. Inspectors evaluate the maintenance condition of each site's storm sewer system. If a regulated private storm sewer system fails an inspection, WES follows an escalating enforcement strategy that begins with education and technical assistance.

Measurable milestone: Implement the SCAP program each year and provide the following information in annual TMDL IP reports to the DEQ: 1) The number of SCAP participants and 2) the total number of catch basins/drains that were cleaned. This data to be reported to the DEQ will include all program participants in the entire WES SWM service area, and all catch basins/drains that were cleaned, including those basins/drains that are NPSs of pollutants.

Fiscal analysis: WES has budgeted the funds necessary to implement this program in the WES SWM service area.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.4 Riparian Area Shade: Other Development-Related Regulations

Riparian vegetation provides shading and can reduce river/stream warming from direct sunlight, in addition to providing a myriad of water quality improvement and bank stabilization benefits. Protection and restoration of riparian areas can be encouraged and enforced through real estate development-related regulations. Reduction of the riparian canopy can also change the microclimate near streams, increasing air flow and heat exchange with the stream and thereby further elevating water temperatures.

TMDL parameters addressed:

- ✓ Temperature
- ✓ Mercury (because stream bank stabilization provided by this management strategy reduces stream channel erosion)
- ✓ DO in the Tualatin River watershed (because cooler stream water can hold more DO)

Description of the management strategy: Protection and restoration of system potential vegetation and effective shade in riparian areas is one of the primary mechanisms for achieving LAs for temperature. These watershed protection regulations that protect streamside vegetation are implemented by Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove.

Many lands that include at least some riparian areas are subject to the following “riparian area buffer regulations” when these lands are developed or redeveloped in a significant manner under Clackamas County’s, Clackamas WES’, and the City of Happy Valley’s and Rivergrove’s building permitting process:

- **Metro Title 3, Clackamas County.** Clackamas County’s Planning Department administers WES’ equivalent of Metro Title 3 regulations in the WES SWM service area through an agreement with WES. Clackamas County’s Planning Department administers these regulations in the other unincorporated areas within the Portland metro area’s UGB and metro service district boundary in Clackamas County, such as the Oak Lodge Water Services District. New and redevelopment that is regulated by Clackamas County near wetlands, springs, natural ponds, creeks, and rivers generally provides a largely undisturbed buffer area varying in width from 25 feet up to as much as 200 feet in certain cases. Buffer areas apply on each side of the creek or river. Wetland setback areas are fixed at 50 feet from the delineated wetland boundary. Creek buffer area width depends on several factors, including topography, whether the stream is perennial or intermittent, and how much contributing drainage acreage in the watershed is upstream of the proposed development.
- **Happy Valley and Rivergrove.** The cities of Happy Valley and Rivergrove have their own equivalent of Metro Title 3 regulations that they apply within the city limits.
- **Zoning and Development Ordinance 709, Clackamas County.** Clackamas County’s Zoning and Development Ordinance (ZDO) 709 applies in unincorporated, urban areas. The provisions regulate disturbances and specify setback distances for wetlands and riparian areas (also known as Water Quality Resource Areas). Disturbances and setbacks to these areas are reviewed in accordance with applicable provisions of the ZDO and are dependent upon several factors that are determined on a case-by-case basis. ZDO 709 is administered by Clackamas County’s DTD. Wetlands are included in this IP because many wetlands discharge their waters directly to creeks and rivers.
- **Metro Title 13 (Goal 5), Clackamas County.** Clackamas County’s ZDO 706 is the county’s version of the Metro Title 13 (Goal 5) model ordinance and associated maps and plans. It was adopted in January 2009. The purpose of Title 13 is to (1) conserve, protect, and restore a continuous ecologically viable streamside corridor system, from the streams’ headwaters to their confluence with other streams and rivers and with their floodplains in a manner that is integrated with upland wildlife habitat and with the surrounding urban landscape and (2) to control and prevent water pollution for the protection of the public health and safety and to maintain and improve water quality throughout the region.

Metro has mapped the areas deemed to be regionally significant and has further designated as Habitat Conservation Areas (HCAs) those areas requiring protection. HCAs shall be protected, maintained, enhanced, and restored as specified in the Metro Code Section 3.07.1340, and city and county development codes shall include provisions for enforcement of these performance standards

and best management practices. Discretionary development approval standards are designed to first avoid HCAs, next to minimize impacts on HCAs and water quality, and finally to mitigate the impacts to these areas.

- **Willamette River Greenway, ZDO 705, Clackamas County.** The Willamette River Design Plan, described in the Clackamas County Comprehensive Plan, provides policy for reducing pollutants and protecting water quality outside of the WES SWM service area. Those policies are codified through Section 705 of the ZDO. The purpose statement of Section 705 (Willamette River Greenway) includes, in part, “to maintain the integrity of the Willamette River by minimizing erosion, promoting bank stability and maintaining and enhancing the water quality and fish and wildlife habitats.” All intensification or change in use, or “development” requires a Greenway Conditional Use permit. Conditions of such a permit include minimum setbacks of 100–150 feet (depending on slope, soils, density of existing vegetation, etc.), along with provision for/enhancement of a vegetative buffer of the same width. In addition, private noncommercial docks and moorages in the limited use rural portions of the Willamette River Greenway are prohibited.
- **River and Stream Conservation Area, ZDO 704, Clackamas County.** This ordinance applies to all unincorporated private lands in Clackamas County that are outside the Portland metro area UGB, outside the Metro Service District boundary, and outside the Willamette River Greenway. It is administered by DTD pursuant to the applicable provisions of the ZDO. New and redevelopment that is regulated by Clackamas County that occurs on land lots that are on or near rivers and qualifying creeks must provide a largely undisturbed setback area varying in width from 50 feet to 100 feet (ZDO 704.07 requires that no less than 75 percent of the setback’s area be preserved with native vegetation). For a river’s riparian area, a setback area wider than 100 feet can be required in certain circumstances. The setback distance for creeks is based on whether a creek has been determined to be small (50 feet), medium (70 feet), or large (100 feet). Smaller (non-fish-bearing) streams and all wetlands are unprotected by ZDO 704’s provisions. All riparian areas around creeks and rivers that are eligible for protection under ZDO 704 are on Water Protection Rule Classification maps that were compiled pursuant to OAR 629-635-000.
- **Floodplain Management District, ZDO 703, Clackamas County.** This ordinance, administered by Clackamas County DTD, applies on all lands within the Special Flood Hazard Area. This ZDO section may in some instances limit the scope of development within the floodplain. This ZDO section tends to direct development away from areas that are directly adjacent to a creek or river’s low and high flow channels, making it more likely that native vegetation will be allowed to provide shade to the water body.
- **River and Stream Corridors, ZDO Subsection 1002.05, Clackamas County.** This ordinance applies within rural Clackamas County but only where River and Stream Conservation Areas subject to 704 do not apply, and only for certain developments such as subdivisions, partitions, etc.
- **Significant Natural Areas, ZDO Subsection 1002.8, Clackamas County.** This regulation protects only four key water resources (Williams Lake Bog, the Land at Marmot, Multorpor Bog, and Wilhoit Springs) that are designated as Scenic and Distinctive Resources.
- **Standards for Flood Hazard Areas, ZDO Subsection 1003.03.** This regulation augments ZDO Section 703 during the development process by limiting clearing, vegetation removal, construction of roads and structures, etc. within all areas of the floodplain to be sited in a manner that minimizes alteration of terrain and other natural features.
- **Riparian Area Protection Regulation Administered by the City of Happy Valley.**
 - **Natural Resources Overlay Zone.** This zone implements natural resource, open space, and environmental goals/policies within the Happy Valley Comprehensive Plan and provides compliance with portions of Statewide Planning Goals 5 and 6 as well as Titles 3 and 13 of

Metro's Urban Growth Management Functional Plan. The Natural Resources Overlay Zone protects and improves the natural resource functions and values by discouraging most development near intermittent/perennial creeks, rivers, streams, wetlands, natural lakes, springs, or other significant features. Applicants identify the location of protected features, vegetated corridors surrounding the features, and HCAs before applying environmental protections, including mitigation, when most development occurs. Unless exempt, applications are subject to a public land use review process to assure compliance as well as provide awareness.

- **Riparian Area Protection Regulations Administered by the City of Rivergrove.** The Tualatin River borders the City of Rivergrove to the south. Some lands in the City of Rivergrove contain wetland areas or are within the floodway or floodplain. All of these lands are managed by Flood Ordinance #70-2001 (www.cityofrivergrove.org under the heading ORDINANCES/ Flood Ordinance). Ordinance 70-2001 is in conformance with Metro Title 3; it applies a protected water quality resource area overlay zone along protected water features, as defined in the ordinance, including wetlands, streams, springs, and the river. In the instance when a property is being divided and contains a water quality resource area, the code stipulates that this property should be in a separate tract.

Measurable milestone: Continue to implement the applicable riparian area protection regulations (see above) when properties are permitted to develop by Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove. Were these applicable regulations implemented? In each TMDL IP annual report, a simple "Yes" or "No" answer will be provided for each of the Co-Owners of this IP.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.5 Erosion Prevention and Sediment Control

Temporary and permanent erosion and sediment control at construction sites can help reduce pollutant-laden stormwater from entering receiving waters.

TMDL parameters addressed:

- ✓ Total phosphorus
- ✓ DO (i.e., SVS) in the Tualatin River watershed
- ✓ Mercury
- ✓ DDT/dieldrin in Johnson Creek
- ✓ Dieldrin/DDT and iron in the Pudding River watershed

Description of the management strategy: Erosion control is addressed through the issuance of erosion control permits for construction sites undergoing significant development or redevelopment. These permits require measures, such as catch basin silt sacks, to reduce the amount of soil leaving the site and subsequent mercury, TSS, and/or SVS, DDT, etc. in stormwater washing from the property. By reducing TSS in stormwater, it is presumed that the concentration in stormwater of TMDL parameters adhered to soil (such as DDT and mercury) or mixed with soil (such as organic matter with high SVS level), if present, is also reduced.

Geographic areas where this management strategy is implemented:

- **Sites within the 1) rural portion of the City of Happy Valley; 2) WES' SWM service area, including SWMACC; and 3) CCSD #1's Boring, Hoodland, and Fischer's Forest Park subunits:** Because many of these areas are within the MS4 Permit's geographic coverage area, Happy Valley and Clackamas WES issue and administer erosion prevention and sediment control (EPSC) Permits for real estate development to all qualifying construction sites whether or not they discharge to their MS4. To avoid duplication, please see the MS4 Permit Stormwater Management Program document (published in November 2022 and approved by the DEQ on February 6, 2023). For the CCSD #1 subunits, WES provides the same EPSC Permit program that WES provides in the MS4 Permit area.
- **Sites not within the rural portion of the City of Happy Valley; the WES SWM service area; and CCSD #1's Boring, Hoodland, and Fischer's Forest Park subunits:** For the construction sites in this geographic area, a comprehensive and Clackamas County-wide erosion control permitting, inspection, and enforcement program is currently under development. It is anticipated that responsibilities related to this program will be shared among building codes and development engineering staff. A written policy is being developed, which will include erosion control permit triggers, inspection requirements, associated fees, and escalating enforcement procedures. This program is being created with the intent of complying with new Willamette River mercury TMDL requirements, as well as with the intent of facilitating improved tracking and documentation. These changes will need to be updated in the Clackamas County Code and ultimately must be approved by the Board of Clackamas County Commissioners. The erosion control permitting, inspection, and enforcement plan will apply to the following activities:
 - Construction activities, including clearing, grading, and excavation that will disturb ½ acre (21,780 sq. ft.) or more and may discharge to surface waters or conveyance systems leading to surface waters of the state.
 - Construction activities including clearing, grading, and excavation that will disturb less than ½ acre but are part of a common plan of development or sale that will ultimately disturb ½ acre or more and may discharge to surface waters or conveyance systems leading to surface waters of the state.
 - Construction activities including clearing, grading, and excavation that will disturb 500 square feet or more within 50 feet of surface waters of the state.

All development activity within Clackamas County that disturbs 1 acre or greater is required to obtain a DEQ 1200-C Construction Stormwater (Erosion Control) Permit or obtain coverage from WES under the 1200-CN Permit and, as a result, these sites will not receive an erosion control permit from DTD.

Measurable milestones: In the City of Happy Valley, Clackamas WES' SWM service area, and the CCSD #1 subunits:

- The number of active EPSC Permits in each jurisdiction during the TMDL's July 1 to June 30 year: Happy Valley and WES (the CCSD #1 subunits shall be included in WES' number).
- The number of inspections performed during each TMDL IP year in each jurisdiction: Happy Valley and WES (the CCSD #1 subunits shall be included in WES' number).
- The number of enforcement actions taken, if any, in each TMDL IP year in each jurisdiction: Happy Valley and WES (the CCSD #1 subunits shall be included in WES' number).

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: For the WES SWM service area, the CCSD #1 subunits, and Happy Valley, this management strategy is currently being fully implemented and is an ongoing activity. For

the other geographic area, this program is being developed and will be fully implemented no less than 3 years from September 3, 2022, as authorized in Table 13-15 in the Final Revised Willamette Basin Mercury TMDL and WQMP.

7.6 Public Education

Public education is a key component of reducing the community's NPS pollution. This section addresses efforts that are believed to be effective in informing the public and encouraging behavioral change to reduce pollutant loading. WES regularly provides, and expects to continue to provide in the future, riparian area enhancement and protection messaging and stormwater management messaging to the public through its extensive public involvement and education program. Educating the public about the way its practices can negatively or positively impact the health of the watershed is an important component in managing NPS water pollution.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Mercury
- ✓ Temperature
- ✓ Total phosphorus and DO in the Tualatin River watershed
- ✓ DDT and dieldrin in the Johnson Creek watershed
- ✓ DDT, dieldrin, and iron in the Pudding River watershed

Selected messages, such as those for erosion control/prevention, are also expected to be provided by Clackamas County from time to time for DDT/dieldrin in the rural portion of Johnson Creek's watershed and DDT, dieldrin, and iron in the Pudding River.

Description of the management strategy: Clackamas County DTD, Clackamas WES, and the Cities of Happy Valley and Rivergrove and provide public involvement and education to encourage citizens to work and live in ways that protect or improve water quality. Public involvement and education are relevant to many of this IP's management strategies, including, but not limited to, public education about proper care for septic systems, responding to and preventing illegal solid waste dumping, and public education about the importance of notifying the appropriate government agency when a spill occurs.

To avoid duplication, specific public education activities that are employed to reduce potential sources of TMDL pollutants are described in the MS4 Permit Stormwater Management Program document. These MS4 Permit educational messages are typically equally relevant to residents and businesses whether or not their homes and businesses discharge to the MS4 (e.g., "Please pick up your dog's poop" is relevant everywhere people reside).

Other messages that are tailored specifically for rural residents and/or businesses, such as tips for the management of horse manure, are already provided by partners such as the Clackamas County Soil and Water Conservation District, but Clackamas County may choose to also share messages that are tailored for rural residents and/or businesses. For more information about NPS water pollution messaging provided by Clackamas County in the rural area, please contact Clackamas County's Devin Patterson at DevinPat@clackamas.us.

Measurable milestones: During the TMDL IP year, was the public education program, which is required by the MS4 Permit, implemented? A yes/no answer shall be provided in each TMDL IP annual report.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.7 Septic System Management

A potential source of bacteria, mercury, SVS, and total phosphorus to surface waters is failing and failed septic systems and cesspools. A septic system or cesspool that is failing or has failed can discharge pollutants in improperly treated or untreated sewage directly into a surface water body, or the wastewater can be pushed into the surface water body by stormwater runoff, or it can pollute shallow groundwater, which can then, in some instances, enter a nearby surface water body through a spring.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Mercury
- ✓ Total phosphorus and dissolved oxygen (SVS) in the Tualatin River watershed

Description of the management strategy: Clackamas County's DTD administers the Septic and Onsite Wastewater (Onsite) Program as an agent of the DEQ throughout Clackamas County; this management strategy is administered in the entire geographic area that is addressed by this IP. The Onsite Program is for the most common and smaller types of septic systems and cesspools; the largest septic systems in Clackamas County, such as those that serve restaurants and schools, are directly regulated by the DEQ through its Wastewater Pollution Control Facility Permit Program.

The goals of Clackamas County's program are to have no septic system/cesspool failures and for all septic systems and cesspools to be in a properly functioning condition. To achieve these goals, Clackamas County implements a process to address suspected failed or failing septic systems and cesspools when they have been referred to Clackamas County. When septic systems and cesspools fail in an area where a public sanitary sewer system is not within 300 feet of the property, and if it has been reported to Clackamas County, a site visit is performed to verify that the septic system/cesspool has indeed failed, identify steps for needed correction, and establish a process for implementing corrective actions. Time frames for repair are discussed with the property owners, and the length of time allotted to repair is determined based on the severity of the problem.

If a public sanitary sewer system is within 300 feet of a property with a failed septic system or cesspool, and if this system is both legally and physically available to the property, the failed system cannot be replaced, and the dwelling and/or other structures with plumbing fixtures (such as a kitchen sink) must be connected to the public sanitary sewer system, according to the State of Oregon requirements.

Discharges from failed/failing septic systems and cesspools to the ground's surface and into waterways are not allowed, and these systems are given the shortest time that is feasible for construction of repairs and for the implementation of short-term alternatives. Alternatives vary from limiting the use of the septic system (e.g., timing of laundry) to vacating the premises until the problem is resolved.

Code Violations

Clackamas County DTD's Code Enforcement group brings violators into compliance if initial efforts to do so are unsuccessful. Initial efforts that are made encourage voluntary compliance. All failing septic systems and cesspools are an enforcement priority. Clackamas County has the ability to levy both fines and fees for code violations.

Measurable milestones:

- The number of reports of failing/failed septic systems and cesspools received by Clackamas County during the TMDL IP year.
- The number of confirmed septic systems and cesspools that failed during the TMDL IP year.
- The number of repair permits issued for septic systems and cesspools during the TMDL IP year.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.8 Illegal Dumping Management

Solid waste can be illegally dumped on public and privately owned lands, which can contribute TMDL pollutants to surface waters if not cleaned up properly in a timely manner.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Mercury
- ✓ Total phosphorus and DO in the Tualatin River watershed

Description of the management strategy: Illegal dumping of selected types of solid waste can cause TMDL pollutants to be transported via stormwater runoff into surface waters. Examples are listed below:

- *E. coli* from soiled disposable diapers
- Mercury from some fluorescent light bulbs, batteries, thermometers, and electronics
- SVS, which can cause instream DO levels to be depleted, from items such as discarded food and yard debris
- Total phosphorus in items such as discarded food, soiled diapers, and yard debris

Illegal dumping of solid waste is addressed by different programs and regulations depending on the place where the solid waste was dumped in Clackamas County.

Metro's Regional Illegal Dumping program

Illegal solid waste dump sites can be cleaned up by the regional illegal dumping program if it is dumped on public land and within the Portland metro area's UGB. The Co-Owners of this IP will continue to refer these sites to the regional illegal dumping program when they're reported or discovered, unless the public landowner chooses to clean it up without assistance.

Public Roads that Receive full Clackamas County Maintenance

Solid waste that is illegally dumped on roads that receive full Clackamas County maintenance can be reported to Clackamas County's Transportation Maintenance Division.

Dump Stoppers Program

This program is provided in forested areas in the easternmost portion of Clackamas County in the following TMDL watersheds: Molalla-Pudding, Willamette, and Sandy River. It is not available in the Tualatin River watershed. The portion of this program that is administered by Clackamas County is

housed within the Business and Community Services Department’s County Parks Program. Dump Stoppers can be contacted to clean up the refuse on federal, county, or industrial timber company-owned lands at 503-650-3333.

Illegal Solid Waste Dump Sites on other Private Properties

If the dumped solid waste is private land, cleanup is the responsibility of the landowner, although law enforcement can play a role if the person(s)/business who dumped the material can be identified. For illegal solid waste dump sites within the urban area, Clackamas County Code Enforcement Division can be contacted. That division can administer a solid waste nuisance ordinance, which pertains to illegal dumping on public and private property. This ordinance is administered on a priority-rated basis, and illegal dumping that involves household garbage is a high priority for enforcement and resolution. Mediation is an additional tool that Clackamas County Code Enforcement Division uses to resolve certain types of solid waste issues that cause a condition of unsightliness on private property.

Measurable milestones:

- The number of reports of illegal solid waste dumping received by Clackamas County Code Enforcement during the TMDL IP year.
- The number of solid waste-related enforcement actions conducted by Clackamas County Code Enforcement during the TMDL IP year.
- Estimated number of pounds of illegally dumped solid waste that was removed by the Dump Stoppers program during the TMDL IP year. If available, the number of dumping sites cleaned up will also be provided.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.9 Respond to Reports of Impaired Stormwater Quality

This management strategy applies to all properties throughout this TMDL IP’s geographic area.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Mercury
- ✓ DO and total phosphorus in the Tualatin River watershed
- ✓ DDT and dieldrin in Johnson Creek’s watershed
- ✓ Dieldrin, DDT, and iron in the Pudding River watershed

Description of the management strategy: All facilities and properties that are the subject of a stormwater quality complaint or request for service will be contacted, if possible, in a timely manner by staff from Clackamas County, Clackamas WES, or Happy Valley. The decision about whether or not to conduct a site visit will be made by staff at his/her/their discretion. Note that staff may choose to refer the complaint or request for service to a partner organization, such as the Clackamas Soil and Water Conservation District, or DEQ, for follow-up and resolution. Staff will refer the complaint or request for service to ODA if it pertains to agricultural stormwater or to Oregon’s Department of Forestry if it pertains to stormwater runoff from forested privately owned lands.

For those complaints or requests for service that pertain to construction site runoff, an erosion control inspector is likely to be the person who responds (see Management Strategy 7.5).

For properties and facilities that are in the WES SWM service area, the implementation of control measures for NPS stormwater discharges from these facilities will be deemed necessary by WES if the presence of excess levels of a TMDL pollutant can be confirmed to be present in a facility's discharge. In these instances, and when a discharger's initial attempts to improve its NPS stormwater quality do not produce the required improvement, WES personnel will continue to provide guidance and technical assistance until the facility's stormwater quality improves. If efforts by WES staff fail to achieve these goals, WES staff will contact the DEQ and request its support. The DEQ has the authority to compel most NPS stormwater dischargers to halt or modify their discharge if it contains a significant concentration of TMDL parameters and flows, or is likely to flow, directly to waters of the state.

Measurable milestone: Did the Co-Owners of this IP respond to all complaints and requests for service that pertain to allegedly impaired non-erosion control program stormwater quality? In each TMDL IP annual report, a yes/no answer shall be provided by Clackamas County DTD, Clackamas WES, and the City of Happy Valley. For this measurable milestone, a field visit or site inspection is not required to "respond" in a satisfactory manner.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.10 Illicit Discharge Detection and Elimination Program (i.e., spills)

Illicit discharges can contain one or more of several different NPS TMDL pollutants. Stopping and preventing illicit discharges is an effective strategy for protecting receiving water quality.

TMDL parameters addressed:

- ✓ *E. coli*
- ✓ Mercury
- ✓ Total phosphorus and DO in the Tualatin River watershed

Description of the management strategy: The illicit discharge of certain liquid substances, such as wastewater, containing NPS TMDL pollutants such as *E. coli* or mercury can cause watershed health impairment. Potential sources of this NPS contamination are listed below:

- *E. coli* in sewage spilled from privately owned sanitary sewer lines due to pipe failure, etc.
- Mercury can be spilled from a broken older thermometer that contained mercury.
- Total phosphorus from illicitly discharged sewage, such as from a recreational vehicle.
- SVS from illicitly discharged sewage, such as from a recreational vehicle.

Stopping the discharge and overseeing the cleanup by the responsible party, if cleanup is feasible and appropriate, and if the responsible party is known, is one of the primary functions of this program. A Co-Owner of this IP can choose to clean it up at its expense, if this is deemed appropriate, and if the responsible party is unknown. A second primary function of the program is to try to prevent illicit discharges from occurring in the future. The Illicit Discharge Detection and Elimination (IDDE) program work described here is limited to the following types of illicit discharges:

- Discharges that flow into, pass through, or move towards privately owned storm sewer outfalls
- Discharges that move by overland sheet flow on private property
- Discharges that flow into, pass through, or move towards Clackamas County-owned/maintained storm sewer systems that are not regulated by the MS4 Permit or the Water Pollution Control Facility Permit. Nearly all of the publicly owned, surface-discharging NPS storm sewer systems that are addressed by this NPS TMDL IP are those that serve Clackamas County-maintained roads in rural areas.

Geographic area where this management strategy is implemented:

Portions of this IDDE management strategy are implemented by Happy Valley, Clackamas County DTD, and WES for the following service areas:

- **Areas not within the WES SWM service area and not within the rural portion of the City of Happy Valley.** This portion of the management strategy is administered by Clackamas County DTD Transportation Maintenance Division. If materials that potentially contain harmful pollutants (such as *E. coli* or mercury) are spilled or illicitly discharged onto a transportation maintenance-maintained road right-of-way (i.e., the impacted road segment is eligible for “full county maintenance”), personnel will respond if they are notified about the incident and it is determined that a response is appropriate. They’ll ensure that the release of the material is halted, if still ongoing, and the material is subsequently cleaned up in a manner that prevents harmful substances from entering waters, if possible, or minimizes the amount of pollution that enters the nearest waterways if that is not possible. If a response by a government agency is required for a spill involving agricultural materials that contain TMDL parameters (e.g., *E. coli* from animal manure), Oregon’s Department of Agriculture may be asked to assume the lead role in responding to the report and resolving the matter. The Clackamas County Transportation Maintenance Division adheres to the ODOT Guide. Roadway spill response work is addressed in these two sections of this document: “Accident Cleanup” (Activity 149) on page 32 and “Spill Prevention and Cleanup” on page 15 of the ODOT Guide.
- **The WES SWM service area and the rural portion of the City of Happy Valley.** Most commonly, IDDE program services in this NPS geographic area are provided by Clackamas WES, but Happy Valley provides some services in some instances, such as in the rural portion of the city. Staff will make reasonable efforts during regular business hours to try to halt the release of spilled and illicitly discharged material in NPS areas and to persuade/motivate the responsible party to clean up the material. The goal is to prevent or to minimize the release of TMDL pollutants and other pollutants into waterways or into groundwater. If efforts by staff fail to halt the release of the material and the material contains TMDL pollutants that are likely to enter surface waters and/or storm sewers, staff will contact the DEQ and request its support. The DEQ has the authority to compel most dischargers to halt or modify their illicitly discharged material if it contains a significant amount of pollution and is flowing, or is likely to flow, into waters of the state.

Measurable milestone: The number of illicit discharges that were verified to have occurred during the TMDL IP year in the NPS water pollution locations in the WES SWM service area. Also, for these incidents, provide 1) the type of material spilled (e.g., sewage), 2) whether any of the material entered a creek, wetland, or river, 3) an estimated total volume spilled and the volume that entered the water body, if this occurred, IV) the name of the responsible party, if known, and 4) the location where the material was spilled.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.11 Riparian Area Assessment and Management

Riparian area assessment and management can provide shading and can reduce river/stream warming from direct sunlight, in addition to providing a myriad of water quality improvement and bank stabilization benefits. Reduction of the riparian canopy can also change the microclimate near streams, increasing air flow and heat exchange with the stream and thereby further elevating water temperatures.

TMDL parameters addressed:

- ✓ Temperature
- ✓ Mercury (because stream bank stabilization reduces stream channel erosion)
- ✓ DO in the Tualatin River watershed (because cooler stream water can hold more DO)

Description of the management strategy: Protection and restoration of riparian areas along the rivers and their tributaries in the TMDL IP's geographic area is conducted to eventually attain the load allocations for temperature. Management Strategy 7.4 (named "Riparian Area Shade: Other Development-Related Regulations) also addresses riparian area shade, but it only applies to properties that are being developed/redeveloped under a permit issued by Clackamas County or the Cities of Happy Valley and Rivergrove. This management strategy applies to all of the other privately owned and publicly owned properties with riparian areas.

Geographic area where this management strategy is implemented

- **Tualatin River Watershed: WES SWM service area.** From February 2018 to June 2023, WES maintained written contracts with the Tualatin River Watershed Council, which included a task with at least \$5,000 available per year to pay for work to plant trees and other native vegetation in privately owned riparian areas in the SWMACC portion of the WES SWM service area. During this time, riparian area planting occurred on private property along Rock Creek-South in the SW Morgan Road area (Sherwood/97140) and along Fields Creek near SW Bosky Dell Lane (West Linn/97068). In fiscal year 2022–23, Tualatin River Watershed Council has obtained a RiverHealth Stewardship Program grant for \$29,950 to continue to install native plants in riparian areas on private land. Additional riparian area planting work is expected to occur on private lands in the future.

The City of Rivergrove also owns some properties with riparian areas, and riparian area planting has occurred on some of these properties as well over the years (Tualatin River riparian area at SW 65th Avenue near Childs Road, for example). More of this work is expected to occur in the future.

- **Other Watersheds in WES' SWM service area.** Other watersheds in the WES SWM area include Kellogg-Mt. Scott Creek, Johnson Creek, and the Clackamas River. Beginning in 1993, many trees and other native plants have been planted, supported by funds from WES, in many privately owned and publicly owned riparian areas in the WES SWM service area.

Funding from WES has supported tree planting on many pieces of publicly owned land, including some lands owned by Clackamas WES, Clackamas County, and the City of Happy Valley. WES owns and maintains about a dozen natural areas, and riparian area vegetation is maintained and enhanced, which includes weed control, on those sites. WES often accomplishes this maintenance through an intergovernmental agreement with North Clackamas Parks & Recreation District. The City of Happy Valley also owns many properties with riparian areas, and riparian area planting and weed control work has occurred on most of them as well over the years (e.g., Mt. Scott Creek

riparian area in Happy Valley Park). More of this work on public lands is expected to occur in the future.

For private lands, the sum total of this work is too extensive to summarize here, but many thousands of trees have been planted at dozens of riparian area sites over the years with funding or other support from Clackamas WES. A summary of the RiverHealth Stewardship Grant program results from 2013 (program inception) to 2022 is below. Nearly all of these properties are privately owned:

# projects or sites	579
# students or volunteer participants	18,791
length of stream worked on, linear feet	229,392
acres of project area	951.25
acres invasives removed	770.76
# trees planted	30,591
# shrubs planted	112,577

Other grant deliverables through this RiverHealth Stewardship Grant include several workshops (in-person and online), presentations, plant sales, site visits, handouts, and videos. Additional riparian area planting work is expected to occur on private lands in the future.

Enforcement of Riparian Area Protection Regulations in the WES SWM Service Area, including Rural Happy Valley

When a privately owned property has a riparian area that is already permanently protected, either with a conservation easement; being in a separate tract of land or Restricted Development Area, which is dedicated to riparian area and water resource protection; or by a rule or other requirement, if WES is notified when inappropriate tree removal, land clearing, etc. has occurred or is occurring on the land, WES and/or Clackamas County will strive to promptly resolve the matter and attempt to persuade/motivate the responsible party to mitigate the damage and re-plant in the places where removal occurred. For enforcement of alleged violations of riparian area protection regulations in the City of Happy Valley, it will respond to the allegation; WES will coordinate with and provide support to the city upon request.

In many instances, signage such as the figure below has been installed along the edges of these riparian areas, which notifies the reader that the riparian area behind the sign is protected; this signage is believed to prevent most instances of inappropriate tree removal, land clearing, etc. from ever occurring on these lands.

Protect our Watershed

This area is being preserved to protect water quality and public health. Please do not disturb soil or vegetation. Building, development and vegetation management are restricted in this area.

To report a problem please call 503-742-4567

On weekends and after hours, call the Clackamas County Dispatch Center's non-emergency number at 503-655-8211

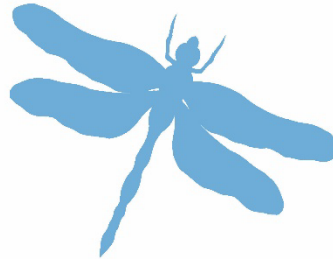


Figure 9. WES Protect Your Watershed Public Signage

Enforcement of Riparian Area Protection Regulations in Areas that are not within the WES SWM Service Area and aren't in the Rural Portion of Happy Valley

In these places, when alleged violations of riparian area protection regulations are reported to Clackamas County's Code Enforcement Division, it will respond to the allegation.

Other Lands in Clackamas County:

Clackamas County's Parks Department and the NCPD both strive to protect and enhance the riparian areas on the lands they own and operate. And from time to time, Clackamas County provides public education about the importance of protecting and enhancing the riparian areas that are on private property.

Measurable milestones:

- During the TMDL IP plan year, the number of project sites where WES provided funding when native vegetation was planted in riparian areas in the WES SWM service area.
- The number of native plants that were planted (either the total number or the number at each of the sites in Management Strategy 7.1, or both).

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

7.12 Cold Water Refugia Assessment and Management

CWR are areas within rivers that maintain cooler temperatures in late spring, summer, and early fall when water temperature elsewhere in the river is significantly warmer. For example, a CWR can be a place where a colder tributary stream enters a river. CWR offer migrating salmonids, and other native fish and aquatic species, relief from the warmer water in the other parts of the river.

TMDL parameters addressed:

- ✓ Water temperature/CWR

Description of the potential sources: The 2006 temperature TMDL includes requirements to assess and protect CWR in the Willamette River in Clackamas County. Alteration to river channel structure including removal or lack of large woody debris and modifications to deep pools and overhanging bank areas can reduce the presence of CWR or potentially eliminate it. Reductions in infiltration of stormwater from development, farming, etc. in upland areas, the resulting reduction in groundwater replenishment, and the corresponding reduction or elimination of flow from springs, are expected to increase temperatures of tributary streams, which can also reduce the quality and size of a CWR.

Description of the management strategy: Clackamas County does not own, control, or regulate the CWR in the Willamette River. And the other Co-Owners of this IP (Clackamas WES' SWM service area and the Cities of Happy Valley and Rivergrove) do not own or regulate any lands near CWR. However, this management strategy does describe work that the Co-Owners of this IP expect to have a positive influence on the enhancement and protection of these CWR.

The Willamette River from its confluence with the Columbia River upstream approximately to the City of Newberg (river mile 0 to river mile 50) has been designated as a salmon and steelhead migration corridor. The biologically based numeric temperature criteria here is 20 degrees Celsius (68 degrees Fahrenheit) and applies throughout the year. The following narrative temperature criteria for salmon/steelhead migration use also apply to this section of the Willamette River: CWR shall be *“sufficiently distributed to allow salmon and steelhead migration without significant adverse effects from higher water temperatures elsewhere in the water body.”*

According to OAR 340-041-0002, CWR are defined as those portions of the water body where, or at times during the diel temperature cycle 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. These refugia include habitats and locations where temperature-sensitive cold-water species may find refuge when ambient stream temperatures are stressful. The DEQ's 2006 Willamette Temperature TMDL includes a CWR section that states the following information:

- DMAs could or should play a role in 1) locating and protecting existing CWR and 2) improving/enhancing the function of existing CWR. In this instance, the DEQ's precise expectation for Clackamas County (a DMA) is unclear.
- CWR in the Willamette River can be created by colder water from perennial creeks that join the Willamette River. Tryon Creek is an example. Protection and enhancement of riparian areas and floodplains along these tributaries is important for maintaining and restoring CWR in the Willamette River.
- Cold water refuges in the Willamette River can also be created by hyporheic flow and groundwater inflows (aka springs) into the main channel and side channels.

The 2015 National Marine Fisheries Service Endangered Species Act Biological Opinion: On November 3, 2015, NOAA's National Marine Fisheries Service issued an Endangered Species Act Biological Opinion (BO) that addressed Oregon's water quality standards for temperature. The BO concluded that the continued existence of wild chinook salmon and steelhead in the Willamette River and many other water bodies is jeopardized. It also concluded that some of their critical habitat has been destroyed or modified. The BO says the DEQ shall develop and implement a CWR plan for the lower 50 miles of the Willamette River, which the DEQ completed in March 2020 (see below). The purpose of the CWR plan is to adequately interpret the narrative temperature criterion to allow for

implementation of the criterion through the DEQ's Clean Water Act authorities. More information about the CWR plan is listed below:

- In the CWR Plan, the DEQ characterized 1) the current spatial and temporal distribution of CWR and 2) potential locations for the restoration or enhancement of CWR.
- The DEQ assessed whether the spatial and temporal extent of CWR present meet the CWR narrative criterion (i.e., whether CWR are "sufficiently distributed to allow salmon and steelhead migration without significant adverse effects from higher water temperatures elsewhere in the water body").

In March 2020, the DEQ published a study that listed and described the known CWR in the lowest 50 miles of the Willamette River. The study identified 20 large CWR suitable for use by migrating adult salmon and steelhead (note that the confluence of the Clackamas and Willamette Rivers is the largest one). In addition, the study identified 27 other small-scale CWR suitable for rearing and migrating juvenile salmon and steelhead but likely too small to accommodate adults.

Action items in this management strategy for the Co-Owners of this IP:

- Continue to try to obtain more infiltration and shallow injection (with drywells, for example) of stormwater in upland areas to replenish the supply of groundwater. This can increase the discharge of cool water from springs, which then flow into creeks and rivers.
- Continue to try to have more trees planted in riparian areas of creeks and rivers in the Tualatin, Clackamas, Molalla-Pudding, and Willamette River watersheds. And continue to try to protect the existing riparian area trees that are in these places.
- Administrators of the Clackamas County-DTD and/or Happy Valley Floodplain Management Program may choose to assess their options for potential CWR-related changes to the administration of their programs to protect and/or enhance colder water in creeks in rivers, including the enhancement or protection of hyporheic flows.

Measurable milestones: None. See above for action items.

Fiscal analysis: This management strategy is currently funded.

Timeline for implementation: This management strategy is currently being implemented and is an ongoing activity.

Table 6. Management Strategies to Address TMDL Pollutants

Section	Management Strategy	Implementation Activities	Pollutants Addressed													Measurable Milestones	Fiscal Analysis	Timeline for Implementation	
			Tualatin River				Willamette River				Molalla-Pudding River				Sandy River				
			E. coli	Mercury	Total Phosphorus	Dissolved Oxygen	Temperature	E. coli	Mercury	DDT/Dieldrin ¹	Temperature	E. coli	Mercury	DDT/Dieldrin ²	Iron ³				Temperature
7.1	Stormwater Regulations for New/Redevelopment and for Capital Improvement Projects	<ul style="list-style-type: none"> Properties within WES SWM Service Area, rural City of Happy Valley, and three CCSD #1 subunits: required to infiltrate, treat, and detain stormwater runoff generated Other properties: Oak Lodge Water Services District's TMDL for Oak Lodge Water Service District and best management practices and LIDA for development in rural areas Capital improvement projects funded by Co-Owners of IP: comply with stormwater management requirements 	P	P	P	P		P	P	P		P	P	P	P	P	None	Currently funded	Ongoing activity
7.2	Operations and Maintenance for Publicly Owned Storm Sewer Systems	<ul style="list-style-type: none"> Retrofit ditches through the addition of rock "check dams" Clean catch basins and stormwater structures on an as-needed basis Consider installing erosion control measures in ditches 		P	P	P			P	P		P	P	P		1. Road mile(s)/mile point(s) and road name(s) of new rock check dams 2. Annual number of miles of ditches that were "skip-ditched" 3. Provide info on any ditches discovered with a reasonably good infiltration rate	Currently funded	Ongoing activity	
7.3	Regulated Private Storm Sewer System Inspection and Maintenance Program	<ul style="list-style-type: none"> Storm Drain Cleaning Assistance Program Inspection and Enforcement Program 	P	P	P	P		P	P	P		P	P		P	1. Number of SCAP participants 2. Total number of catch basins/drains cleaned	WES budgeted funds for WES SWM Service Area	Ongoing activity	
7.4	Riparian Area Shade: Other Development-Related Regulations	<ul style="list-style-type: none"> Metro Title 3—Clackamas County Zoning and Development Ordinate 709—Clackamas County Metro Title 13 (Goal 5)—Clackamas County Willamette River Greenway, ZDO 705—Clackamas County River and Stream Conservation Area, ZDO 704—Clackamas County Floodplain Management District, ZDO 703—Clackamas County River and Stream Corridors, ZDO Subsection 1002.05—Clackamas County Significant Natural Area, ZDO Subsection 1002.8—Clackamas County Standards for Flood Hazard Areas, ZDO Subsection 1003.03 Natural Resources Overlay Zone—City of Happy Valley 		P		P	P		P		P			P		Continue to implement riparian area protection regulations and report (yes/no) regarding whether regulations were implemented	Currently funded	Ongoing activity	
7.5	Erosion Prevent and Sediment Control	<ul style="list-style-type: none"> WES SWM Service Area, rural City of Happy Valley, and three CCSD #1 subunits: issue and administer EPSC Permits for real estate development Outside WES SWM Service Area, rural City of Happy Valley, and three CCSD #1 subunits: comprehensive inspection and enforcement program 		P	P	P			P	P		P	P	P		1. Number of active EPSC Permits in each jurisdiction 2. Number of inspections performed in each jurisdiction 3. Number of enforcement actions taken	Currently funded	Ongoing activity	
7.6	Public Education	<ul style="list-style-type: none"> Provide public involvement and education regarding septic systems, illegal solid waste dumping, spill clean up, etc. 	P	P	P	P	P	P	P	P	P	P		P	P	Continue to implement the Public Education Program and report (yes/no) regarding whether the program was implemented	Currently funded	Ongoing activity	
7.7	Septic System Management	<ul style="list-style-type: none"> Address suspected failed or failing septic systems and cesspools Bring violators into compliance for code violations 	P	P	P	P	P	P	P		P	P		P		1. Number of reports of failing/failed septic systems and cesspools 2. Number of confirmed failed septic systems and cesspools 3. Number of repair permits issued for septic systems and cesspools	Currently funded	Ongoing activity	
7.8	Illegal Dumping Management	<ul style="list-style-type: none"> Metro's regional illegal dumping program Public roads that receive full Clackamas County maintenance: report to Transportation Maintenance Division Dump Stoppers Program Illegal solid waste dump sites on other private properties: landowner cleanup 	P	P	P	P		P	P		P	P		P		1. Number of reports of illegal solid waste dumping 2. Number of solid waste-related enforcement actions 3. Estimated number of pounds illegally dumped that was removed	Currently funded	Ongoing activity	
7.9	Respond to Reports of Impaired Stormwater Quality	<ul style="list-style-type: none"> Contact facilities and properties subject to a stormwater quality complaint or request for service Facilities and properties in the WES SWM Service Area: implement control measures for non-point sources when deemed necessary WES staff contact the DEQ if facility and property stormwater quality does not improve 	P	P	P	P		P	P	P		P	P	P	P	Report (yes/no) if Co-Owners responded to all complaints and requests for service	Currently funded	Ongoing activity	
7.10	Illicit Discharge, Detection, and Elimination Program (Includes Spill Response)	<ul style="list-style-type: none"> Within WES SWM Service Area and rural City of Happy Valley: make reasonable efforts during regular business hours to stop the release of spilled and illicitly discharged material in non-point source areas and motivate the responsible part to clean up Outside of WES SWM Service Area and rural City of Happy Valley: Clackamas County DTD-Transportation Maintenance Division will respond to spilled or illicitly discharged material onto a Transportation Maintenance-maintained right-of-way 	P	P	P	P		P	P		P	P		P		1. Number of illicit discharges verified 2. Type of material spilled and receiving water body	Currently funded	Ongoing activity	
7.11	Riparian Area Assessment and Management	<ul style="list-style-type: none"> Tualatin River Watershed WES SWM Service Area: make funds available to plant trees and other native vegetation in privately owned riparian areas Land owned by City of Rivergrove and Clackamas County in Tualatin River Watershed: manage natural area land next to Tualatin River in City of Rivergrove and natural area land in SWMACC portion of WES SWM Service Area Other watersheds: manage native plants and trees in Kellogg-MT, Scott Creek, Johnson Creek, and Clackamas River Enforce riparian protection regulations within and outside WES SWM Service Area 		P		P	P		P		P			P		1. Number of project sites where WES provided funding for native plants in riparian areas 2. Number of native plants planted	Currently funded	Ongoing activity	
7.12	Cold Water Refugia Assessment and Management	<ul style="list-style-type: none"> Actions for Co-Owners of IP: obtain more infiltration and shallow injection of stormwater in upland areas, plant more trees in riparian areas, and assess options for CWR-related changes to programs 					P				P			P		None	Currently funded	Ongoing activity	

Notes:
¹ DDT/dieldrin only in Johnson Creek Watershed
² DDT/dieldrin only in the Pudding River
³ E. coli applies to the Cedar Creek Watershed (tributary to Sandy River)

8. TMDL Implementation

This section of the TMDL IP addresses how management strategies will be implemented and includes some potential barriers to implementation as well as timelines for implementation.

8.1 Implementation Monitoring and Evaluation Reports

According to OAR 340-042-0080(4)(a)(C), this IP shall *“Provide for performance monitoring....”* The definition of performance monitoring, as provided in OAR 340-042-0030(7) is *“...monitoring implementation of management strategies, including sector-specific and source-specific implementation plans, and resulting water quality changes.”*

Implementation monitoring will be conducted by Clackamas County, Clackamas WES, and/or the Cities of Happy Valley and Rivergrove to confirm that this IP’s management strategies were implemented as described. From time to time, when deemed appropriate, this IP will be revised to reflect enhanced understanding of the program’s effectiveness and to reflect current watershed conditions.

8.2 Barriers to Implementation

Land ownership categories that are potential NPSs of pollutants that Clackamas County, Clackamas WES, and the Cities of Happy Valley and Rivergrove have very little or no authority to regulate or control include, but are not limited to, the following areas:

- Privately owned timberlands
- Privately owned farm, ranch, and orchard lands
- Lands within the other cities in the TMDL’s geographic area, such as West Linn and Estacada
- Highways, such as I-205, and other state-owned lands

Specific barriers include, but are not limited to, the following issues:

- The bacteria LAs may be exceedingly difficult and prohibitively expensive to attain if much of the instream *E. coli* loading is from the feces of wild birds and mammals.
- The predominant NPSs of nearly all of these TMDL pollutants are privately owned lands, and the Co-Owners of this IP, as units of local government, typically have little or no authority to compel these thousands of residents and businesses to reduce their contributions of these pollutants by significant amounts. In most instances, their right to use their privately owned property as they wish outweighs and outranks the local government’s power to regulate the use of their land.

8.3 Adaptive Management Approach to Attaining Load Allocations

The Co-Owners’ goal is to attain the LAs that have been issued to them for each TMDL parameter through an adaptive management process. The Co-Owners are committed to investing in activities and programs that contribute to overall watershed health and are currently implementing and tracking the effectiveness of a variety of management strategies to improve and maintain water quality, as described in Chapter 7. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the load allocations given the barriers to implementation described above. As progress is made toward pollutant reduction, the Co-Owners will adaptively manage activities and programs in order to work toward attaining the LAs.

9. Mercury TMDL Implementation Update

In September 2006, the DEQ issued a TMDL for the entire Willamette River Basin to protect and restore the beneficial uses of the Willamette River. Chapter 14 of the 2006 TMDL includes a WQMP, which provides the framework of management strategies to attain and maintain water quality standards. Given data limitations for mercury at that time, load and waste LAs were not provided for mercury. In 2019, the DEQ issued the revised Willamette River Mercury TMDL and associated WQMP. After revising some of the load and waste LAs, USEPA approved the revised Mercury TMDL on February 4, 2021. Updated LAs for mercury are provided in Table 5 (Section 3) of this document. This Willamette River TMDL pertains to all sub-basins in the 11,500-square mile watershed, including 12 major sub-basins. The DEQ gave DMAs 18 months from TMDL issuance to submit updated TMDL IPs to address mercury requirements in the WQMP. The September 2022 TMDL IP, which was replaced by this 2023 updated TMDL IP, was prepared to address this requirement.

9.1 Management Strategies

In the revised 2021 Willamette River Mercury TMDL WQMP, the DEQ established four minimum measures for counties to control NPSs of mercury. Table 7 below references those minimum measures and includes the management strategies from Sections 7.1 through 7.12 that the Co-Owners of this IP are implementing to address the measure.

Table 7. Minimum Mercury Requirements for Counties		
Stormwater Measure	Requirements	Measures Implemented and Described
Pollution Prevention and Good Housekeeping for County Operations	Counties must properly operate and maintain lands, properties, and facilities using prudent pollution prevention and good housekeeping measures and through appropriate staff training reduce the discharge of mercury-related pollutants to waterbodies. Counties must maintain records for meeting these requirements and include a descriptive summary of their activities in the TMDL annual report.	O&M for Publicly Owned Storm Sewer Systems (7.2)
Public Education and Outreach	Counties must conduct public education and outreach to reduce mercury and mercury-related pollutants, such as sediment, on county lands and properties, as applicable. Such activities should include outreach to property owners adjacent to county roads and ditches. In addition, public outreach must include efforts to encourage and facilitate reporting of sediment related issues or concerns from the public. Public outreach should be tailored to meet the needs and diversity of the county population (e.g., signs, social media, website presence, etc.). Counties must track implementation of the public education and outreach requirements and describe all activities in the TMDL annual report.	Public Education (7.6)
Enforcement of Prohibited Pollutants	Counties must reduce conveyance of mercury and mercury-related pollutants to waterbodies from county lands and properties and have the capability of enforcing on other entities that contribute mercury-related pollutants, such as sediment, to county property and assets. The DEQ recognizes that county ordinances already in place or that must be adopted will likely be more comprehensive and prohibit discharges of other pollutants, rather than only those pollutants associated with mercury. The program must also maintain a procedure or system to document all complaints or reports of mercury and mercury-related pollutant discharges to county lands and properties and to water bodies from county lands and properties. In each TMDL annual report, counties must track implementation of their enforcement program and describe all activities	Illegal Dumping Management. (7.8) Respond to Reports of Impaired Stormwater Quality (7.9) Illicit Discharge Detection and Elimination Program (7.10)
Construction Site Runoff Control	To minimize mercury and control potential sediment runoff from construction sites, counties must incorporate erosion control requirements into county building and grading permit applications. Permit language must require erosion, sediment, and waste material management controls to be used and maintained at construction sites from initial clearing through final stabilization. Counties may prioritize where these building and grading permit requirements are applied, for example where increased development is occurring, according to county zoning regulations, or where large subdivisions or large-scale dense development is allowed. Through an ordinance or other regulatory mechanism, counties must be able to pursue enforcement and technical assistance, as appropriate, at construction sites where pollutants could discharge to waters of the state, either directly to stream or through a conveyance system. In each TMDL annual report, the county must track implementation of its construction site runoff control program and describe all activities.	Erosion Prevention and Sediment Control. (7.5) Riparian Area Assessment and Management. (7.11)

Adapted from Final Revised Willamette Basin Mercury TMDL and WQMP.

In addition to the minimum measures addressed in Table 7 above, the following mercury reduction recommendations will be implemented (adapted from Table 13-13 of the Final Revised Willamette Basin Mercury TMDL and WQMP, 2019). Table 8 includes a summary of recommendations and applicable management strategies.

Table 8. Sediment-Bound Mercury Reduction Measures	
Requirements	Applicable Management Strategy being Implemented that is Relevant to this Recommendation
Roads	
Identify and prioritize county roads and ditches that contribute sediment and runoff to waterbodies. Best practices could include planting/retaining vegetation in ditches and reducing use of pesticides when appropriate to site conditions. Special attention should be focused on the following situations: unimproved/gravel roads in higher traffic areas, roads where traffic consists of heavy machinery use, near quarries or other activities that can exacerbate dust and track-out concerns.	O&M for Publicly Owned Storm Sewer Systems (7.2)
Develop and implement an O&M program with a schedule of regular and long-term inspection and maintenance ensuring the proper operation and effectiveness of both structural and source controls, e.g., stormwater system maintenance and/or road maintenance actions that prevent erosion of road surfaces	O&M for Publicly Owned Storm Sewer Systems (7.2)
Riparian Buffers	
Retain or plant adequate riparian buffers along waterbodies on county properties, such as a park, to provide natural filtering of sediment. Percent effective shade targets to meet the 2006 Willamette Basin TMDL for temperature are available in the 2006 TMDL document. Meeting shade targets will help provide shade for reducing heat impacts, as well as buffers to filter runoff. Counties that were identified as DMAs in the 2006 TMDL should already be conducting activities in support of this goal.	Riparian Area Assessment and Management (7.11)
Develop an enforceable ordinance that establishes a minimum buffer along streams, wetlands, lakes, and other waterbodies.	Riparian Area Shade: Other Development-Related Regulations (7.4)
Onsite Stormwater Management	
Strive to reduce the percent of new impervious surfaces by prioritizing onsite stormwater infiltration on county-owned properties for existing properties, new development, and redevelopment.	Stormwater Regulations for New/Redevelopment and for CIPs (7.1)
Encourage and incentivize developers to implement low-impact design standards on large development sites.	Stormwater Regulations for New/Redevelopment and for CIPs (7.1)

10. Review and Revision of Plan

The 2006 Willamette River TMDL Water Quality Management Plan (Chapter 14) states the following on page 14-6: *“DMAs will be expected to prepare an annual report and undertake an evaluation of the effectiveness of their plans every five years to gauge progress toward attaining water quality standards.”*

Annual reports will be provided to the DEQ on or before December 1 of each year.

This 2023 updated IP replaces the September 2022 NPS TMDL IP, which had been created to satisfy the requirements of the DEQ’s 2021 Willamette River Mercury TMDL. The 2023 updated NPS TMDL IP is the result of the process that assessed the effectiveness of the 2022 NPS TMDL IP. Numerous changes and adjustments were made which were identified during this effectiveness assessment.

According to OAR 340-042-0080(4)(b), Clackamas County DMAs shall also *“Implement and revise the plan as needed,”* and the Co-Owners expect to also continue to comply with this rule in the future.

11. Statewide Land Use Requirements

Oregon Administrative Rule 340-042-0080(4)(a)(D) states that, to the extent required by ORS 197.180 and OAR Chapter 340, Division 18, evidence of this IP’s compliance with the applicable land use requirements shall be provided. Clackamas County, Clackamas WES’ SWM service area, including the SWMACC and CCSD #1, and the Cities of Happy Valley and Rivergrove are currently in compliance

with all land use requirements that pertain to this IP. This IP is consistent with Clackamas County's Comprehensive Plan and land use regulations and with the City of Happy Valley's and City of Rivergrove's Comprehensive Plans and land use regulations. These Comprehensive Plans have been acknowledged by Oregon's Land Conservation and Development Commission to be in compliance with the Statewide Planning Goals. This IP is consistent with the county's Comprehensive Plan and the city's Comprehensive Plan to the extent required by law.

The co-owners of this IP have concluded that the City of Rivergrove's, the City of Happy Valley's, and Clackamas County's Comprehensive Plans have provisions that are relevant to this IP and that this IP is compatible with these provisions.

12. Citation of Legal Authority

The co-owners of this IP have the legal authority to implement TMDL management strategies as provided by relevant Oregon State Constitution sections, Oregon state statutes, and charter and code. Specific orders, codes, and authorities associated with TMDL implementation are listed below:

- **Surface Water Management Agency of Clackamas County.** Organized under ORS 451 in 1992, SWMACC was empowered with surface/stormwater management authority by Clackamas County Board Order No. 92-289 on March 19, 1992. This order authorizes SWMACC to provide nonstructural and structural NPS pollution controls to meet state and federal regulations and to, in general, address surface/stormwater quality and flooding problems in the district. These controls are contained within the *Water Environment Services Rules & Regulations*, revised July 2018. Clackamas WES, a Clackamas County Department, administers the SWMACC through WES' administration of the WES Municipal Partnership, which is organized under ORS 190.
- **Clackamas County Service District No. 1.** Organized under ORS 451 in the late 1960s or early 1970s, CCSD #1 was empowered with surface/stormwater management authority by Clackamas County Commissioners in 1993. This Order authorizes CCSD #1 to provide nonstructural and structural NPS pollution controls to meet state and federal regulations and to, in general, address surface/stormwater quality and flooding problems in the district. These controls are contained within the *Water Environment Services Rules & Regulations*, revised July 2018. Clackamas WES, a Clackamas County Department, administers the CCSD #1 through WES' administration of the WES Municipal Partnership, which is organized under ORS 190.
- **Clackamas County Comprehensive Plan, ZDOs, and Other Board Orders.** The Clackamas County Comprehensive Plan addresses planning goals and policies, including land use, transportation, community and design plans, stormwater drainage, natural resources, and open space/parks. Current policies regarding development, implementation, and enforcement of stormwater controls for new development or redevelopment are identified in the Public Facilities and Services element of the Comprehensive Plan. The Comprehensive Plan, which can be viewed here <https://www.clackamas.us/planning/comprehensive.html>, provides authority to adopt measures that protect surface/stormwater quality.

ZDO provides the rules, regulations, and standards that implement the goals and policies of the Comprehensive Plan. The following ZDOs serve to protect surface/stormwater quality:

- Floodplain Management District (Section 703)
- River and Stream Conservation Area (Section 704)
- Willamette River Greenway (Section 705)
- Habitat Conservation Area District (Section 706)

- Water Quality Resource Area District (Section 709)
- Protection of Natural Features (Section 1002)
- Utilities, Street Lights, Water Supply, Sewage Disposal, Surface Water Management, and Erosion Control (Section 1006)
- Open Space and Parks (Section 1011)
- Lot Size and Density (Section 1012)
- Planned Unit Developments (Section 1013)
- Open Space Review (Section 1103).

Existing regulations that prohibit illicit connections to storm sewers are promulgated in ORS 447.140. Clackamas County Board Order 81-1-36 (“An Ordinance Pertaining to Enforcement of the Building Code, Excavation, and Grading Standards and Sewage Disposal System Standards”), as amended pursuant to Ordinance No. 05-2000, provides Clackamas County with the authority to enforce regulations which prevent and control illicit connections. This order was amended by Board Order 88-179 to include grading and filling regulations.

The Comprehensive Plan, ZDOs, and Board Orders apply during new/redevelopment and during times when development is not proposed or occurring. If a property is not being developed or redeveloped, Clackamas County’s Planning and/or Community Environment Divisions administer the applicable portions of the Comprehensive Plan, the applicable ZDOs, and many Board Orders.

City of Rivergrove’s Comprehensive Plan and Codes: The City of Rivergrove’s Comprehensive Plan’s last major update occurred in 2011 (the portion for Goal #12, titled “Transportation” was updated in 2014). The Comprehensive Plan addresses planning goals and policies, including land use, transportation, community and design plans, stormwater drainage, natural resources, and open space/parks. Current policies regarding development, implementation, and enforcement of stormwater controls for new development or redevelopment are identified in the Public Facilities and Services element of the Comprehensive Plan. The Comprehensive Plan provides authority to adopt measures that protect surface/stormwater quality.

The City of Rivergrove Land Development Ordinance provides the regulations that implement the goals and policies of the Comprehensive Plan. The following specific Development Code sections serve to protect surface/stormwater quality:

- Subdivision/planned unit development design and improvement standards (Section 6.130 and Sec. VI, Ord. #70-2001)
- Significant natural resource lands (Section 5.070 and Sections I-IV, Ord. #70-2001)
- Water quality and flood management (Sections I-III and V-VII, Ord. #70-2001)
- Tree cutting and preservation (Section 5.100 as amended by Ord. #74-2004)
- Surface water runoff and detention (Section IV, Ord. #70-2001)

Ordinance and associated HCA map adoption requirements necessary to implement Metro’s Title 13 (mandated in part by State of Oregon Goal 5 regulations) were approved in 2008 to provide additional protection for riparian shade.

The Comprehensive Plan, codes, and City Council Orders apply during new/redevelopment and during times when development is not proposed or occurring. If a property is not being developed or redeveloped, the city administers the applicable portions of the city’s Municipal Code. If a property has

been proposed to be developed/redeveloped, all plans are checked for conformance with the following documents:

- Conditions of Approval associated with the pertinent land use approval.
- Provisions of the Development Code.
- The Engineering Design Standards Manual.
- WES Rules and Regulations, but only if the tax lot is in SWMACC (the portion of the City of Rivergrove that is in Washington County is not in SWMACC). Developers may be required to provide stormwater detention, erosion control, post-construction stormwater treatment, and a streamside or wetland setback area.

City of Happy Valley's Comprehensive Plan and Codes: The City of Happy Valley's Comprehensive Plan's last major update occurred in 2021. The Comprehensive Plan addresses planning goals and policies, including land use, transportation, community and design plans, stormwater drainage, natural resources, and open space/parks. Current policies regarding development, implementation, and enforcement of stormwater controls for new development or redevelopment are identified in the Public Facilities and Services element of the Comprehensive Plan. The Comprehensive Plan provides authority to adopt measures that protect surface/stormwater quality.

Title 16 of the City of Happy Valley Municipal Code (Development Code) provides the regulations that implement the goals and policies of the Comprehensive Plan. The following Development Code sections serve to protect surface/stormwater quality:

- Subdivision/ planned unit development design and improvement standards (Sections 16.62-16.67)
- Significant natural resource lands (Sections 16.32 and 16.34)
- Water quality and flood management (Sections 16.32, 16.34, 16.35, 16.63.020, and 16.64.040)
- Tree cutting and preservation (Section 16.45.050)
- Surface water runoff and detention (Section 16.63.020)

Regulations include implementation of Metro's Title 13 (mandated in part by State of Oregon Goal 5) that provides protection for riparian shade.

The City of Happy Valley's municipal code for controlling illicit discharges is here:

https://library.qcode.us/lib/happy_valley_or/pub/municipal_code/item/title_8-chapter_8_08

Regulations that prohibit illicit connections (e.g., a toilet) to storm sewers are promulgated in ORS 447.140.

The Comprehensive Plan, codes, and City Council Orders apply during new/redevelopment and during times when development is not proposed or occurring. If a property is not being developed or redeveloped, the City's Community Services Department administers the applicable portions of the City's Municipal Code. If a property has been proposed to be developed/redeveloped, all plans are checked for conformance with the following documents:

- Conditions of Approval associated with the pertinent land use approval.
- Provisions of the Development Code.
- The Engineering Design Standards Manual.
- CCSD #1's Rules and Regulations. The city has adopted WES' surface water management standards. These standards apply both inside and outside the WES service district boundary.

Developers may be required to provide stormwater detention, erosion control, post-construction stormwater treatment, and a streamside/wetland setback area.

13. Oregon Administrative Rules 340-042-0080: “Implementing a Total Maximum Daily Load”

The DEQ is the entity responsible for implementing portions of the U.S. Clean Water Act in Oregon, including the development of TMDLs and issuing them as orders. The full set of OAR in 340-042-0080, as of July 18, 2022, which is titled “Implementing a Total Maximum Daily Load,” is provided below:

(1) Management strategies identified in a WQMP to achieve wasteload and load allocations in a TMDL will be implemented through water quality permits for those sources subject to permit requirements in *ORS 468B.050* [Water quality permit] and through sector-specific or source-specific implementation plans for other sources. WQMPs will identify the sector and source-specific implementation plans required and the persons, including DMAs, responsible for developing and revising those plans.

(2) Nonpoint source discharges of pollutants from forest operations on state or private lands are subject to best management practices and other control measures established by the Oregon Department of Forestry under the *ORS 527.610* [Short title] to *527.992* [Civil penalties] and according to *OAR chapter 629*, divisions 600 through 665. Such forest operations, when conducted in good faith compliance with the Forest Practices Act requirements are generally deemed not to cause violations of water quality standards as provided in *ORS 527.770* [Good faith compliance with best management practices not violation of water quality standards]. Where the department determines that there are adequate resources and data available, the department will also assign sector or source specific load allocations needed for nonpoint sources of pollution on state and private forestlands to implement the load allocations. In areas where a TMDL has been approved, site specific rules under the Forest Practices Act rules will need to be revised if the department determines that the generally applicable Forest Practices Act rules are not adequate to implement the TMDL load allocations. If a resolution cannot be achieved, the department will request the Environmental Quality Commission to petition the Board of Forestry for a review of part or all of Forest Practices Act rules implementing the TMDL.

(3) In areas subject to the Agricultural Water Quality Management Act the Oregon Department of Agriculture (ODA) under *ORS 568.900* Definitions for *ORS 568.900* to *568.933* [Civil penalties] and *561.191* [Program and rules relating to water quality] and according to *OAR chapter 603*, divisions 90 and 95 develops and implements agricultural water quality management area plans and rules to prevent and control water pollution from agricultural activities and soil erosion on agricultural and rural lands. Where the department determines that there are adequate resources and data available, the department will also assign sector or source specific load allocations needed for agricultural or rural nonpoint sources to implement the load allocations. In areas where a TMDL has been approved, agricultural water quality management area plans, and rules must be sufficient to meet the TMDL load allocations. If the department determines that the plan and rules are not adequate to implement the load allocation, the department will provide ODA with comments on what would be sufficient to meet TMDL load allocations. If a resolution cannot be achieved, the department will request the Environmental Quality Commission to petition ODA for a review of part or all of water quality management area plan and rules implementing the TMDL.

(4) Persons, including DMAs other than the Oregon Department of Forestry or the Oregon Department of Agriculture, identified in a WQMP as responsible for developing and revising sector-specific or source-specific implementation plans must:

(a) Prepare an implementation plan and submit the plan to the Department for review and approval according to the schedule specified in the WQMP. The implementation plan must:

(A) Identify the management strategies the DMA or other responsible person will use to achieve load allocations and reduce pollutant loading;

(B) Provide a timeline for implementing management strategies and a schedule for completing measurable milestones;

(C) Provide for performance monitoring with a plan for periodic review and revision of the implementation plan;

(D) To the extent required by ORS 197.180 [State agency planning responsibilities] and OAR chapter 340, division 18, provide evidence of compliance with applicable statewide land use requirements; and

(E) Provide any other analyses or information specified in the WQMP.

(b) Implement and revise the plan as needed.

(5) For sources subject to permit requirements in ORS 468B.050 [Water quality permit], wasteload allocations and other management strategies will be incorporated into permit requirements.

14. References

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