



TUALATIN RIVER WATERSHED TOTAL MAXIMUM DAILY LOAD IMPLEMENTATION PLAN

Clackamas County, the Surface Water Management Agency of
Clackamas County
and the City of Rivergrove

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SECTION A

OVERVIEW

1. Introduction

The federal Clean Water Act, section 303, requires states to develop water quality standards to support uses beneficial of public water bodies. Where water quality standards are not being met, the water body or the appropriate reach is listed on the 303(d) list of water quality limited water bodies for that parameter. 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.

The TMDL process begins when a stream, lake, or river does not meet water quality standards and is classified as water quality-limited on the state's 303(d) list. TMDLs identify the maximum amount of a specific pollutant that can be present in a water body without violating water quality standards. This is known as the loading capacity. 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, 2004). The excess load is split up 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. DEQ develops wasteload allocations for point sources such as wastewater treatment plants and industrial discharges, and load allocations for non-point pollution from agricultural, urban, and forestry lands such as erosion, animal wastes, and stormwater.

The Oregon Administrative Rule (OAR) 340-042-0025 that addresses TMDLs requires local governments and other agencies to develop TMDL Implementation Plans.

Responsible parties that are able to implement pollution reduction strategies are classified as Designated Management Agencies (DMAs). DMAs can include federal agencies such as the Bureau of Land Management, state agencies such as the Oregon Department of Forestry and the Oregon Department of Agriculture, counties, cities, and others. According to OAR 340-042-0025, TMDL Implementation Plans must include the following five elements:

1. Management strategies that will be used to achieve load allocations
2. A timeline and schedule to achieve measurable milestones
3. A plan for periodic review and revision of the implementation plan
4. Evidence of compliance with applicable statewide land use requirements
5. Any other analyses or information as specified in the Water Quality Management Plan

This TMDL Implementation Plan is for the Surface Water Management Agency of Clackamas County (SWMACC), Clackamas County's Business and Community Services Dept. (BCS), Clackamas County's Dept. of Transportation & Development (DTD), and the City of Rivergrove and summarizes the management strategies for protecting and improving water quality. The particular focus of this Implementation Plan is on strategies for reducing TMDL pollutants from non-point sources to achieve load allocations. Strategies for

reducing TMDL pollutants from point sources to achieve waste load allocations are addressed comprehensively in point source permits for storm water and wastewater discharges.

To comply with DEQ requirements for TMDL Implementation Plans (provided in OAR 340-042-0080(3)), the management strategies and information provided herein address each parameter within the Tualatin River TMDL over which Clackamas County, SWMACC, and the City of Rivergrove have jurisdiction (in stream heat, *E. coli*, total phosphorus, and mercury). In addition, we believe that this Implementation Plan demonstrates commitment and reasonable assurance of implementation and maintenance of effort over time. Many of the elements of this TMDL Implementation Plan are also summarized in the Matrices of Management Strategies in Chapters 8 through 12.

The Surface Water Management Agency of Clackamas County (SWMACC) is a County Service District that was created in 1992 for the specific purpose of addressing the total phosphorus Total Maximum Daily Load (TMDL). Its boundaries include the properties in the Tualatin River Watershed that are within unincorporated Clackamas County and the City of Rivergrove. SWMACC collects revenue from each residence and business within its boundaries for the specific purpose of addressing stormwater-related water quality issues and the stormwater-related TMDLs. The funding received by SWMACC is dedicated to this purpose and cannot be allocated to other functions or programs. Water Environment Services (WES), a department of Clackamas County, administers SWMACC.

SWMACC is a largely rural area with a small urban component in the City of Rivergrove and the unincorporated Lake Grove area, near the City of Lake Oswego. This plan addresses the Load Allocations (LA) that have been allocated to Clackamas County, SWMACC and the City of Rivergrove. A LA is issued for non-point sources of pollution. Waste Load Allocations, which are issued by DEQ to point sources (MS4 outfalls, for example), are not addressed in this IP.

The overall goal for the TMDL Implementation Plan is to reduce, or eliminate wherever practicable, sources of pollution to the Tualatin River and its tributaries. As discussed above, this goal aligns with:

1. The sole purpose of SWMACC;
2. Therefore, all the resources generated by SWMACC are directed toward addressing removal of the sources of stormwater-related pollutants?
3. Improving water quality in the Tualatin Watershed, improving/protecting groundwater quality in areas where drywells are operated; and,
4. Protecting/improving riparian areas to provide shade.

This plan addresses specifically the TMDL Load Allocations for Bacteria, pH and Chlorophyll A (Total Phosphorus), Mercury, Temperature, and Dissolved Oxygen.

2. Clackamas County Surface Water Overview

2.1 Watersheds

The major watersheds of Clackamas County are shown on Table 1. A large portion of Clackamas County is drained by the Willamette River and its tributaries including the Clackamas, Molalla, Pudding, and Tualatin Rivers (Table 1). The remaining lands are drained by the Sandy River, which enters the Columbia River in the City of Troutdale. Separate TMDL Implementation Plans have been developed for Clackamas County's, the City of Happy Valley's, and Clackamas County Service District #1's efforts to comply with the Willamette, Sandy, and Molalla-Pudding Rivers' TMDLs.

Clackamas County watersheds	Total acres in watershed	Watershed in Clackamas County, acres	Percent of watershed in Clackamas County
Clackamas	602,634	540,456	90
Molalla-Pudding	560,037	305,785	55
Tualatin	453,849	12,587	3
Lower Columbia-Sandy	560,566	235,361	42
Middle Willamette	455,502	73,906	16
Lower Willamette	411,905	33,797	8
<i>Total</i>	<i>3,044,494</i>	<i>1,201,890</i>	
<i>Sub-watershed of Lower Willamette</i>			
Johnson Creek	32,709	9,902	30

This TMDL Implementation Plan specifically addresses the Tualatin TMDL's Load Allocations, and Interim load allocations for mercury, but does not include lands in the cities of West Linn, Tualatin, and Lake Oswego.

2.2 Organizational Summary

Water Environment Services (WES), as the administrator of the Surface Water Management Agency of Clackamas County (SWMACC), plays a role in implementing portions of this Implementation Plan; others also play a role in implementing the Implementation Plan. General responsibilities of each County Department, County Service District, and the City of Rivergrove are outlined in Table 2.

Table 2. County, City and Service District Responsibilities

DMA name	Jurisdictional area	TMDL Implementation Plan responsibility
Clackamas County WES	Limited to SWMACC (except for septic system and 1200C programs, which are county-wide)	Administers SWMACC. Also administers septic system and 1200C programs on a county-wide basis
Clackamas County DTD	County-wide	Includes Planning, Maintenance & Engineering and the Office of Sustainability. Riparian area use and other land uses, roads, illegal dumping and solid waste nuisances on private property
Clackamas County BCS	County-wide	Clackamas County Parks, North Clackamas Parks & Recreation District, Economic Development, County Fair, management of surplus real estate, and Dump Stoppers (an illegal solid waste dumping prevention program)
SWMACC	In-district	All-purpose stormwater management agency, and riparian area land use ¹
City of Rivergrove	To City limits only	Limited to land use authority. Most other stormwater management functions are provided by WES/SWMACC on behalf of the City ¹

1) WES/SWMACC does not provide any services in the portion of the City of Rivergrove which lies within Washington County

2.3 Surface Water Responsibilities

As stated above, Clackamas County, SWMACC, and the City of Rivergrove have responsibility as Designated Management Agencies (DMAs) and have cooperated in the development of this Implementation Plan. Each organization has ongoing programs that provide for overall management of surface and ground water quality that contribute to watershed health in the Tualatin watershed.

2.3.2 Stormwater

Stormwater enters the Tualatin River and tributaries in the Tualatin TMDL's geographic area from areas regulated by the NPDES Municipal Separate Stormwater System (MS4) 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. DEQ considers these MS4-permitted storm sewer outfalls as point sources, and as a result, they are not addressed in this Implementation Plan. WES is aware of five outfalls which are located in SWMACC's MS4 permitted area. The MS4 permit was issued to Clackamas County, SWMACC and other co-permittees in December 1995. It was subsequently renewed in March 2004, and modified in July 2005, and in December 2007 and renewed in March 2012.

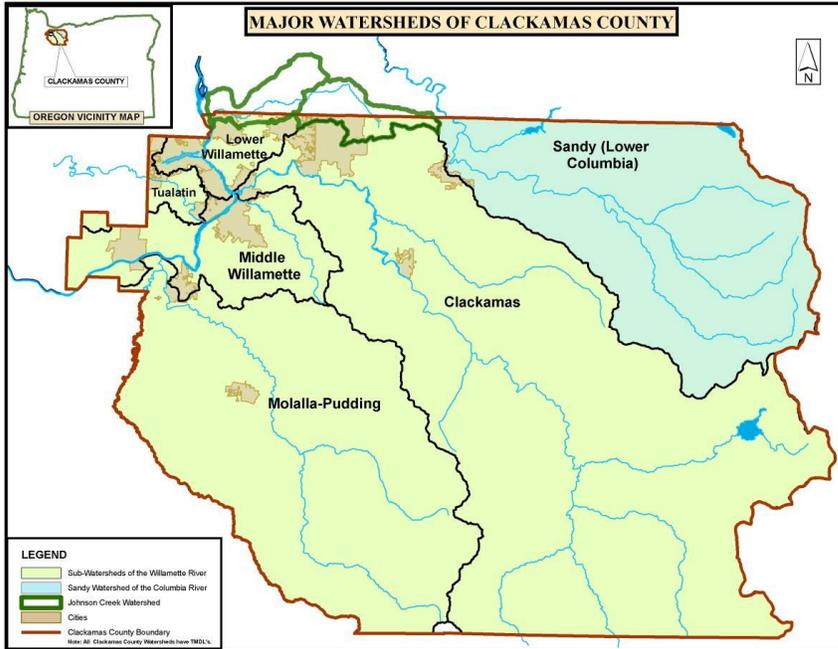


Figure 1. Major Watersheds of Clackamas County

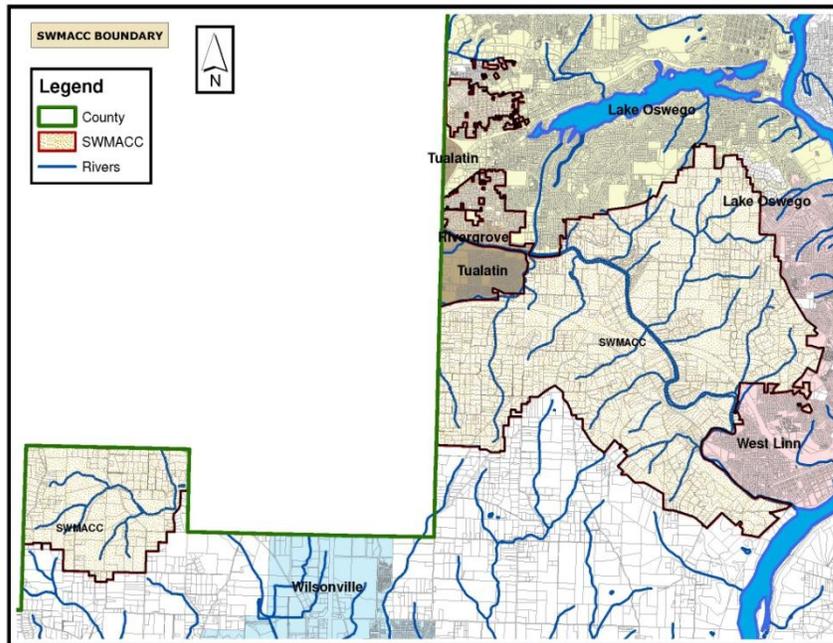


Figure 2. SWMACC NPDES MS4 Permit Boundaries

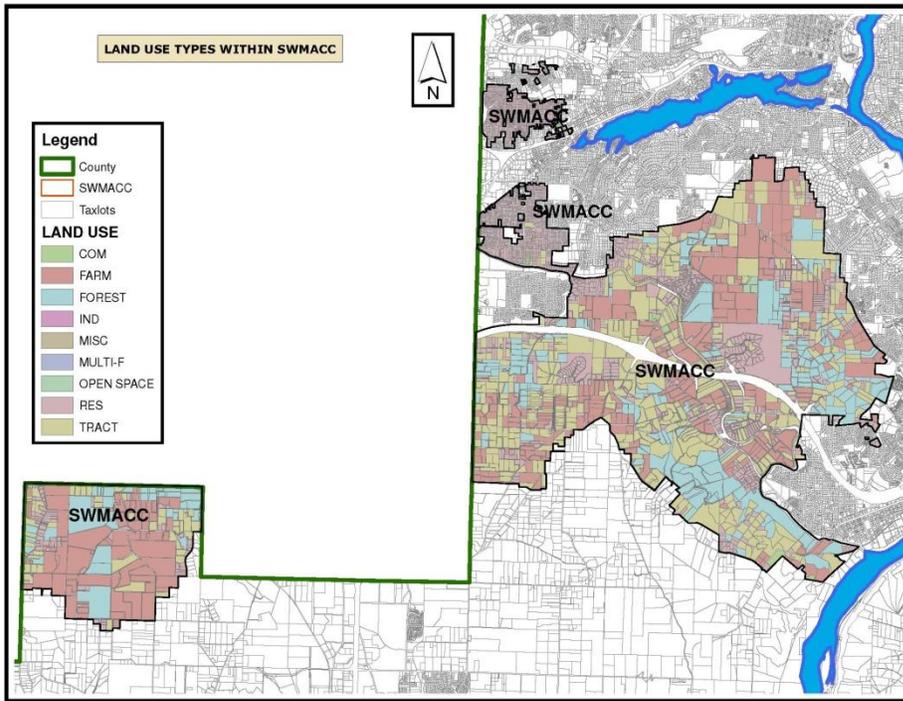


Figure 3 SWMACC Land Use Types

3. TMDL Parameters and Allocations

TMDLs have been developed in the Tualatin watershed for *E. coli*, pH and Chlorophyll A (Total Phosphorus), mercury, dissolved oxygen, and in-stream water temperature. Table 3 summarizes each TMDL parameter, load allocation, measurement, and DMA.

Table 3. TMDL Parameters and Load Allocations					
Affected waters	Parameters	Measurement method	Allocation type	LA	DMA
All	In-stream temperature	Surrogate: shade	LA	Attaining "system potential vegetation" conditions	CC, SWMACC and Rivergrove
All	<i>E. coli</i>	<i>E. coli</i>	LA	Summer (May 1 st -Oct 31 st): 12,000 colonies/100ml during storms AND 406 colonies/100ml during all other times. Winter (Nov. 1 st -April 30 th): 5,000 colonies/100ml during storms AND 406 colonies/100ml during all other times.	CC, SWMACC and Rivergrove
All	pH and Chlorophyll A (Total Phosphorus)	Lab: Total Phosphorus	LA	0.14 mg/L in most instances. Only applies from May 1 to Oct. 31	CC, SWMACC, and Rivergrove
All	Dissolved Oxygen	Lab: Winkler method, or field meter	LA	20% or 50% reduction in "Settleable Volatile Solids in Runoff".	CC, SWMACC, and Rivergrove
All	Mercury	Direct Lab:Mercury	Interim	27 percent reduction from all sources	CC, SWMACC, and Rivergrove Soil disturbance, air deposition, etc.

3.1 *E. coli*

According to the January 2001 Tualatin TMDL, the following *E. coli* Load Allocations (LAs) apply to all River and tributary segments in SWMACC:

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

3.2 Dissolved Oxygen

The DEQ established a new TMDL for dissolved oxygen (DO) – this one based largely on reducing the levels of settleable volatile solids (SVS) – in the Tualatin River watershed in 2001. Levels of SVS are believed to play in role in contributing to the amount of instream DO that bed sediments take as organic material is consumed or decomposes. The DO TMDL’s Load Allocations that were issued are for SVS.

The DO TMDL’s LAs are expressed in terms of a required percent reduction of Settleable Volatile Solids (SVS) in stormwater runoff. For the roughly 27 acres of lands in SWMACC which can drain into Carter Creek, a Fanno Creek tributary, the required SVS reduction is 50% from May 1st to October 31st. For all other streams in SWMACC, including the mainstem Tualatin River, the required reduction is 20% from May 1st to October 31st.

3.3 Mercury

The TMDL has established a 27 percent reduction over time from all sources (point and non-point sources) of mercury compared to current loading levels. The Willamette TMDL for mercury applies to the Tualatin River because the Tualatin River is a Willamette River tributary.

The stated objective of the mercury TMDL is to reduce average fish tissue mercury concentrations in the Willamette River so that all fish species are safe for human consumption. The multiple fish consumption advisories for mercury in the Willamette Basin and the numerous 303(d) listings indicate that this beneficial use is not currently being met. DEQ acknowledges that it may take many years, perhaps even decades, to ultimately achieve the desired reduction in fish tissue concentrations of mercury. In establishing interim water quality guidance values, DEQ considered the criteria and thresholds utilized when fish consumption advisories are issued.

3.4 Temperature

All stream and river reaches in SWMACC are part of the Tualatin River’s temperature TMDL. DEQ has established Percent Effective Shade (PES), a measurement of the shade-yielding capacity of a riparian area, is the TMDL’s surrogate for in stream heat load. “System potential vegetation” conditions represent areas with a high PES value. “System potential vegetation” conditions are considered by DEQ to be necessary to achieve “system potential effective shade,” which is defined by DEQ as “the potential near-stream vegetation that can grow and reproduce on a site, given the climate, elevation, soil properties, plant biology, and hydro-logic processes.” Shade curves, developed by 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 SWMACC.

3.5 pH and Chlorophyll A (Total Phosphorus)

The EPA approved Total Maximum Daily Loads (TMDLs) for total phosphorus in the Tualatin River in 1988 and again in 1994. The DEQ issued the most recent TMDL for total phosphorus in the Tualatin River watershed in 2001. The 2001 TMDL’s Load Allocations (LA) are for total phosphorus.

As delineated by the 2001 total phosphorus TMDL, the summer (May 1st to October 31st) instream median concentration for total phosphorus is 0.14 or 0.13 mg/L in SWMACC, depending on the specific location.

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 which enters the river and tributaries from springs. According to Tables 42 and 48 in the 2001 TMDL document’s total phosphorus section, the estimated background levels of phosphorus in the watershed are identical to the load allocations that were granted by DEQ to nonpoint sources (storm water running off of a field into the creek is a nonpoint source, for example), so there is no allowance in the TMDL for additional discharge of phosphorus beyond background levels in at least some instances.

4. Goals and Objectives of Plan

The goal of this Implementation Plan is to identify the ongoing and planned management strategies to improve watershed health and address requirements of the Tualatin River TMDL related to reductions in bacteria (*E. coli*), total phosphorus, mercury, in-stream heat, and dissolved oxygen loading.

The objectives of this Implementation Plan include applying adequate management strategies for pollution prevention (e.g., erosion control, riparian protection strategies, and stormwater management strategies), evaluating strategies annually for effectiveness and level of service, and implementing adaptive management as necessary.

To achieve this goal and these objectives, this Implementation Plan’s DMAs (Clackamas County, SWMACC, and the City of Rivergrove) will be implementing the portions of this Plan that they are responsible for in a coordinated fashion. A single annual report to DEQ is expected to be submitted by these DMAs each year.

In order to focus the efforts toward developing a more integrated and coordinated approach to improving the health of the watersheds in Clackamas County amongst the Clackamas County departments, representatives from WES, DTD Maintenance, DTD Engineering, DTD Planning, and Parks communicate regularly on coordinated activities. The representatives meet as needed to coordinate efforts and have identified and committed to the following goals and objectives:

1. WES will provide both technical expertise and the identification of high-priority maintenance areas to DTD. This will help DTD to develop a cost-effective program of enhanced and targeted maintenance.
2. In December 2012, DTD and WES finalized the Integrated Pest Management (IPM) plan. Integrated pest management is a coordinated decision-making and action process that uses the most appropriate pest control methods and strategy in an environmentally and economically sound manner to meet agency pest management objectives. The IPM Plan aims to protect public health, water quality, and suitable conditions for fish and wildlife. This IPM Plan represents an important element of SWMACC's permit compliance strategy.
3. County DTD - will work with WES on adopting WES' stormwater quality and quantity design standards for those areas within the UGB
- 4 All County department representatives agreed on the need to be more responsive to reporting requirements.

These objectives will be revised and additional tasks will be added as the committee's and the DMA's implementation work progresses.

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SECTION B

POLLUTANT REDUCTION AND MANAGEMENT STRATEGIES

5. Potential Sources of Pollutants

According to the Oregon Department of Environmental Quality (DEQ) specific known or suspected sources of TMDL parameters should be noted in this Implementation Plan. The potential sources of TMDL parameters in the Clackamas County watersheds are discussed below.

5.1 *E. coli*

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

Studies conducted in the Puyallup River watershed in Washington state and the Tualatin River watershed in Oregon indicate that stormwater washing over fecal matter that had been deposited by a range of wild animals, including birds and rodents, appears to be the source of most *E. coli* contamination in urban stormwater.

In rural areas where no sanitary sewer infrastructure exists, on-site septic systems can be a significant source of *E. Coli* bacteria given the right circumstances. Other potential sources of *E.coli* bacteria in rural areas include:

- Livestock waste
- Wild bird and mammal feces
- Pet waste
- Failed septic systems
- Illegal dumping of solid waste
- Spills and illicit discharges
- Stormwater runoff

5.2 Dissolved Oxygen

A dissolved oxygen (DO) test measures the amount of oxygen that is dissolved in the water being analyzed. Dissolved oxygen levels in streams and river segments in the Tualatin River watershed are rarely too high for the maintenance of a healthy aquatic ecosystem, but very low DO levels can be harmful or even fatal to many forms of aquatic life.

The DEQ established a new TMDL for DO – this one based on reducing the levels of settleable volatile solids (SVS) – in the Tualatin River watershed in 2001. Levels of SVS are believed to play a role in contributing to the amount of instream DO that bed sediments take as organic material is consumed or decomposes. The DO TMDL's Load Allocations that were issued are for SVS.

Examples of materials which do, or can, contain SVS include, but aren't limited to, leaves & other pieces of vegetation, soil, and discarded food. Programs which reduce their instream presence, such as sweeping leaves from roadsides, are expected to yield lower SVS levels in stormwater runoff.

The DO TMDL's LAs are expressed in terms of a required percent reduction of Settleable Volatile Solids (SVS) in stormwater runoff. For the roughly 27 acres of lands in SWMACC which can drain into Carter Creek, a Fanno Creek tributary, the required SVS reduction is 50% from May 1st to October 31st. For all other streams in SWMACC, including the mainstem Tualatin River, the required reduction is 20% from May 1st to October 31st. Since a laboratory method does not exist for SVS, documenting compliance with this requirement is unusually complex. For several years, we have used, and expect to continue to use, a combination of the following water quality measurements to qualitatively determine our progress towards meeting these LAs: total suspended solids (TSS), volatile solids (VS), and direct measurements of dissolved oxygen in stream and at outfalls using dissolved oxygen meters 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 which 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 very 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 falling down over rocks) increases the rate of mixing of water and air, increasing DO levels.

5.3 Mercury

Mercury is a naturally occurring element found in high concentrations in cinnabar deposits. 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 our 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 wild/forest fires.

Mercury has been used historically 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 much of the mercury which enters the Willamette River had been deposited in the watershed by the atmosphere.

Mercury can be present in various physical and chemical forms in the environment (Ulrich et al., 2001; USEPA, 2001b). The majority 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, dissolved oxygen 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. One 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.

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

- Erosion of soils from agricultural, forest, urban and commercial/industrial areas and lands
- Runoff and soil erosion from new development and redevelopment and commercial and industrial areas
- Soil disturbance related to road maintenance
- Illegal dumping of solid waste
- Spills and illicit discharges of certain materials

5.4 Temperature

Stream temperature is determined 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
- Conduction with the stream bed
- 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 a source 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 as to what are 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 may be 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 recent 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 non-point source in-stream heat loading include:

- Alteration of the riparian and upland canopy; and removal of streambank vegetation
- Filling and drying of wetlands
- Interception and rerouting of groundwater inputs
- Withdrawal and return of water for agricultural irrigation
- Release of water from ponds and reservoirs
- Changes in channel or water body size
- Suspended sediment/turbidity in streams
- Low stream flow

Although scientific studies indicate that water temperature is affected by a variety of processes, 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 non-point source 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 Implementation Plan are focused on increasing the percent effective shade in the watershed and other reasonable steps to reduce elevated stream temperatures.

5.5 pH and Chlorophyll A (Total Phosphorus)

Phosphorus can, or will, enter the waters of the Tualatin River and tributaries in various ways. At this time, Clackamas County, SWMACC, and the City of Rivergrove are not aware of any specific known sources of phosphorus in the Tualatin River watershed, although general (i.e., non-specific) sources include:

- Stormwater runoff from agricultural, forested, rural residential, and urban lands
- Soil erosion from new development and redevelopment
- Soil disturbance related to road maintenance
- Illegal dumping of solid waste
- Spills and illicit discharges
- Groundwater, which feeds the River and creeks through springs, is known to contain elevated levels of total phosphorus during at least certain times during the year.

Until summer 2008, excessive phytoplankton growth (i.e. algal “blooms”) hadn’t been observed in the Tualatin River during the summer and autumn seasons for many years. Scientific review of summer 2008’s conditions appears to indicate that waters pumped into the Tualatin River from Wapato Lake’s bed near Gaston in Washington County was a contributing factor. During a bloom, algae become much more abundant due to a variety of factors. One factor which 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 produce elevated pH levels and very low levels of dissolved oxygen.

The EPA approved Total Maximum Daily Loads (TMDLs) for total phosphorus in the Tualatin River in 1988 and again in 1994. The DEQ issued the most recent TMDL for total phosphorus in the Tualatin River watershed in 2001. The 2001 TMDL’s Load Allocations (LA) are for total phosphorus.

As delineated by the 2001 total phosphorus TMDL, the summer (May 1st to October 31st) instream median concentration for total phosphorus is 0.14 or 0.13 mg/L in SWMACC, depending on the specific location. Comparing data that was collecting by WES in recent years during visits to creeks in SWMACC on rainy and dry days, the mean total phosphorus concentration is greater during monitoring events that occur during storms.

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 which enters the river and tributaries from springs. According to Tables 42 and 48 in the 2001 TMDL document’s total phosphorus section, the estimated background levels of phosphorus in the watershed are identical to the load allocations that were granted by DEQ to nonpoint sources (storm water running off of a field into the creek is a nonpoint source, for example), so there is no allowance in the TMDL for additional discharge of phosphorus beyond background levels.

6. TMDL Implementation Responsibilities

Responsibility for implementing the Tualatin River TMDLs has been assigned by DEQ to several designated management agencies (DMAs). The City of Rivergrove, SWMACC, and the County’s various departments were named as separate DMAs in August 2012. s. These parties were previously described by DEQ as a single DMA named “Clackamas County”. This single DMA includes the following separate elements:

- WES
 - Surface Water Management Agency of Clackamas County (SWMACC)
- Clackamas County
 - Department of Transportation & Development
 - Planning
 - Maintenance & Engineering
 - Office of Sustainability
 - Community Environment/Code Compliance
 - Business & Community Services
 - Economic Development
 - Property Resources
- City of Rivergrove

TMDLs are being implemented by appropriate state and federal agencies for state and federally-owned and managed lands (example: I-205 is ODOT's MS4 permit and regulates runoff from I-205 in SWMACC). TMDLs for private lands in timber management areas are being implemented through the Oregon Department of Forestry (ODF), and the TMDLs for private lands in agricultural areas are being implemented through the Oregon Department of Agriculture (ODA). TMDLs are being implemented through the NPDES permitting process for point sources of pollutants such as wastewater treatment plant discharges and NPDES MS4-permitted stormwater discharges.

This Implementation Plan focuses on management strategies that address non-point sources of pollution in SWMACC, including surface discharges of stormwater runoff from areas that are not regulated by the NPDES MS4 program. Stormwater runoff directed to subsurface discharge through injection systems – such as drywells – and through infiltration systems is not addressed through this Implementation Plan. Lands subject to ODF and ODA jurisdiction are also not the focus of this Implementation Plan. In addition, this Implementation Plan does not address runoff from lands owned by the state or federal government. See Chapters 1 and 2 for previous discussion on jurisdictional authority and responsibility coverage.

This Implementation Plan addresses stormwater runoff-related TMDL parameters that are discharged by these types of stormwater drainage systems:

- Clackamas County and County Service District-owned storm sewer outfalls that are not subject to the NPDES MS4 permit requirements. (See the areas outside the NPDES MS4 permit boundaries in Figures 2 and 3.)
- Privately-owned storm sewer 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 non-point sources of pollution.
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls. These drainage systems are non-point sources of pollu-

tion. They are found on lands with every type of land use. Those drainage systems that are not in agricultural and timber management areas are addressed in this Implementation Plan.

It is important to note that Clackamas County's, SWMACC's, and the City of Rivergrove's authority to control sources of pollution from County and County Service District-owned storm sewer outfalls, privately owned storm sewer outfalls, overland sheet flow, and channelized flows is quite limited. If Clackamas County, SWMACC, and/or the City of Rivergrove are aware of a discharge that does not flow through a publicly owned storm sewer system that is a significant, known source of pollution, the matter will be referred to DEQ if public education and/or mediation fail to yield the necessary water quality improvement.

7. Clackamas County Water Quality Programs and Activities

A variety of management programs, activities, and strategies are employed by Clackamas County, SWMACC, and the City of Rivergrove to improve and protect water quality and overall watershed health. The strategies that are implemented or planned for implementation to address non-point sources of TMDL parameters in the area covered by this Plan include:

- 7.1 Stormwater policies, regulations, and administrative procedures
- 7.2 Water quality monitoring
- 7.3 Industrial/Commercial stormwater maintenance program
- 7.4 Other development related and watershed protection regulations
- 7.5 Erosion prevention and sediment control
- 7.6 Public involvement and education
- 7.7 Pet waste management
- 7.8 Septic system management
- 7.9 Illegal dumping management
- 7.10 Spill response and Illicit Discharge, Detection, and Elimination Program (IDDE)
- 7.11 Riparian assessment and management

These management strategies are described in detail in the sections below. Applicable management strategies for each TMDL parameter are also summarized in the matrices in Section C: Implementation.

7.1 Stormwater Regulations

TMDL parameters addressed: *E. coli*, total phosphorus, mercury, and DO.

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 were followed during site design and construction can influence the amount of 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 portion of the Implementation Plan describes the planning procedures for developing, implementing, and enforcing controls to reduce the discharge of TMDL parameters from storm sewers which collect stormwater runoff from areas that have been significantly developed or redeveloped. These post-construction controls are applied to: a) development on private property, and b) Clackamas County and SWMACC-funded capital improvement

projects (CIPs) including road and building construction projects.

Clackamas County, SWMACC, and the City of Rivergrove implement the following Management Strategies:

Clackamas County, SWMACC and the City of Rivergrove

Stormwater regulation services are provided by WES in SWMACC, which includes the City of Rivergrove. The application of these storm water regulations is limited to newly developed or redeveloped properties which drain: 1) through privately owned storm sewer outfalls, 2) by overland sheet flow on private property, and 3) through privately owned ditches. Two primary Management Strategies are employed:

- a) Unless a waiver is granted, all new/redevelopment in SWMACC's UGB subunit 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 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 injection, such as through drywells, instead of infiltration. Reducing stormwater runoff volumes appears to be among the most effective techniques to reduce instream loading of TMDL parameters such as *E. coli* from upland areas.
- b) Unless a waiver is granted, WES' stormwater treatment requirements adopted in December 15, 2002 also apply. One requirement, contained within the SWMACC Rules and Regulations, requires that stormwater quality control facilities be designed to remove 65% of the phosphorus from the runoff from 100% of all newly constructed impervious areas. Most stormwater treatment technologies, which generally are designed to reduce total suspended solids (TSS), may also be appropriate in reducing pollutant loading of mercury. Some treatment technologies also appear to reduce the loading of *E. coli* through filtration such as wet ponds, wetlands, rain gardens, and bioswales, and/or pervious pavement) and by providing enhanced residence times (which can increase the bacterial die-off rate). If stormwater filtration and/or enhanced residence time systems are constructed at a site, then *E. coli* loading could be expected to be lower than if these methods were not employed. For Clackamas County-funded and SWMACC-funded projects, stormwater treatment is often provided.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking permit applications for new development and redevelopment sites, and tracking the types of stormwater management measures implemented at development sites.

Fiscal analysis: This management strategy is currently funded.

7.2 Water Quality & Flow Monitoring

TMDL parameters addressed: *E. coli*, total phosphorus, dissolved oxygen, and temperature

Description of the potential sources: Watersheds can be impacted by development and impervious surfaces that contribute to or causes changes in hydrology, habitat, water quality, and biological communities. Stormwater, the runoff occurring from precipitation events, can pick up and convey pollutants as it travels over impervious surfaces and the land surface. In addition, alteration of riparian and upland vegetation can impact stream temperatures. Monitoring the quality of rivers creeks and stormwater that is discharged to them provides information to assess current impairment, long-term trends, and the effectiveness of current management strategies and determine potential new management strategies to employ.

Description of the Management Strategy: Clackamas County WES conducts periodic stormwater and in-stream water quality monitoring. Monitoring is performed at one in-stream site in SWMACC (nine times per year) and one outfall site in SWMACC (three times per year). SWMACC also provides annual financial support for a USGS-owned network of continuous surface/stormwater monitoring stations in the watershed, including ones on the Tualatin River in SWMACC at River Miles 1.8 and 3.4.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to meet watershed health limiting factors and needs.

Fiscal analysis: Existing monitoring levels are currently funded.

7.3 Industrial/Commercial Stormwater Maintenance Program

TMDL parameters addressed: *E. coli*, total phosphorus, dissolved oxygen, and mercury

Description of the potential sources: Stormwater from commercial and industrial areas can wash TMDL parameters such as *E. coli*, phosphorus, or mercury into waterways regulated by the Tualatin TMDL. Potential sources of contamination at these sites could include land deposition of air pollutants, spills, poor housekeeping practices, and leachate from improperly stored solid waste. The most common sources of *E. coli* at these sites may be feces deposited on impervious and landscaped surfaces by wild birds and mammals.

Description of the Management Strategy: The applicable Management Strategies vary depending on the location and type of facility. One set of potential Management Strategies applies for facilities that are located within SWMACC UGB and a different set applies to all other facilities in this Implementation Plan's geographic area of coverage.

NSFRMAP/SCAP

The WES "Stormdrain Cleaning Assistance Program" (SCAP), formerly known as the "Non-Single-Family Residential Maintenance Agreement Program" (NSFRMAP), was created in fiscal year 2008-2009. Modeled upon the program created by the City of Gresham, this incentive based program encourages properties to clean their private storm systems by offering a discounted cleaning rate for catch basins. WES staff solicit competitive bids from vendors for catch basin cleaning pricing that includes all associated costs. The winning bid is then offered to WES' commercial/industrial cus-

tomers through an annual mailing and RSVP process. The list of participants is then provided to the vendor who then arranges for the cleaning and bills the participants directly. Cleaning of other system components such as ponds, swales, oil-water separators, etc are contracted separately between the property owner and the vendor. While there are few commercial/industrial properties within SWMACC, this program helps to reduce the build up and transport of pollutants from these types of land uses to the local waterways.

DEQ 1200Z/1200A Permit

If WES staff become aware that an industrial facility may be required to apply for and obtain a 1200 series NPDES permit from DEQ, WES staff will notify the business' owner(s) that they should contact the DEQ for a determination on their eligibility for this permit. At this time, there are not any 1200Z-permitted facilities in SWMACC. A portion of the sand/gravel mine at 12542 SW Morgan Road has a 1200A permit.

If a facility in SWMACC ever does receive a 1200Z permit, while holders of 1200Z permits are generally not required to monitor for the presence of *E. coli* and other TMDL parameters in their stormwater, permit holders are required to regularly collect and analyze stormwater samples to ensure that stormwater leaving the facility complies with the permit's water quality benchmarks for many other pollutants, including TSS and lead. Facility improvements at 1200Z-permitted sites are often made to improve the quality of stormwater leaving the site so that levels of pollutants with benchmarks are no longer elevated. It is possible that these improvements may also be reducing or preventing contamination of stormwater with TMDL parameters.

Industrial and Commercial facilities in SWMACC which discharge stormwater runoff will primarily be inspected on a complaint-driven basis, but it is possible that some inspections will be conducted by WES staff during source tracking activity if WES' in-stream routine or in-stream storm event monitoring work reveals that excessive levels of *E. coli* or other TMDL parameters are present. All facilities that are the subject of a complaint will be contacted, and potentially inspected, in a timely manner by WES staff. The implementation of control measures for stormwater discharges from these facilities will be deemed necessary by WES if the presence of excess levels of *E. coli* or other TMDL parameters can be confirmed to be present in their discharge. In these instances, and in the event that the discharger's initial attempts to improve 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 their support. The DEQ has the authority to compel most dischargers to halt or modify their discharge if the material contains a significant concentration of TMDL parameters and is likely to flow directly to Waters of the State.

Timeline for implementation: The 2010-11 SCAP is currently underway.

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to meet limiting factors for

watershed health. Assessment of this strategy will include tracking annual letters sent to property owners in the SCAP program identifying their requirements and tracking annual reports received from SCAP property owners.

Fiscal analysis: WES/SWMAACC has budgeted 0.1 FTE to implement the SCAP.

7.4 Other Development-Related & Watershed Protection Regulations

TMDL parameters addressed: Temperature

Description of the potential sources: Removal or disturbance of vegetation reduces stream shading, exposing streams to higher levels of solar radiation. Solar radiation (sunlight) falling directly on streams can cause water temperature to increase. Alteration of the riparian canopy can also change the microclimate near streams, increasing air flow and heat exchange with the stream and thereby elevating water temperatures.

Description of the Management Strategy: Protection of system potential vegetation and effective shade in riparian areas is one of the primary mechanisms for achieving load allocations for temperature. The following watershed protection regulations that protect streamside vegetation are implemented in Clackamas County, SWMAACC, and the City of Rivergrove.

Streamside Buffer Areas: Many lands that include at least some riparian area are subjected to “streamside buffer regulations” when these lands are developed or re-developed in a significant manner under Clackamas County’s and the City of Rivergrove’s building permitting process. These streamside buffer regulations include:

- 1) *Metro Title 3.* Clackamas County’s Planning Department administers WES’ equivalent of Metro Title 3 regulations in SWMAACC through an agreement with WES. Clackamas County’s Planning Department administers these regulations in the other unincorporated other areas within the Portland metro area’s UGB in Clackamas County, including but not limited to, the OLSD. Significant new and re-development 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.

The buffer area is protected in one of two ways: a conservation easement or a separate tract of land. In SWMAACC, a) if an owner proposes to encroach into WES’ buffer and can enhance the buffer by creating additional buffer on the property at a ratio of 1.5:1.0, than no other mitigation is required; or b) if a variance is applied for and granted, WES can authorize a customized vegetation plan that includes removing invasive species and replanting the buffer area with native vegetation, including shade-yielding trees.

Rivergrove. The city of Rivergrove has their own equivalent of Metro Title 3 regulations which they apply within the city limits.

- 2) *ZDO 709*. Clackamas County's Zoning and Development Ordinance (ZDO) 709 applies in unincorporated, urban areas in the watershed. 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 here in this Implementation Plan, for many wetlands in the Tualatin River's watershed discharge their waters directly to creeks and rivers in the watershed.
- 3) *Metro Title 13 (Goal 5)*. Clackamas County's Zoning and Development Ordinance (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 HCA's, next to minimize impacts on HCAs and water quality, and finally to mitigate the impacts to these areas

- 4) *River and Stream Conservation Area, ZDO 704*. This ordinance applies to all rural unincorporated private lands in Clackamas County and is administered by DTD pursuant to the applicable provisions of the ZDO. Significant new and re-development which is regulated by Clackamas County that occurs on land lots 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.

- 5) *Floodplain Management District, ZDO 703.* This ordinance, administered by Clackamas County DTD, applies on the unincorporated lands that are addressed by this Implementation Plan. This ZDO restricts the types, and in some instances, the magnitude of development that can occur in floodplains. This ZDO 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.
- 6) *River and Stream Corridors, ZDO subsection 1002.05* Within rural Clackamas County (outside of Portland Metropolitan UGB and Metro Service District Boundary), assigns variable width buffers (based upon soil type, vegetative cover, bank stability, slope, flood hazards, etc.) to streams not regulated by Section 704, prohibiting most new development within those buffers.
- 7) *Significant Natural Areas, ZDO Subsection 1002.8* Significant natural Areas. Protects four, key water resources (Williams Lake Bog, the Land at Marmot, Multnomah bog and Wilhoit Springs) that are designated as Scenic & Distinctive Resources.
- 8) *Standards for Flood Hazard Areas, ZDO Subsection 1003.03.* Augments regulations of 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.

Sustainability Resolution: Clackamas County established an Office of Sustainability in 2007. In a resolution, adopted February, 28, 2008, the Board of County Commissioner's adopted a resolution regarding sustainability. A portion of that resolution is listed below. Some of the elements of this resolution will aid in the implementation of management measures to control and reduce TMDL parameters:

We are committed to meeting or exceeding global targets for mitigating climate change by taking actions in our own operations and communities, including the following:

- a. Create an action plan for reducing global warming emissions in County operations;
- b. Increase the average fuel efficiency of County fleet vehicles;
- c. Increase recycling rates in County operations and in the community;
- d. Make County procurement decisions that minimize negative environmental and social impacts;
- e. Continue to practice and promote sustainable building practices using the U.S. Green Building Council's LEED™ program;
- f. Adopt and enforce land-use policies that reduce sprawl; preserve open space; create compact, walkable urban communities, and
- g. Protect and foster productive and healthy agriculture and natural resource lands;

- h. Make energy efficiency a priority, and increase the use of clean, alternative energy;
- i. Promote transportation options;
- j. Preserve water resources through education, planning and water supply coordination;
- k. Help educate the public, schools, other jurisdictions, professional associations, businesses, and industry about reducing the negative impacts of climate change.

While Clackamas County has existing language allowing low impact development, the sustainability project will facilitate a comprehensive policy review of our programs for regional impacts to water quality. The Sustainability Project will address these issues further by identifying possible methods to require all new projects to be “low impact.”

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include analyzing aerial photos for changes in tree canopy along the major streams within the County’s portion of the Tualatin River Watershed. Previous management strategies included tracking the number of zoning and building permits issued, which did not provide any insights into changes in the amount of tree canopy. Every calendar year the County will review aerial photos, with a more comprehensive review occurring every 5 years to assess any changes.

Fiscal analysis: Implementation of the above is currently funded through implementation of Metro Title 13 (Goal 5) in Clackamas County and may ultimately require additional resources.

Timeline for implementation: Implemented and ongoing.

7.5 Erosion Prevention and Sediment Control

TMDL parameters addressed: Total phosphorus, dissolved oxygen, and mercury

Description of the potential sources: Erosion of disturbed soil at construction sites can result in stormwater being contaminated with sediment and other pollutants, which can then be transmitted to waterways. Mercury is naturally present in some soils and also reaches soil through air deposition.

Description of the Management Strategy: Erosion control is addressed through the issuance of erosion control permits for sites undergoing significant development or redevelopment, reducing the amount of soil leaving the site and subsequent total suspended solids (TSS) and/or settleable volatile solids (SVS) in stormwater washing from the property. By reducing TSS and SVS in stormwater, it is presumed that the concentration in stormwater of TMDL parameters adhered to soil (such as mercury), or mixed with soil (such as organic matter with high SVS level), if present, is also reduced.

The implementation of the erosion control program varies depending on the location of the property being developed. One set of Management Strategies applies for sites that are located within SWMACC; a second set applies outside of SWMACC and all other lands in this Implementation Plan’s geographic area of coverage. The erosion control methods employed at these permitted sites

include installation of sediment fence and catch basin silt sacks, planting grass to re-stabilize disturbed areas, and other similar techniques.

Sites within SWMACC (and the City of Rivergrove). Erosion control permits are required for sites where 800 or more square feet of soil are disturbed during construction. For instances where soil disturbance occurs yet is exempt from permitting requirements, technical assistance on erosion prevention and sediment control is provided by WES staff either on request or by complaint. Construction sites where one or more acres of soil disturbance occurs or is expected to occur are required to have a NPDES 1200-C permit. This permit is administered by WES, serving in the capacity as an agent of DEQ. The Clackamas County DTD Maintenance Division occasionally disturbs soil in their road rights-of-way while performing routine road maintenance and repair work. Clackamas County DTD Maintenance Division recently began the process of adhering to the Oregon Department of Transportation's *Routine Road Maintenance, Water Quality and Habitat Guide, Best Management Practices, Revised 2004* (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), 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). Capital Improvement and maintenance projects are performed by DTD in accordance with the requirements of the 1200-CA.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking erosion control permits issued, inspections performed, enforcement actions taken, and education and outreach activities implemented. In the future, turbidity monitoring may also play a role in assessment of program effectiveness and in terms of future regulatory compliance with the outcome of the proposed and pending turbidity rule.

Fiscal analysis: This management strategy is currently funded for SWMACC; however additional resources may be needed in the future. Additional resources may be needed to fully implement this management strategy in DTD service area.

7.6 Public Involvement and Education

TMDL parameters addressed: *E. coli*, total phosphorus, dissolved oxygen, mercury, and temperature

Description of the potential sources: Land management decisions on private lands and activities conducted by the public throughout the watershed affect overall watershed health and may contribute to the release of TMDL parameters into waterways. Educating the public about the way their practices can negatively or positively impact the health of the watershed is an important component in managing these potential sources.

Description of the Management Strategy: Public involvement and education is targeted by Clackamas County DTD and WES to encourage citizens to work and live in ways that protect or improve water quality. Public involvement and education is a part of many water quality management strategies im-

plemented in Clackamas County including pet waste education and management, septic system education and management, responding to and preventing illegal solid waste dumping, spill response, industrial/commercial stormwater maintenance, erosion prevention and sediment control, and design/construction standards for new/redevelopment management strategies. Specific activities and strategies employed by Clackamas County to reduce potential sources of *E. coli*, phosphorus, mercury, and temperature are described below.

A) *E. coli*

Public involvement and educational activities intended to reduce *E. coli* load contributions to waterways include the following:

- ◆ Educating the public about how to prevent septic system failures and how to report failures when they occur. This information is provided in brochures, on WES' website, and on request when citizens contact WES in person, by phone, e-mail, or U.S. mail.
- ◆ Clackamas County's *Citizen News* newsletter. *Citizen News* is U.S. Mailed to every Clackamas County address four times per year. Issues have included articles such as "Proper care of septic systems prevent the discharge of sewage (and thus bacteria) into surface water bodies" and "Buffer Zones: Protecting Sensitive Creeks and Streams", which as the title suggests, encouraged citizens to maintain their healthy—and enhance their degraded—riparian areas. Healthy riparian areas infiltrate, transpire, and filter non-point source stormwater runoff, and can reduce or assist in eliminating *E. coli* loading to streams and creeks, and may contribute to reducing water temperatures in receiving waterbodies.

One or more future newsletters may possibly include an article on one or more of the following topics that have the potential to further reduce in-stream *E. coli* loading levels:

- "Reasons why you should not feed ducks and geese"
 - "Proper management of dog and cat wastes"
 - "Please take your RV to an approved dump site after your vacation"
- Clackamas County's Dog Services provides information about proper dog waste management to the general public. The City of Rivergrove's park has a dispenser with bags for dog waste. This dispenser serves to educate dog owners about the importance of cleaning up after their pets and it prevents some pet waste from being washed into the Tualatin River.
 - The Clackamas County Soil & Water Conservation District (CCSWCD). The CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a department of Clackamas County, it is noted here because for Clackamas County and the CCSWCD work closely together. The CCSWCD helps landowners identify, plan for, and implement conservation measures that reduce pollutants coming off their lands including *E. coli* contamination through wise management of livestock manure, pet waste (this can include horses), and by installing vegetated buffer areas that allow stormwater to infiltrate into, be evaporated by, or filtered through the vegetated area. Within SWMACC, WES provides additional public education and involvement opportunities that may reduce instream *E. coli* loading from stormwater runoff in SWMACC. These include, but aren't limited to:

- a) Providing updates to the WES' website, which encourages citizens, customers, and stakeholders to pick up their pet's waste, maintain their septic system, naturescape their yard to increase infiltration (which eliminates runoff of contaminated stormwater), etc.
- b) Providing educational opportunities to school-age children. In *the past*, this has included presentations/stories/music in their classrooms and co-sponsorship of the Children's Clean Water Festival.
- c) Media campaigns, which are usually implemented and funded in partnership with many local governmental agencies.
- d) Watershed signs. These signs are currently displayed at multiple locations in or adjacent to SWMACC where County roads cross a river, creek, or significant tributary. These signs advertise the "watershed concept"...that lands surrounding these crossing points drain to creeks and rivers. WES believes that some citizens will be more likely to respond to our water quality protection and improvement-related initiatives and programs if they are more familiar with the waterbodies they live within, commute to and from, and potentially affect.

B) pH and Chlorophyll A (Total Phosphorus)

Public involvement and education is targeted by Clackamas County, WES, the City of Rivergrove, and SWMACC to encourage citizens and the development community to practice erosion prevention and sediment control (EPSC) best management practices:

- ◆ Development of EPSC informational materials in English, Spanish and Russian for distribution.
- ◆ Development of a multi-jurisdictional *Erosion Prevention and Sediment Control Planning and Design Manual*.

Public involvement and education is also used by Clackamas County, WES, the City of Rivergrove, and SWMACC to encourage citizens to maintain natural and landscaped areas in a manner which reduces instream phosphorus levels. For example, citizens are encouraged to avoid or minimize the use of fertilizer which contains phosphorus. Another example involves yard debris management. Citizens are urged to not rake or blow yard debris into the street, allowing it to wash into a stream, but instead area asked to sweep the material up and properly dispose of it.

C) Mercury

Land management decisions and activities conducted by the public throughout the watershed can affect overall watershed health and may contribute to the potential release of mercury into waterways. Educating the public about the way their practices can negatively or positively impact the health of the watershed is an important component in managing these potential sources.

Public involvement and educational programs and projects encourage citizens to work and live in ways that are sustainable and help to protect or improve water quality. Specific public involvement and educational

activities and strategies employed by Clackamas County, WES and the City of Rivergrove that can assist in reducing mercury loads to the Tualatin River in SWMACC includes the following:

- Clackamas County’s *Citizen News* newsletter. *Citizen News* is U.S. Mailed to every Clackamas County address four times per year.
- In November 2013, WES distributed 170 brochures (“Protecting our Watersheds”) for the City of Rivergrove newsletter. An electronic version of the brochure was distributed to their email list as well.
- Metro’s Household Hazardous Waste Facility (HHWF) in the City of Oregon City. Metro’s public involvement program encourages citizens to take unused amounts of hazardous wastes including insecticide products there for disposal. When inquiries from the public about the proper disposal method for potentially harmful substances (such as mercury-containing products) are received by WES, citizens are promptly forwarded to Metro’s informational phone number (503-234-3000) and to the Metro HHWF.
- The Clackamas County Soil & Water Conservation District (CCSWCD). The CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a Department of Clackamas County, it is noted here for Clackamas County provides some funding to the CCSWCD they work closely together. The CCSWCD helps landowners identify, plan for, and implement conservation measures that reduce soil erosion
- WES publications are available which encourage folks to live and do business in ways which would prevent and reduce soil erosion. For example, the “*What have you done for your watersheds lately?*” brochure includes the following statement: “Plant a buffer of native trees, shrubs, and groundcover near the streams instead of planting lawn all the way to a stream. The trees and shrubs prevent erosion...”
- Providing educational opportunities to school-age children. This includes presentations/stories/music and other activities in their classrooms and co-sponsorship of the Children’s Clean Water Festival.
- Watershed signs are currently displayed at seven locations in SWMACC where County roads cross the Tualatin river or a tributary. These signs advertise the “watershed concept”, notifying road users that the lands surrounding these crossing points are within the Tualatin River watershed and drain to creeks and the Tualatin River. WES believes that some citizens will be more likely to respond to our water quality protection and improvement-related initiatives and programs if they are more familiar with the boundaries of and waterbodies within that they affect.

D) Temperature

Public involvement and education is targeted by Clackamas County, WES, the City of Rivergrove, and SWMACC to encourage citizens to maintain their existing healthy riparian areas, and to encourage them to enhance degraded riparian areas that are on their property. Riparian area-related public involvement and educational opportunities available to the citizens and property owners in the area regulated by the Tualatin temperature TMDL are present in many forms, including, but not limited to the following:

- ◆ Clackamas County’s *Citizen News* newsletter. This newsletter is U.S. Mailed to every Clackamas County address, four times per year. An example of a previous article was one titled “Buffer Zones: Protecting Sensitive Creeks and Streams”, which as the title suggests, encourages citizens to maintain their healthy—and enhance their degraded—riparian areas.
- ◆ *CCSWCD*. CCSWCD provides assistance to landowners who are interested in conservation and watershed enhancement. While the CCSWCD is not a department of Clackamas County, they are noted here for Clackamas County and the CCSWCD work closely together.

They routinely assist landowners with identifying, planning, and undertaking riparian area protection and enhancement projects.

- ◆ Within SWMACC, WES provides additional educational and involvement opportunities that encourage the public to support watershed health and may reduce non-point source in-stream heat loading. These include, but aren't limited to:
 - a) Bill inserts, which on a periodic basis, contains relevant articles, such as those which encourage citizens to remove invasives, and to protect existing native vegetation and plant new trees. Many other County publications are also available, many of which encourage the public to live and do business in ways which would reduce non-point sources, impact riparian areas, and contribute to increased stream temperatures.
 - b) Providing updates to the WES' website, which also encourages the public to live and do business in ways which would reduce non-point pollutant sources, maintain healthy riparian areas, and implement best management practices that would contribute to watershed health and assist in lowering stream temperatures.
 - c) Providing educational opportunities to school-age children about watershed health.
 - d) Watershed signs are currently displayed at multiple locations in or adjacent to SWMACC, most often where County roads cross a river, creek, or significant tributary. These signs advertise the "watershed concept"...that lands surrounding these crossing points drain to creeks and rivers. WES believes that some citizens will be more likely to respond to our water quality protection and improvement-related initiatives and programs if they are more familiar with the waterbodies they affect.

E) Dissolved Oxygen

The DEQ established a new TMDL for dissolved oxygen (DO) – based on reducing the levels of settleable volatile solids (SVS) in runoff – in the Tualatin River watershed in 2001. As the name implies, SVS are those solids which can settle to the bottom of the River and then break down over time. Levels of SVS in stormwater are believed by DEQ to play a key role in contributing to the amount of instream DO that bed sediments take as organic material is consumed or decomposes. The DO TMDL's Load Allocations that were issued are for SVS levels in stormwater runoff. Examples of materials which do, or can, contain SVS include, but aren't limited to, leaves & other pieces of vegetation, soil, and discarded food. The following Public Involvement & Education efforts are expected to yield lower SVS levels in stormwater runoff:

- Yard debris management: For example, if leaves are swept – or pushed with a leaf blower – onto roadsides and abandoned, some of the material could be washed into the nearest stream. During Naturescaping workshops, which are supported by WES on a periodic basis, citizens are encouraged to pick up and properly dispose of their yard debris.
- Street sweeping: Materials that contain some SVS, such as grass clippings from lawn mowing, can be removed from the roadway by street sweeping.

Solid waste management. Several programs, including the County's Dump Stoppers program, help to raise awareness about the fact that garbage needs to be properly disposed of.

7.7 Pet Waste Management

TMDL parameters addressed: *E. coli*, dissolved oxygen, and total phosphorus

Description of the potential sources: When pet waste is left in uncovered areas, stormwater can transport *E. coli*, total phosphorus, and settleable volatile solids (SVS) from the land surface into the waters of the Tualatin watershed. (The DO TMDL's LAs expect that SVS levels in stormwater runoff will be reduced in order to improve instream DO levels).

Description of the Management Strategy: There are two main elements to the pet waste management strategy:

- ◆ *Public involvement and education:* Chapter 7.6, Public Involvement and Education, provides more information on this element.
- ◆ *Technical assistance and enforcement:* This management strategy is implemented when reports of improper pet waste management are submitted to Clackamas County's DTD Community Environment Division (CED). The CED's staff are the County's solid waste management experts, and they can interface with complainants and pet owners to find solutions which prevent or greatly minimize the discharge of pet waste to the waterways.

Not all types of solid waste generated by animals are addressed by CED's program (e.g., agricultural activities that generate manure). If reports of improper pet waste management in SWMACC are submitted to WES, WES will respond.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include performing qualitative assessments through interviews with staff and our customers and by tracking public education and outreach metrics such as:

- ◆ The number of website "hits" per year.
- ◆ The number of brochures printed and/or distributed per year.
- ◆ The number of pet waste bags taken from dispensers each year.

Fiscal analysis: This management strategy is currently funded.

7.8 Septic System Management

TMDL parameters addressed: *E. coli*, dissolved oxygen, and total phosphorus.

Description of the potential sources: A potential source of bacteria, settleable volatile solids (SVS), and total phosphorus in the waters regulated by the Tualatin TMDL is failing septic systems (The DO TMDL's LAs expect that SVS levels in stormwater runoff will be reduced in order to improve in-

stream DO levels). A septic system that is failing or has failed can discharge improperly treated or untreated wastewater directly into a surface water body or the wastewater can be pushed into the surface water body by stormwater runoff. A properly functioning septic system discharges all of its wastewater into the earth's uppermost, unsaturated soil layers after treatment; the water then percolates down into groundwater. In addition, setback requirements are administered for subsurface sewage disposal drainfields to minimize potential impacts to surface waters

Description of the Management Strategy: WES administers the Onsite Sewage Treatment and Disposal (Onsite) Program as an agent of DEQ throughout Clackamas County. The goals of the program are to have no septic system failures and for all septic systems to be in a properly functioning condition. To achieve these goals, WES implements:

- ◆ A process to address suspected failed or failing systems, and
- ◆ A process to educate the public about how to prevent septic system failures and how to report failures when they occur. This process is discussed in Chapter 7.6, Public Involvement and Education.

When septic systems fail in an area where sanitary sewer infrastructure is not within 300 feet of the property, a site visit is performed if the septic system has indeed failed and this is verified during the site visit, steps for needed correction are identified and a process for implementation is established. 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. Discharges to the ground surface and into waterways are not allowed and are given the shortest time that is feasible for construction of repairs or implementation of alternatives. Alternatives vary from limiting the usage of the septic system (timing of laundry, for example) to vacating the premises until the problem is resolved. To address failing septic systems Clackamas County funds the Safety Net Program, this provides low interest loans for low income property owners to repair failing septic systems.

WES has an agreement with Clackamas County's DTD CED to bring violators into compliance if initial efforts are unsuccessful. All failing septic systems are an enforcement priority for CED. Initial efforts made by CED encourage voluntary compliance. In the event this is unsuccessful, CED has the ability to levy both fines and fees for code violations. A citation with forfeiture up to \$500 can be issued for a high priority violation. If a violation case is referred to the Compliance Hearings Officer, he/she can issue civil penalties up to \$3,500 on priority one violations. Additionally, all costs incurred by CED while administering the enforcement action, or a \$75 monthly administrative fee, can also be assessed.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Assessment of this strategy will include tracking the number of reports of failing septic systems, the outcome of inspections (failing or not), the date of follow-up that confirmed repairs were made, and the number of Safety Net loans provided.

Fiscal analysis: This management strategy is currently funded.

7.9 Illegal Dumping Management

TMDL parameters addressed: *E. coli*, dissolved oxygen, total phosphorus, and mercury

Description of the potential sources: Illegal dumping of solid waste can be transported into waterways regulated under the Tualatin TMDL via stormwater runoff. Solid waste that may contain:

- *E. coli* includes, but is not limited to, soiled diapers and other waste containing fecal matter
- Mercury includes, but is not limited to, fluorescent light bulbs, batteries, thermometers, and electronics.
- Settleable volatile solids (SVS) – which can cause instream dissolved oxygen levels to be depleted – includes but is not limited to, old food, soiled diapers, and yard debris,
- Total phosphorus includes, but is not limited to, old food, soiled diapers, and yard debris.

Description of the Management Strategy: Illegal dumping of solid waste is addressed by two separate programs, each of which serves their own geographic area within the area that is regulated by the Tualatin TMDL. Each program is described separately below:

- ◆ *Developed, unincorporated, primarily urban areas and the City of Rivergrove: County Ordinance:* Illegal dumping in developed, unincorporated, primarily urban areas and in the City of Rivergrove is addressed by Clackamas County’s Department of Transportation and Development’s (DTD) Community Environment Division (CED). The CED administers 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 CED uses to resolve certain types of solid waste issues that cause a condition of unsightliness on private property.

Rural areas: Clackamas County’s Dump Stoppers Program: Illegal dumping of solid waste in rural areas, including the edges of roadways in these areas, is addressed by Clackamas County’s Dump Stoppers Program. County employees respond to reports of illegally dumped waste and coordinate the removal of the waste. Crews of people who have been ordered to perform community service remove the garbage and properly dispose of or recycle it. County employees install “no dumping” signs, with the program’s hotline prominently displayed, in places where dumping has occurred. County employees aggressively sift through the trash in search of clues that can identify the persons who illegally dumped the waste. A Sheriff Deputy who is assigned to this program uses these clues to confirm identities of dumpers, and then tracks down, and if appropriate, cites those persons. The Clackamas County District Attorney’s office has assigned a prosecutor to this program, and it pursues the most egregious cases.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address li-

miting factors for watershed health... Assessment of this strategy will include tracking waste removed through the Dump Stoppers Program, tracking the number of persons per year who complete the mediation process for solid waste dumping, and tracking the number of enforcement actions taken per year for solid waste dumping.

Fiscal analysis: This management strategy is currently funded.

7.10 Spill Response and Illicit Discharge Elimination Programs

TMDL parameters addressed: *E. coli*, dissolved oxygen, total phosphorus, and mercury

Description of the potential sources: The spill or illicit discharge of certain substances containing TMDL parameters such as *E. coli* and mercury can cause watershed health impairment. Potential sources of:

- *E. coli* include untreated sewage releases from a privately owned sanitary sewer line due to pipe failures or improper connections.
- Mercury or liquid or sludge-like materials that contain mercury.
- Total phosphorus are food (i.e. molasses) and certain wastewaters (for example, those generated by mopping a kitchen floor).
- Settleable volatile solids – which can cause instream levels of dissolved oxygen to be depleted if discharged into the Tualatin River or a tributary – include food and certain wastewaters.

Description of the Management Strategy: Spill response and illicit discharge detection and elimination (IDDE) programs are addressed by several management strategies depending on location. Clackamas County’s Road Department’s and WES’ Management Strategies are as follows:

- ◆ *Clackamas County DTD Maintenances:* If materials that potentially contain harmful substances (such as TMDL parameters including *E. coli* or mercury) are spilled or illicitly discharged onto a Clackamas County Transportation Maintenance road’s right-of-way and the impacted road segment is eligible for “full County maintenance”, personnel from Clackamas County’s Road Department will respond if they discover the incident or if they are notified about the incident and it is determined that a response is appropriate.

Clackamas County Transportation Maintenance Division crews will ensure that the release of the material is halted and that the material is subsequently cleaned up in a manner that prevents harmful substances from entering waters, if possible, or minimizes the amount of harmful substances that enters 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 (i.e., *E. coli* from animal manure), ODA may be asked to assume the lead role in responding to the report and resolving the matter. As was noted previously, 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.

WES: Spill response and illicit discharge elimination program services are provided by WES in SWMACC, which includes the City of Rivergrove. Instances involving spills and illicit discharges on County and City-owned roadways within the UGB in SWMACC are regulated by the MS4 permit and by Oregon's stormwater injection rules for drywells (OAR 340-044) and are not addressed in this Implementation Plan.

The spill response and illicit discharge elimination work performed in SWMACC by WES that is described in this portion of the Implementation Plan is limited to spills and illicit discharges that: 1) pass through privately owned storm sewer outfalls, 2) move by overland sheet flow on private property, and 3) move through privately owned ditches.

WES staff makes reasonable efforts during regular business hours to try to halt the release of spilled and illicitly discharged material and to get the responsible party to clean up their material. The goal is to prevent or to minimize the release of TMDL parameters and other potentially harmful substances into waterways. If efforts by WES staff fail to halt the release of the material and the material contains TMDL parameters that are likely to enter surface waters and/or storm sewers, WES staff will contact the DEQ and request their support. DEQ has the authority to compel most dischargers to halt or modify their spill or illicit discharge if the material contains a significant amount of pollution and is likely to flow to Waters of the State.

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

Measurable milestones (if any): This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health... Assessment of this strategy will include tracking the number of illicit discharges and spills per year.

Fiscal analysis: This management strategy is currently funded.

7.11 Riparian Assessment and Management

TMDL parameters addressed: Temperature

Description of the potential sources: Removal or disturbance of riparian vegetation reduces stream shading, exposing streams to higher levels of solar radiation. Solar radiation (sunlight) falling directly on streams can cause water temperature to increase. Alteration of the riparian canopy can also change the microclimate near streams, increasing air flow and heat exchange with the stream and thereby elevating water temperatures.

Description of the Management Strategy: Protection and restoration of riparian canopy is the primary mechanism for achieving load allocations for temperature.

To assess riparian shade, in 2009 Clackamas County updated Biological Surveys (previous studies conducted in 2002-2003) to include Benthic Macroinvertebrates and Habitat/Riparian Inventories. Through an intergovernmental agreement with the Oregon Department of Fish and Wildlife (ODFW), WES was provided with updated biological surveys for approximately 9 river miles within

SWMACC. Stream reach selection for updated surveys was based in part on priority reaches and landowner access. The Biological Surveys generally included:

- ◆ Fish abundance and distribution
- ◆ Habitat and riparian shade assessments
- ◆ Canopy density measurements
- ◆ Continuous summer temperature monitoring during June through September

The results of the updated Biological Surveys will be incorporated into final reports. .

Clackamas County will focus riparian enhancement/protection activities within high priority stream reaches with the following strategies:

- ◆ Tax or other landowner incentives for providing easements and establishing riparian vegetation
- ◆ Riparian plantings and maintenance agreements
- ◆ Partnerships with non-profit watershed restoration groups and watershed councils.

Timeline for implementation: Biological Surveys are updated approximately every 5 years. **Measurable milestones (if any):** This management strategy will be evaluated annually for effectiveness and appropriate level of service. Adaptive management will be applied as appropriate to address limiting factors for watershed health. Implementation of this strategy will include working with landowners directly and via partnerships to develop on-the-ground projects to enhance/protect riparian areas. These activities will be tracked both spatial (via GIS) and in a database to determine the effectiveness of these strategies.

Fiscal analysis: Clackamas County intends to fund these on a 5 year basis to perform biological surveys including benthic macroinvertebrates, fish populations, and habitat.

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SECTION C

IMPLEMENTATION

8. *E. coli*

8.1 Matrix of Management Strategies

Table 4 lists strategies for reduction and management of *E. coli* (bacteria).

8.2 Barriers to Implementation

This Implementation Plan addresses *E. coli* that are discharged by the following types of conveyance systems from lands under Clackamas County jurisdiction for the TMDL implementation (i.e., land not owned by the state or federal government, and land not in Oregon Department of Agriculture (ODA)/Oregon Department of Forestry (ODF) regulated areas):

- Clackamas County and County Service District-owned storm sewer outfalls that are not subject to the MS4 permit's requirements.
- Privately owned storm sewer outfalls.
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls.

Clackamas County's, SWMACC's, and the City of Rivergrove's authority to control sources of bacteria in privately owned conveyance systems is usually quite limited. If Clackamas County and/or the City of Rivergrove is aware of a privately owned conveyance system that is a significant, known source of *E. coli*, the matter will be referred to the Oregon Department of Environmental Quality (DEQ) if public education and/or mediation fail to yield the necessary water quality improvement.

The sources of in-stream *E. coli* loading are generally not well defined, and in most instances are likely to include significant contributions from the feces of wild birds and mammals. Clackamas County, SWMACC, and the City of Rivergrove cannot and do not accept sole responsibility for reducing *E. coli* loading in any of the Tualatin basin water bodies.

Clackamas County, SWMACC, and the City of Rivergrove do accept some of the responsibility for reducing the fraction of the *E. coli* loading:

- Which originates on those lands which Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate, and
- Which is generated by the specific land uses that Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate, but

Only if the *E. coli* loading is not from the feces of wild birds and mammals.

Table 4. Management Strategies Matrix for Bacteria

Source	Strategy	How and Implementer(s)	Fiscal analysis	Measure	Timeline	Milestone
<i>What sources of this pollutant are under your jurisdiction?</i>	<i>What is being done, or what will you do, to reduce and/or control pollution from this source?*</i>	<i>How will this be done and by which jurisdiction(s)?*</i>	<i>What is the expected resource need?*</i>	<i>How will we demonstrate successful implementation or completion of this strategy?*</i>	<i>When do you expect it to be completed?*</i>	<i>What goals do you expect to achieve, and by when, to know progress is being made?*</i>
1. Stormwater runoff						
	a. "Stormwater regulations for New and Re-Development"	Implement design/construction standards for post-construction phase stormwater management of new/redevelopment within SWMACC. <i>(SWMACC, Clackamas County & Rivergrove)</i>	Currently funded		Ongoing; revision to design/construction standards may follow the development of the WAPs.	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	b. Industrial/ Commercial Stormwater Program	Implement the WES "Stormdrain Cleaning Assistance Program" (SCAP) The SCAP agreements obligate property owners to clean and maintain their storm sewer system. <i>(WES)</i>	0.1 FTE required for SCAP)	Track annual letters sent to property owners in SCAP identifying their requirements; track annual reports received from SCAP property owners.	Ongoing	Receive annual reports from owners. Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	c. Water quality monitoring	Conduct stormwater and in-stream water quality monitoring. <i>(WES)</i>	Existing monitoring levels currently funded;	Review monitoring results annually and evaluate effectiveness of management strategies.	Ongoing.	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
2. Failing septic systems	a. Septic system management	Respond to reports of failing systems; work with homeowner to set a timeline for repair. County-funded Safety Net Program provides low interest loans for low income property owners to repair failing septic systems. <i>(WES & Clackamas County)</i>	Currently funded	Track number of Failures that need repair permits, number of Failures that need maintenance, number of enforcement actions, and # of Safety Net loans provided.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	b. Public involvement and education	Provide information in brochures, on WES' website, and upon request about septic system maintenance and how to detect failures. <i>(WES & Clackamas County)</i>	Currently funded	Track the number of website "hits" and the number of brochures printed or distributed/year	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
3. Pet waste	a. Pet waste management and Public involvement and education	Public education to pet owners through a variety of sources. Continue to encourage the City of Rivergrove to provide a dog waste bag dispenser in the City of Rivergrove's park. <i>(WES, Clackamas County & Rivergrove)</i>	Currently funded	Track number of bags taken from dispensers each year, if possible. Track the number of website "hits" and the number of brochures printed/year	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management

Table 4. Management Strategies Matrix for Bacteria						
4 Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Administer Clackamas County's Dump Stoppers Program in rural areas, and administer solid waste nuisance ordinance in urban areas. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities. <i>(Clackamas County)</i>	Currently funded	Track waste removed through Dump Stoppers Program. Track number of persons/year who complete mediation process for solid waste dumping. Track the number of enforcement actions taken per year for solid waste dumping.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management
5. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service roads and within SWMACC. Refer other cases to DEQ. <i>(WES & Clackamas County)</i>	Currently funded	Track the number of discharges/spills per year.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management

* Note: Details on management strategies are provided in Chapter 7. Fiscal analysis primarily applies to Clackamas Co. and SWMACC. City of Rivergrove management strategies may require further fiscal analysis.

Land ownership categories that are potential sources of in-stream *E. coli* loading which Clackamas County, SWMACC, and the City of Rivergrove have very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, and orchard lands
- Nearly all lands within the other cities in the TMDL's geographic area
- Highways and other State-owned lands

The bacteria load allocation may be exceedingly difficult and prohibitively expensive to attain if much of the in-stream *E. coli* loading is from the feces of wild birds and mammals.

It is Clackamas County SWMACC's and the City of Rivergrove's understanding that we are legally responsible only for preventing and/or controlling the portion of the *E. coli* load that originated in the gut of humans or in fecal material from pets—and then only if we have the authority to regulate the activity which caused the pollution—but not from other host species, including livestock (ODA), wild mammals (ODFW), and wild birds (ODFW).

8.3 Implementation Monitoring and Evaluation Reports

According to OAR 340-042-0080(3)(a)(C), Clackamas County and SWMACC 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.” The other type of performance monitoring, “effectiveness” monitoring, is addressed in 8.4.

Implementation monitoring will be conducted by the City of Rivergrove and by Clackamas County's Departments of Transportation and Development, and/or WES to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be kept on file in WES' offices. When appropriate, this Implementation Plan will be revised to reflect our enhanced understanding of our program's effectiveness and to reflect current watershed conditions; this is Adaptive Management.

8.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if our Management Strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County, the City of Rivergrove, and/or SWMACC are partially or completely responsible for. The resulting data will then, from time to time, be compared to:

- The applicable *E. coli* LA to determine if the allocation has been attained. According to the 2001 TMDL, the applicable LAs vary depending on the season (May 1st to October 31st or Nov. 1st to April 30th and also vary depending on whether runoff is occurring or not), and/or
- Current *E. coli* water quality standards/criteria and to historic data to determine if in-stream water quality has improved to the desired level or by the desired percentage.

Each year in SWMACC, WES performs *E. coli* monitoring: a) one County-owned storm sewer outfall during storms, and b) in a creek in both dry weather and during storms. The in-stream monitoring that is being conducted will be very useful for assessing the current and future degree of SWMACC's in-stream *E. coli* contamination. We believe that the current monitoring location and frequency provide sufficient coverage of discharges in SWMACC which are addressed by this Implementation Plan.

In-stream *E. coli* monitoring in the portion of the watershed that is regulated by the Tualatin *E. coli* TMDL that is in or very near Clackamas County but not within SWMACC is currently performed on an ongoing basis by many other clean water partners, including but not limited to, the DEQ, the City of Portland, and the Cities of Lake Oswego and West Linn.

8.5 Timeline

Our goal is to attain the load allocations for each TMDL parameter through an Adaptive Management process. We are committed to investing in activities and programs that contribute to overall watershed health. We are currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 8.4. 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 in Chapter 8.2. As monitoring demonstrates progress toward pollutant reduction, we will adaptively manage our activities and programs in order to work toward attaining the load allocations.

It is expected to take longer to attain the load allocations in areas where a larger share of the in-stream *E. coli* loading is from the feces of wild birds and mammals. The load allocation may be exceedingly difficult and prohibitively expensive to attain in many of those water bodies where much of the in-stream *E. coli* loading is from the feces of wild birds and mammals.

Attaining the load allocation for *E. coli* in the Tualatin TMDL watershed, especially the allocations which apply to time periods when storm events are not occurring, will likely require action by a variety of government agencies and private landowners. Clackamas County's, SWMACC's, and the City of Rivergrove's work toward reducing *E. coli* levels in surface water will likely be complemented by actions taken by the following three government agencies that provide additional regulatory authority and/or education and technical assistance:

- The Clackamas County Soil & Water Conservation District
- ODA
- ODF

9. pH and Chlorophyll A (Total Phosphorus)

9.1 Matrix of Management Strategies

Table 5 lists strategies for reduction and management of phosphorus in the Tualatin Watershed.

9.2 Barriers to Implementation

This Implementation Plan addresses total phosphorus that is discharged by the following types of conveyance systems from lands under our jurisdiction (i.e., land not owned by the state or federal government, and land not in geographic areas regulated by ODA and ODF):

- Clackamas County, City of Rivergrove, and SWMACC-owned storm sewer outfalls that are not subject to the MS4 permit's requirements.
- Privately owned storm sewer outfalls.
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls.

Clackamas County's, SWMACC's, and the City of Rivergrove's authority to control sources of total phosphorus in privately owned conveyance systems is usually quite limited. If Clackamas County, SWMACC, and/or the City of Rivergrove is aware of a privately owned conveyance system that is a significant, known source of total phosphorus, the matter will be referred to DEQ if public education and/or mediation fail to yield the necessary water quality improvement.

Clackamas County, SWMACC, and the City of Rivergrove cannot and do not accept sole responsibility for reducing total phosphorus loads in the Tualatin River or in any of its tributaries. Clackamas County, SWMACC, and the City of Rivergrove do accept some of the responsibility for reducing the fraction of the total phosphorus loading:

- Which originates on those *lands* which Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate, and
- Which is generated by the specific *land uses or activities* that Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate.

Land ownership categories that are at least modest sources of in-stream total phosphorus loading which Clackamas County, SWMACC, and the City of Rivergrove have very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, and orchard lands
- Lands in Clackamas County which are within the Cities of Tualatin, Lake Oswego, and West Linn.
- Interstate 205 and other State-owned lands (if any are present)

The sources of in-stream total phosphorus loads which originate in SWMACC are still not fully defined, but during dry weather, a very large percentage of the load is known to be entering the river through spring waters which are naturally rich in phosphorus. During rain events which occur during the TMDL season (May 1st to October 31st), soils, sediments and other solids that may contain phosphorus can be washed in to the river and tributaries. The total phosphorus load allocation will be exceedingly difficult – and possibly prohibitively expensive – to attain during the TMDL season if large amounts of phosphorus-rich groundwater continue to enter the Tualatin River and tributaries. This is due, in part, to the small amount of rain which typically falls during these months.

It is our understanding that we are legally responsible only for preventing and/or controlling the portion of the total phosphorus loading that enters the River through stormwater, authorized non-stormwater discharges (i.e. dechlorinated swimming pool wastewaters), illicit discharges, and spills, but only if we have the authority to regulate the activity which caused the pollution.

9.3 Implementation Monitoring and Evaluation Reports

According to OAR 340-042-0080(3)(a)(C), Clackamas County and SWMACC 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.” The other type of performance monitoring, “effectiveness” monitoring, is addressed in 9.4.

Implementation monitoring will be conducted by Clackamas County’s Departments of Transportation and Development, Business and Community Services, and/or WES, and/or the City of Rivergrove to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be kept on file in WES’ offices. From time to time, when appropriate, this Implementation Plan will be revised to reflect our enhanced understanding of our program’s effectiveness and to reflect current watershed conditions

Table 5. Management Strategies Matrix for Total Phosphorus

Source	Strategy	How and Implementer(s)	Fiscal analysis	Measure	Timeline	Milestone
<i>What sources of this pollutant are under your jurisdiction?</i>	<i>What is being done, or what will you do, to reduce and/or control pollution from this source?*</i>	<i>How will this be done and by which jurisdiction(s)?*</i>	<i>What is the expected resource need?*</i>	<i>How will we demonstrate successful implementation or completion of this strategy?*</i>	<i>When do you expect it to be completed?*</i>	<i>What goals do you expect to achieve, and by when, to know progress is being made?*</i>
1. Stormwater runoff						
	a. Stormwater regulations for new and re-development	Implement design/construction standards for post-construction phase stormwater management of new/redevelopment within SWMACC. (SWMACC, Clackamas County & Rivergrove)	Currently funded	Track permit applications for new/redevelopment and stormwater management measures implemented.	Ongoing; revision to design/construction standards may follow the development of the WAPs.	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	b. Industrial/ Commercial Stormwater Program	Implement the WES "Stormdrain Cleaning Assistance Program" (SCAP) The SCAP agreements obligate property owners to clean and maintain their storm sewer system. (WES)	Currently funded	Track annual letters sent to property owners in SCAP identifying their requirements; track annual reports received from SCAP property owners.	Ongoing	<ul style="list-style-type: none"> Evaluate measures annually for effectiveness and level of service; apply adaptive management.

Table 5. Management Strategies Matrix for Total Phosphorus

	c. Water quality monitoring	Conduct stormwater and in-stream water quality monitoring. WES provides funds for multi-jurisdictional funding of USGS monitoring of certain pollutants - such as chlorophyll "A", that are related to total phosphorus - and flow in the watershed. <i>(WES)</i>	Existing monitoring levels currently funded	Review monitoring results annually and evaluate effectiveness of management strategies.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
2. Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Administer Clackamas County's Dump Stoppers Program in rural areas, and administer solid waste nuisance ordinance in urban areas. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities.	Currently funded	<ul style="list-style-type: none"> Track waste removed through Dump Stoppers Program. Track # of persons/year who complete mediation process for solid waste dumping. Track # of enforcement actions taken/year for solid waste dumping. 	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
3. Failing septic systems	a. Septic system management	Respond to reports of failing systems; work with homeowner to set a timeline for repair. County-funded Safety Net Program provides low interest loans for low income property owners to repair failing septic systems. <i>(WES & Clackamas County)</i>	Currently funded	Track number of Failures that need repair permits, number of Failures that need maintenance, number of enforcement actions, and # of Safety Net loans provided.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
4. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service roads and within SWMACC. Refer other cases to DEQ.	Currently funded	Track the number of discharges/spills per year.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
5. Pet waste	a. Pet waste management and Public involvement and education	Public education to pet owners through a variety of sources. Continue to encourage the City of Rivergrove to provide the dog waste bag dispenser in the City of Rivergrove's park. <i>(WES, Clackamas County & Rivergrove)</i>	Currently funded	Track number of bags taken from dispensers each year, if possible. Track the number of website "hits" and the number of brochures printed/year	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management
6. Runoff and soil erosion from construction sites	a. Erosion control programs and public and education and involvement	Implement erosion control programs in SWMACC. Require erosion control permits as applicable; provide technical assistance, education, and outreach as applicable. Implement road maintenance practices on Clackamas County full maintenance roads according to ODOT BMP manual for water quality and habitat.	Currently funded	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.

* Note: Details on management strategies are provided in Chapter 7. Fiscal analysis primarily applies to Clackamas Co. and SWMACC. City of Rivergrove management strategies may require further fiscal analysis.

9.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if our Management Strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County, the City of Rivergrove, and/or SWMACC are partially or completely responsible for. The resulting data will then, from time to time, be compared to:

- The applicable total phosphorus LA to determine if the allocation has been attained. According to the 2001 TMDL, the applicable total phosphorus LA is 0.13 mg/L, 0.14 mg/L, or the load, in pounds per unit of time, and/or
- Historic data to determine if in-stream water quality has improved to the desired level or by the desired percentage.

Each year in SWMACC, WES currently performs a significant amount of total phosphorus and orthophosphate monitoring: a) one County-owned storm sewer outfall during storms, and b) one creek in both dry weather and during storms. The in-stream monitoring that is being conducted will be very useful for assessing the current and future concentrations and loads of total phosphorus in SWMACC's streams. We believe that the current monitoring locations and frequency provide sufficient coverage of discharges in SWMACC which are addressed by this TMDL Implementation Plan.

In-stream monitoring of total phosphorus, and orthophosphate in some cases, in the portion of the watershed that is regulated by the Tualatin TMDL that is in or very near Clackamas County but not within SWMACC is currently performed on an ongoing basis by many other clean water partners, including but not limited to, the DEQ, the City of Portland, and the Cities of Lake Oswego and West Linn.

9.5 Timeline

Our goal is to attain the load allocations for each TMDL parameter through an adaptive management process. We are committed to investing in activities and programs that contribute to overall watershed health. We are currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 9.4. 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 in Chapter 9.2. As monitoring demonstrates progress toward pollutant reduction, we will adaptively manage our activities and programs in order to work toward attaining the load allocations.

It is expected to take longer to attain the load allocations in areas where a large share of the in-stream total phosphorus loading enters the stream in phosphorus-rich springwater. The total phosphorus load allocation will be exceedingly difficult – and possibly prohibitively expensive – to attain during the TMDL season if large amounts of phosphorus-rich groundwater continue to enter the Tualatin River and tributaries. This is due, in part, to the small amount of rain which typically falls during these months.

Attaining the load allocations will likely require action by a variety of government agencies and private landowners. Clackamas County's, SWMACC's, and the City of Rivergrove's work toward reducing total phosphorus levels in surface water will likely be complemented by actions taken by the following three government agencies that provide additional regulatory authority and/or education and technical assistance:

- The Clackamas County Soil & Water Conservation District

- ODA
- ODF

10. Mercury

10.1 Matrix of Management Strategies

Table 6 lists strategies for reduction and management of mercury.

10.2 Barriers to Implementation

This Implementation Plan addresses mercury that is discharged by the following types of conveyance systems from lands under our jurisdiction (i.e., land not owned by the state or federal government, and land not in geographic areas regulated by ODA and ODF):

- Clackamas County, City of Rivergrove, and SWMACC-owned storm sewer outfalls that are not subject to the MS4 permit's requirements.
- Privately owned storm sewer outfalls.
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls.

Clackamas County's, SWMACC's, and the City of Rivergrove's authority to control sources of mercury in privately owned conveyance systems is usually quite limited. If Clackamas County, SWMACC, and/or the City of Rivergrove is aware of a privately owned conveyance system that is a significant, known source of mercury, the matter will be referred to DEQ if public education and/or mediation fail to yield the necessary water quality improvement.

Clackamas County, SWMACC, and the City of Rivergrove cannot and do not accept sole responsibility for reducing mercury loads in the Tualatin River or in any of its tributaries. Clackamas County, SWMACC, and the City of Rivergrove do accept some of the responsibility for reducing the fraction of the mercury loading:

- Which originates on those *lands* which Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate, and
- Which is generated by the specific *land uses or activities* that Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate.

Land ownership categories that could be sources of in-stream mercury loading which Clackamas County, SWMACC, and the City of Rivergrove have very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, and orchard lands
- Lands in Clackamas County which are within the Cities of Tualatin, Lake Oswego, and West Linn.
- Interstate 205 and other State-owned lands (if any are present)

Research has shown that much of the mercury which enters the Tualatin and Willamette Rivers has been deposited in the watershed by the atmosphere. It is Clackamas County's, SWMACC's, and the City of Rivergrove's understanding that we are not legally responsible for preventing and/or controlling the portion of the Tualatin River's mercury load that had been deposited on SWMACC by the atmosphere. We will reduce mercury contributions to waterways to the extent possible where we have the authority to regulate stormwater discharges from the locations where mercury is deposited. In many instances, we will make "good faith" efforts to reduce the portion of the mercury load that is attributable to atmospheric sources.

The stated objective of the mercury TMDL is to reduce average fish tissue mercury concentrations in the Willamette River so that all fish species are safe for human consumption. The multiple fish consumption advisories for mercury in the Willamette Basin and the numerous 303(d) listings indicate that this beneficial use is not currently being met. DEQ acknowledges that it may take many years, perhaps even decades, to ultimately achieve the desired reduction in fish tissue concentrations of mercury. In establishing interim water quality guidance values, DEQ considered the criteria and thresholds utilized when fish consumption advisories are issued.

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 which may cause in-stream mercury contamination. Other activities, such as those which cause the atmosphere to deposit mercury in the watershed, or certain ways to cause mercury-containing soil to be disturbed and eroded, such as through extensive off-road vehicle use on private property, are not regulated at all. Unfortunately, unregulated and thinly regulated sources of mercury appear to account for the vast majority of the Willamette River's annual mercury loading. Only a small amount of the Willamette River's annual mercury loading is being discharged by publicly owned wastewater treatment plants (DEQ estimated to be 2.72 percent of the Willamette River's total mercury load per year) or by industries (DEQ estimated to be 1.17 percent of the total/year).

10.3 Implementation Monitoring and Evaluation Reports

According to OAR 340-042-0080(3)(a)(C), Clackamas County and SWMACC 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." The other type of performance monitoring, "effectiveness" monitoring, is addressed in 10.4.

Implementation monitoring will be conducted by Clackamas County's Departments of Transportation and Development, Business and Community Services, and/or WES, and/or the City of Rivergrove to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be kept on file in WES' offices. From time to time, when appropriate, this Implementation Plan will be revised to reflect our enhanced understanding of our program's effectiveness and to reflect current watershed conditions

10.4 Effectiveness Monitoring

Effectiveness monitoring is expected to be conducted to determine if our Management Strategies are effectively reducing in-stream mercury loading from sources that Clackamas County, the City of Rivergrove, and/or SWMACC are completely or partially responsible for. At the present time in SWMACC, WES performs a significant amount of monitoring of various pollutant levels under a DEQ-approved surface/stormwater monitoring plan: a) at one City/County-owned storm sewer outfall during storms, and b) one al creek in both dry weather and during storms. Due to the high cost of mercury analysis, mercury is not one of the pollutants that is monitored from year to year, although Mercury is expected to be monitored in 2014 at the Ms4 permitted storm sewer system outfall in the City of Rivergrove. This monitoring, which will be conducted for a limited time only is required by the MS4 permit. The data could be useful during our efforts to evaluate the effectiveness of this Implementation Plan.

We plan to participate in a coordinated mercury monitoring project for discharges from the MS4 in the

future. The findings will enhance our collective understanding of mercury transport and fate in stormwater. It is expected that useful information about mercury transport and fate in private storm sewer systems, in overland runoff, and in non-MS4 public storm sewer systems in our service areas, sources addressed by this Implementation Plan, can then be estimated after the project is complete. After this mercury concentration data is available, it will be used initially to establish a portion of the baseline level of mercury in our discharges. After a baseline is established, future mercury data will be compared to this baseline to determine if loading has been reduced by 27 percent or more (the TMDL's Interim Allocation Load).

Table 6. Management Strategies Matrix for Mercury

Source	Strategy	How and Implementer(s)	Fiscal analysis	Measure	Timeline	Milestone
<i>What sources of this pollutant are under your jurisdiction?</i>	<i>What is being done, or what will you do, to reduce and/or control pollution from this source?*</i>	<i>How will this be done and by which jurisdiction(s)?*</i>	<i>What is the expected resource need?*</i>	<i>How will we demonstrate successful implementation or completion of this strategy?*</i>	<i>When do you expect it to be completed?*</i>	<i>What goals do you expect to achieve, and by when, to know progress is being made?*</i>
1. Stormwater runoff						<ul style="list-style-type: none"> • • •
	a. Stormwater regulations for new and redevelopment (AJS)	Implement design/construction standards for post-construction phase stormwater management of new/redevelopment within SWMACC. <i>(WES, Clackamas County & Rivergrove)</i>	Currently funded		Ongoing. Revisions to design/ construction standards may follow the development of Watershed Action Plans.	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	b. Industrial/ Commercial Stormwater Program	Implement the WES "Stormdrain Cleaning Assistance Program" (SCAP) The SCAP agreements obligate property owners to clean and maintain their storm sewer system. <i>(WES)</i>	0.1 FTE required for SCAP	Track annual letters sent to property owners in SCAP identifying their requirements; track annual reports received from SCAP property owners.	Ongoing	Receive annual reports from owners. Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	c. Water quality monitoring and other stormwater management activities	We will begin monitoring for mercury in discharges from the MS4 in 2014, as required by the MS4 permit and as a part of the stormwater and in-stream water quality monitoring program. . <i>(WES & Clackamas County)</i>	Existing monitoring levels currently funded. Additional funds required for Mercury Analysis have been budgeted (AJS)	Review monitoring results annually and evaluate effectiveness of management strategies. Track # of curb miles swept per year and other relevant data.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.

Table 6. Management Strategies Matrix for Mercury						
2. Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Administer Clackamas County's Dump Stoppers Program in rural areas and administer solid waste nuisance ordinance in urban areas. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities. <i>(Clackamas County)</i>	Currently funded	<ul style="list-style-type: none"> Track waste removed through Dump Stoppers Program. Track # of persons/year who complete mediation process for solid waste dumping. Track the number of enforcement actions taken/year for solid waste dumping 	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
3. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service roads and within certain other locations within SWMACC. Refer other cases to DEQ. <i>(WES & Clackamas County)</i>	Currently funded	Track the number of discharges/spills per year.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
4. Runoff and soil erosion from construction sites	a. Erosion control program and public education and involvement	Implement erosion control programs in SWMACC, Rivergrove, and Clackamas County DTD service areas. Require erosion control permits as applicable; provide technical assistance, education, and outreach as applicable. Implement road maintenance practices on Clackamas County full maintenance roads according to ODOT BMP manual for water quality and habitat. <i>(WES, Clackamas County & Rivergrove)</i>	Currently funded for SWMACC and Rivergrove; additional resources may be needed. Additional resources are needed in DTD service area.	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.

* Note: Details on management strategies are provided in Chapter 7. Fiscal analysis primarily applies to Clackamas Co. and SWMACC. City of Rivergrove management strategies may require further fiscal analysis.

10.5 Timeline

Our goal is to attain the load allocations for each TMDL parameter through an adaptive management process. We are committed to investing in activities and programs that contribute to overall watershed health. We are currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and we intend to track the effectiveness of these activities with monitoring, as described in Chapter 10.4, because. It is unknown at this time whether the current and planned level of management activities will provide enough pollutant load reduction to meet the Interim Allocation Load (IAL), given the barriers to implementation described in Chapter 10.2. Because a baseline level for mercury in discharges from SWMACC has not yet been established, it will be several years before it is known if the IAL-mandated reduction of 27% has been achieved. As monitoring demonstrates progress toward pollutant reduction, Clackamas County will adaptively manage its activities and programs in order to work toward attaining the IAL.

The attainment of the mercury IAL in SWMACC will likely require action by a variety of government agencies and private landowners Clackamas County's, SWMACC's, and the City of Rivergrove's work towards reducing mercury levels in the waters of the Tualatin River will likely be complemented by actions taken by the following three government agencies who provide additional regulatory authority and/or education & technical assistance:

- The Clackamas County Soil and Water Conservation District
- ODA
- ODF

11. Temperature

11.1 Matrix of Management Strategies

Table 7 lists strategies for management and reduction of elevated water temperature.

11.2 Barriers to Implementation

Much of the privately owned land in SWMACC lies within timber management and agricultural areas. The TMDL in these geographic areas is being administered by ODF and ODA. Management strategies for these lands are not contained within this Implementation Plan.

Desired riparian shade conditions cannot be attained within 100 percent of the watershed's riparian area in SWMACC on Clackamas County and City of Rivergrove-owned lands (SWMACC does not own any land) because these lands have, in some cases, been developed into paved County owned roads, for . Desired riparian shade conditions cannot be attained within 100 percent of the watershed's riparian area on non-ODA/ODF privately-owned lands due to citizens and corporations who will choose to exercise their private property rights, historic land use decisions, and other factors.

11.3 Implementation Monitoring and Evaluation Reports

According to OAR 340-042-0080(3)(a)(C), Clackamas County and SWMACC 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." The other type of performance monitoring, "effectiveness" monitoring, is addressed in 11.4.

Implementation monitoring will be conducted by the City of Rivergrove and by Clackamas County's Water Environment Services, Business & Community Services Dept., and/or by the Dept. of Transportation & Development to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be kept on file in WES' offices. From time to time, when appropriate, this Implementation Plan will be revised to reflect our enhanced understanding of our program's effectiveness and to reflect current watershed conditions

Table 7. Management Strategies Matrix for Elevated Water Temperature

Source	Strategy	How and Implementer(s)	Fiscal analysis	Measure	Timeline	Milestone
<i>What sources of this pollutant are under your jurisdiction?</i>	<i>What is being done, or what will you do, to reduce and/or control pollution from this source?*</i>	<i>How will this be done and by which jurisdiction(s)?*</i>	<i>What is the expected resource need?*</i>	<i>How will we demonstrate successful implementation or completion of this strategy?*</i>	<i>When do you expect it to be completed?*</i>	<i>What goals do you expect to achieve, and by when, to know progress is being made?*</i>
1. Effective shade (radiant heat)						•
	a. Riparian assessment and management	i. Update biological surveys to include benthic macroinvertebrate surveys and habitat/riparian Inventories. Through IGA with ODFW, perform updated biological surveys up to 9 river miles within SWMACC (based in part on priority reaches and landowner access). Biological surveys to include: a) fish abundance and distribution; b) habitat and riparian shade assessments; c) canopy density measurements; and d) continuous summer temperature monitoring during June thru Sept. (WES)	\$100,000 budgeted in FY 2010.	Final reports to include specific reaches with recommended list of actions for restoration and protection.	2010-2015	Identify and prioritize riparian areas.
		ii. For roads with Full County Maintenance, apply ODOT Guide. As roads are maintained, repaired, and rebuilt, the ODOT Guide's BMPs will be used to address river/stream surface shade where appropriate over time. (Clackamas County)	Currently funded. Additional resources needed	Qualitative assessment through interviews with staff.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	b. Implement Other Watershed Protection Regulations	i. Metro Title 3 - Within SWMACC (but outside of City of Rivergrove). The equivalent of Title 3 is part of the SWM Rules and REGS for SWMACC. WES has contracted with Clackamas County Planning to administer these requirements within SWMACC's unincorporated areas. (WES, Clackamas County)	Currently funded. Additional resources may be needed	Analyze aerial photos for changes in tree canopy.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
		iii. Metro Title 13 (Goal 5)—Clackamas County/WES jurisdictional areas. This will be adopted by ordinance and HCA maps by DTD Planning. (Clackamas County)	Additional resources needed: (Minimum \$100,000).	Analyze aerial photos for changes in tree canopy.	Ordinance and Map of Habitat Conservation Areas adopted by December 2008	Protection of Class I and II HCA's. Report to Metro REIN Program and annually.
		iv. River and Stream Conservation Area (ZDO 704). This is	Currently funded	Analyze aerial photos for changes in	Ongoing	Evaluate measures

Table 7. Management Strategies Matrix for Elevated Water Temperature						
		administered by Clackamas County. (Clackamas County)		tree canopy.		annually for effectiveness and level of service; apply adaptive management.
		v. Floodplain Management District (ZDO 703). This is administered by Clackamas County. (Clackamas County)	Currently funded	Analyze aerial photos for changes in tree canopy.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
		vi. Wetland Provisions of ZDO 1002 and 709. These ZDOs, which only apply to wetlands, are administered by Clackamas County. (Clackamas County)	Currently funded	Analyze aerial photos for changes in tree canopy.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	c. Public involvement and education	i. Encourage landowners to voluntarily protect/enhance their riparian areas through public education and involvement (e.g. Earth Day event providing educational lecture, informational pamphlets, and field demonstration). (WES & Clackamas County)	Currently funded, additional resources may be needed.	Qualitative assessment through interviews with staff.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
		iii. Provide education opportunities for Environmental Youth Corps members, school groups, private company and non-profit groups, and individual volunteers to help restore riparian habitats through restoration work events. These events highlight specific topics such as canopy cover, non-native plant invasion, soil erosion and health. (Clackamas County)	Currently funded	Track the number of volunteer Events and their associated activities (i.e. amount of trash removed, Number of plantings, etc)		Evaluate measures annually for effectiveness and level of service; apply adaptive management.

* Note: Details on management strategies are provided in Chapter 7. Fiscal analysis primarily applies to Clackamas Co. and SWMACC. City of Rivergrove management strategies may require further fiscal analysis.

11.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if the selected management strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County, the City of Rivergrove, and/or SWMACC are responsible for. The resulting data will then, from time to time, be compared to:

- The non-point source temperature LA—or the LA surrogate, percent effective shade—to determine if the allocation or surrogate has been attained, and/or
- Current water quality standards and to historic data to determine if in-stream water quality has improved to the desired level or by the desired percentage.

In-stream temperature monitoring is expected to include:

- Continuous monitoring of water temperature in the Tualatin River (at the Lake Oswego Corporation's dam in River Mile 3.4) by the U.S. Geological Survey (USGS). For several years, funds from SMWACC have been paid to the USGS to offset a portion of the total cost of this and other USGS monitoring of the River flow and water quality, and we expect that SWMACC will continue to contribute to this effort in future years if funds continue to be available. This cooperative monitoring arrangement's participants also include Washington County's Clean Water Services, and the Cities of Lake Oswego and West Linn.
- One grab sample is collected from Pecan Creek, which is tributary to the Tualatin River in SWMACC by WES. Please see the current surface/stormwater monitoring plan for more information about current monitoring locations and frequencies.

In addition, it is expected that riparian area shade monitoring will be conducted in the future in portions of SWMACC through updated Biological Surveys and other programmatic efforts. Shade monitoring in SWMACC could be conducted by Clackamas County, SWMACC, the City of Rivergrove, West Linn, Lake Oswego, or Tualatin, DEQ, or ODFW.

11.5 Timeline

Our goal is to attain the load allocations for each TMDL parameter through an adaptive management process. Clackamas County is committed to investing in activities and programs that contribute to overall watershed health. Clackamas County is currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 11.4. 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 allocation given the barriers to implementation described in Chapter 11.2. As monitoring demonstrates progress toward pollutant reduction, we will adaptively manage our activities and programs in order to work toward attaining the load allocation.

We will address the temperature TMDL by focusing on the acquisition of an increase in riparian shading. It will take many years for sufficient numbers of 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 in SWMACC were to be planted with native trees within ten years, which is exceedingly unlikely, it would take at least sixty more years for the trees in all of these areas to reach sufficient size to yield System Potential shade conditions.

As discussed in the Barriers to Implementation section, System Potential shade conditions cannot be attained within 100 percent of the watershed's riparian area in SWMACC on lands owned by Clackamas County and the City of Rivergrove, and on non-ODA/ODF privately owned lands due to private property rights, historic land use decisions, and other factors.

It is expected that the eventual attainment of improved riparian condition in SWMACC will be the product of a series of partnerships between Clackamas County, SWMACC, the City of Rivergrove and:

- Citizens
- Non-profit organizations (the watershed council, Friends of Trees, SOLV, etc.)
- Certain for-profit companies who own land in the watershed
- The Clackamas County SWCD
- Metro (large landowner and riparian area regulator)

12. Dissolved Oxygen

12.1 Matrix of Management Strategies

Table 8 lists strategies for the management of Settleable Volatile Solids (SVS) in stormwater runoff, which is expected to yield some improvement of dissolved oxygen levels in the Tualatin Watershed.

12.2 Barriers to Implementation

As was previously noted in this Plan, the DEQ established a new TMDL for DO – this one based on reducing the levels of settleable volatile solids (SVS) – in the Tualatin River watershed in 2001. Levels of SVS are believed to play in role in contributing to the amount of instream DO that bed sediments remove as organic material is consumed or decomposes. The DO TMDL's Load Allocations (LA) that were issued are for SVS. The LAs are expressed in terms of a required percent reduction of SVS in stormwater runoff. For the roughly 27 acres of land in SWMACC which can drain into Carter Creek, a Fanno Creek tributary, the required SVS reduction is 50% from May 1st to October 31st. For all other streams in SWMACC, including the mainstem Tualatin River, the required SVS reduction is 20% from May 1st to October 31st.

This Implementation Plan addresses SVS that are discharged by the following types of conveyance systems from lands under our jurisdiction (i.e., land not owned by the state or federal government, and land not in geographic areas regulated by ODA and ODF):

- Clackamas County, City of Rivergrove, and SWMACC-owned storm sewer outfalls that are not subject to the MS4 permit's requirements.
- Privately owned storm sewer outfalls.
- Overland sheet flow or channelized flows that do not flow through MS4-permitted or privately owned storm sewer outfalls.

Clackamas County's, SWMACC's, and the City of Rivergrove's authority to control sources of SVS in privately owned conveyance systems is usually quite limited. If Clackamas County, SWMACC, and/or the

City of Rivergrove becomes aware of a privately owned conveyance system that is a significant, known source of SVS, the matter will be referred to DEQ if public education and/or mediation fail to yield the necessary water quality improvement.

Clackamas County, SWMACC, and the City of Rivergrove cannot and do not accept sole responsibility for reducing SVS levels in the Tualatin River or in any of its tributaries. Clackamas County, SWMACC, and the City of Rivergrove do accept some of the responsibility for reducing the fraction of the SVS levels:

- Which originates on those *lands* which Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate, and
- Which is generated by the specific *land uses or activities* that Clackamas County, SWMACC, and the City of Rivergrove have the authority to regulate.

Land ownership categories that may be at least minor sources of in-stream SVS loading which Clackamas County, SWMACC, and the City of Rivergrove have very little or no authority to regulate or control include, but are not limited to:

- Privately owned timberlands
- Privately owned farm, ranch, and orchard lands
- Lands in Clackamas County which are within the Cities of Tualatin, Lake Oswego, and West Linn.
- Interstate 205 and other State-owned lands (if any are present)

The sources of SVS in stormwater and other discharges in SWMACC are not well defined. Examples of materials which do, or can, contain SVS include, but aren't limited to, stormwater runoff which contains: 1) leaves & other pieces of vegetation, and/or 2) soil with a significant amount of organic material. Programs which reduce their instream presence, such as sweeping leaves from roadsides, are expected to yield lower SVS levels in stormwater runoff. During rain events which occur during the TMDL season (May 1st to October 31st), soils, sediments and other solids that may contain SVS can be washed in to the river and tributaries.

Since a laboratory method does not exist for SVS, documenting compliance with this requirement is unusually complex. For several years, we have used, and expect to continue to use, a combination of the following water quality measurements to qualitatively determine our progress towards meeting these LAs:

- Total suspended solids (TSS). Since TSS levels in stormwater runoff tend to be primarily comprised of inorganic materials (i.e. silts and sands), this parameter is only somewhat useful for determining the stormwater's SVS content.
- Volatile solids (VS). Since VS levels in stormwater runoff can be largely comprised of inorganic materials (i.e. certain mineral salts) which don't make a significant contribution to depletion of instream DO levels, this parameter is also only somewhat useful for determining the stormwater's SVS content, and
- Direct measurements of dissolved oxygen in streams and at one or more outfalls using dissolved oxygen meters in the field or using the Winkler method for laboratory analysis.

Since direct measurements of SVS have not yet been conducted on SWMACC's stormwater runoff, it is not known if compliance with the SVS LA will be possible, and if so, whether or not it will be difficult or expensive to do so. It is also possible that SVS levels in stormwater may not be as important, as was once believed, to the depletion of instream DO levels in the Tualatin River. Recent research suggests that leaves from trees which are growing in the watershed's riparian areas are a major contributor to the total supply of

organic material in the Tualatin River's bed sediments. And as was discussed previously, many other factors also influence instream DO levels, including:

- Instream levels of phosphorus and nitrogen-containing compounds, such as orthophosphate and ammonia
- The algal population which is present in the stream (i.e. photosynthesis, respiration, die-off events)
- Water temperature
- Turbulence. When water flows slowly without turbulence, such as is the case for much of the Tualatin River's mainstem, less atmospheric oxygen can be transferred to the stream.

It is our understanding that we are legally responsible only for preventing and/or controlling the portion of the total SVS loading that enters the Tualatin River in SWMACC through stormwater, authorized non-stormwater discharges (i.e. dechlorinated swimming pool wastewaters), illicit discharges, and spills, but only if we have the authority to regulate the activity which caused the pollution.

12.3 Implementation Monitoring and Evaluation Reports

According to OAR 340-042-0080(3)(a)(C), Clackamas County and SWMACC 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." The other type of performance monitoring, "effectiveness" monitoring, is addressed in 12.4.

Implementation monitoring will be conducted by Clackamas County's Departments of Transportation and Development, Business and Community Services, and/or WES, and/or the City of Rivergrove to confirm that specific Management Strategies that are outlined in this Implementation Plan were actually implemented. A summary of the work that was done to implement the Management Strategies will be kept on file in WES' offices. When appropriate, this Implementation Plan will be revised to reflect our enhanced understanding of our program's effectiveness and to reflect current watershed conditions

Section C: Implementation

Table 8 Management Strategies for Dissolved Oxygen

Source	Strategy	How and Implementer(s)	Fiscal analysis	Measure	Timeline	Milestone
<i>What sources of this pollutant are under your jurisdiction?</i>	<i>What is being done, or what will you do, to reduce and/or control pollution from this source?*</i>	<i>How will this be done and by which jurisdiction(s)?*</i>	<i>What is the expected resource need?*</i>	<i>How will we demonstrate successful implementation or completion of this strategy?*</i>	<i>When do you expect it to be completed?*</i>	<i>What goals do you expect to achieve, and by when, to know progress is being made?*</i>
1. Stormwater runoff						
	a. Stormwater regulations for new and Redevelopment	Implement design/construction standards for post-construction phase stormwater management of new/redevelopment within SWMACC. (SWMACC, Clackamas County & Rivergrove)	Currently funded		Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
	b Industrial/ Commercial Stormwater Program	Implement the WES "Stormdrain Cleaning Assistance Program" (SCAP) The SCAP agreements obligate property owners to clean and maintain their storm sewer system. (WES)	Currently funded	Track annual letters sent to property owners in SCAP identifying their requirements; track annual reports received from SCAP property owners.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.

	c. Water quality monitoring	Conduct stormwater and in-stream water quality monitoring. WES provides funds for multi-jurisdictional funding of USGS monitoring of targeted pollutants in SWMACC, including dissolved oxygen at river mile 3.4, and flow in the watershed. <i>(WES)</i>	Existing monitoring levels currently funded	Review monitoring results annually and evaluate effectiveness of management strategies.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
2. Illegal dumping of solid waste	a. Illegal dumping management and public education and involvement	Administer Clackamas County's Dump Stoppers Program in rural areas and administer solid waste nuisance ordinance in urban areas. Provide public education related to illegal dumping, including publicizing Metro hazardous waste facilities.	Currently funded	<ul style="list-style-type: none"> Track waste removed through Dump Stoppers Program. Track # of persons/year who complete mediation process for solid waste dumping. Track # of enforcement actions taken/year for solid waste dumping. 	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
3. Illicit discharges and spills	a. Spill response and IDDE	Implement spill response and IDDE program on Clackamas County full service roads and within certain portions of SWMACC. Refer other cases to DEQ.	Currently funded	Track the number of discharges/spills per year.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
4. Failing septic systems	a. Septic system management	Respond to reports of failing systems; work with homeowner to set a timeline for repair. County-funded Safety Net Program provides low interest loans for low income property owners to repair failing septic systems. <i>(WES & Clackamas County)</i>	Currently funded	Track number of Failures that need repair permits, number of Failures that need maintenance, number of enforcement actions, and # of Safety Net loans provided.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.
5. Pet waste	a. Pet waste management and Public involvement and education	Public education to pet owners through a variety of sources. Continue to encourage the City of Rivergrove to provide the dog waste bag dispenser in the City of Rivergrove's park. <i>(WES, Clackamas County & Rivergrove)</i>	Currently funded	Track number of bags taken from dispensers each year, if possible. Track the number of website "hits" and the number of brochures printed/year	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management
6. Runoff and soil erosion from construction sites	a. Erosion control programs and public and education and involvement	Implement erosion control programs in SWMACC, Require erosion control permits as applicable; provide technical assistance, education, and outreach as applicable. Implement road maintenance practices on Clackamas County full maintenance roads according to ODOT BMP manual for water quality and habitat.	Currently funded	Track erosion control permits issued; inspections performed; enforcement actions taken; and education and outreach activities implemented.	Ongoing	Evaluate measures annually for effectiveness and level of service; apply adaptive management.

* Note: Details on management strategies are provided in Chapter 7. Fiscal analysis primarily applies to Clackamas Co. and SWMACC. City of Rivergrove management strategies may require further fiscal analysis.

12.4 Effectiveness Monitoring

Effectiveness monitoring is conducted to determine if our Management Strategies are effectively reducing in-stream pollutant loading from sources that Clackamas County, the City of Rivergrove, and/or SWMACC are partially or completely responsible for. Each year in SWMACC, WES currently performs a significant amount of monitoring for TSS, VS, and DO: a) one County-owned storm sewer outfall during storms, and b) one creek in both dry weather and during storms. The resulting data on TSS, VS, and/or DO levels in stormwater and instream will then, from time to time, be compared to:

- The applicable SVS LA to determine if the allocation has been attained, if this is even possible to do so, and/or
- Historic data to determine if in-stream dissolved oxygen levels have improved to the desired level.

We believe that the current monitoring locations and frequency provide sufficient coverage of discharges in SWMACC which are addressed by this TMDL Implementation Plan.

In-stream monitoring of TSS, VS and DO in the portion of the watershed that is regulated by the Tualatin TMDL that is in or very near Clackamas County but not within SWMACC is currently performed on an ongoing basis by many other clean water partners, including but not limited to, the DEQ, the City of Portland, and the Cities of Lake Oswego and West Linn.

12.5 Timeline

Our goal is to attain the load allocations for each TMDL parameter through an adaptive management process. We are committed to investing in activities and programs that contribute to overall watershed health. We are currently implementing a variety of management strategies to improve and maintain water quality, as described in Chapter 7, and tracking the effectiveness of these activities with monitoring as described in Chapter 12.4. 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 in Chapter 12.2. As monitoring demonstrates progress toward pollutant reduction, we will adaptively manage our activities and programs in order to work toward attaining the load allocations.

It is expected to take a substantial amount of time to attain the SVS load allocations, for a baseline level of SVS discharges has not yet been established, which is due in large part to the absence of a laboratory method for SVS. After a baseline level of SVS discharges has been established, and after the nature of SVS loading in stormwater is better understood, we will have a better understanding of our ability to attain the SVS LAs during the TMDL season. A large number of storms will need to be monitored to show that the SVS LA has been attained, for measuring a given percentage reduction requires a large data set if one expects to have high confidence in the measurement.

Attaining the load allocations will likely require action by a variety of government agencies and private landowners. Clackamas County's, SWMACC's, and the City of Rivergrove's work toward reducing SVS levels in stormwater in SWMACC will likely be complemented by actions taken by the following three government agencies that provide additional regulatory authority and/or education and technical assistance:

- The Clackamas County Soil & Water Conservation District
- ODA
- ODF

13. Review and Revision of Plan

According to OAR 340-042-0080(3)(a)(C), Clackamas County, the City of Rivergrove, and SWMACC shall “Provide for... periodic review and revision of the implementation plan.” We will review and revise the Implementation Plan on an as-needed basis. The original Tualatin TMDL Implementation Plan was issued on August 7, 2003. On March 31, 2008, the Plan was amended to incorporate elements related to the Willamette River’s mercury TMDL. We then reviewed and, revised the Implementation Plan in 2014 because the Tualatin TMDL was reissued by DEQ in August 2012. This Implementation Plan may be reviewed and, if we deem it necessary, revised at other times if we learn that one or more cost-effective modifications to the Implementation Plan can be made which, if implemented, will result in attainment, or significant progress towards attainment, of one or more LA.

14. Statewide Land Use Requirements

Oregon Administrative Rule 340-042-0080(3)(a)(D) states that—to the extent required by ORS 197.180 and OAR chapter 340, Division 18—evidence of this Implementation Plan’s compliance with the applicable land use requirements shall be provided. Clackamas County, the City of Rivergrove, and SWMACC are currently in compliance with all land use requirements which pertain to this Implementation Plan. This Implementation Plan is consistent with Clackamas County’s Comprehensive Plan and land use regulations, and with the City of Rivergrove’s Comprehensive Plan 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 Implementation Plan is consistent with the County’s Comprehensive Plan and the City’s Comprehensive Plan to the extent required by law.

For example, within the Clackamas County Comprehensive Plan’s “Natural Resources and Energy” Chapter, setback distances from streams/wetland/rivers are addressed with broad policies and in specific detail. These broad setback distance policies and details are then repeated and detailed further in Section 704 of the Zoning and Development Ordinance. While the Clackamas County Comprehensive Plan does not specifically mention TMDLs by name, overarching goals that are present in the TMDL—including the need to keep in-stream water temperatures down during the summer—are addressed in the Comprehensive Plan.

We have concluded that the City of Rivergrove’s and Clackamas County’s Comprehensive Plans have provisions that are relevant to this Implementation Plan and that this Implementation Plan is compatible with these provisions.

15. Citation of Legal Authority

- *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 non-point source 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 with the *Surface Water Management Rules & Regulations*, revised December 15, 2002, and in *the Surface Water Management Administrative Procedures*, dated January 2003.

Surface water management fees charged to customers in the SWMACC Urban Area (SWMACC UGB) support a wide range of Surface Water Management services for the community.

- *Clackamas County Comprehensive Plan, ZDOs, and Other Board Orders.* The Clackamas County Comprehensive Plan was last updated on March 1, 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.

Zoning and Development Ordinances (ZDO) provides the rules, regulations, and standards that implement the goals and policies of the Comprehensive Plan. The ZDOs that serve to protect surface/stormwater quality are:

- ◆ Floodplain Management District (Section 703)
- ◆ River and Stream Conservation Area (Section 704)
- ◆ Willamette River Greenway (Section 705)
- ◆ Habitat Conservation Areas (Section 706)
- ◆ Water Quality Resource Areas (Section 709)
- ◆ Protection of Natural Features (Section 1002)
- ◆ Utility Lines and Facilities (Section 1006)
- ◆ Storm Drainage (Section 1008). Includes stormwater quality control, such as detention and erosion control.
- ◆ Open Space and Parks (Section 1011)
- ◆ Density Standards, Transfers and Bonuses (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. If a property has been proposed to be developed/redeveloped, all Plans are checked for conformance with the following:

- ◆ ZDOs (Clackamas County)
 - ◆ Grading and Excavation Ordinances (DTD)
 - ◆ *The Roadway Standards Manual*. This document provides requirements for drainage standards, roadway standards, and submittal requirements, including a section on hydrology, hydraulics, and water quality. The manual was completed in January 1999 (Clackamas County)
 - ◆ SWMACC's Rules and Regulations. Developers may be required to provide stormwater detention, erosion control, post-construction stormwater treatment, and a stream-side/wetland setback area (WES)
- *City of Rivergrove's Comprehensive Plan and Codes*: The City of Rivergrove's Comprehensive Plan's last major update occurred in 1989. 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 particular Development Code sections that serve to protect surface/stormwater quality are:

- ◆ Subdivision/PUD 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) are expected to be approved in 2008 that will 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:

- ◆ Conditions of Approval associated with the pertinent land use approval
- ◆ Provisions of the Development Code
- ◆ The Engineering Design Standards Manual
- ◆ SWMACC's 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.

16. References

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