Water Quality Report

Tualatin Subbasin TMDL Response to Comments

August 2012

State of Oregon
Department of
Environmental
Quality

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DEQ 12-WQ-050

This report prepared by:

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1. Introduction

This Response to Public Comments document addresses comments received regarding the Draft Tualatin Subbasin Total Maximum Daily Load and Water Quality Management Plan dated September 2011. The Oregon Department of Environmental Quality (DEQ) appreciates the time and effort that all the commenters put into reviewing the document. The TMDL version issued for public comment in September 2011 included a Temperature TMDL that was revised according to the temperature standard adopted in 2004, and subsequently approved by the US Environmental Protection Agency (EPA). On February 28, 2012, U.S. District Court Judge Acosta issued an opinion to a legal challenge of that standard. DEQ is suspending issuance of the revised temperature TMDL for the Tualatin Subbasin until the legal issues are settled. Thus, no comments pertaining to the revised temperature TMDL draft have been responded to here. All other comments have been considered by DEQ and, where appropriate, changes have been made to the final document. The full content of the comments are included in the Appendix to this document.

The TMDL amendments and the revised Water Quality Management Plan have been adopted as a DEQ order and then submitted to the US Environmental Protection Agency (EPA). EPA will then either approve or disapprove the TMDL.

2. Background

The public comment period on the proposed TMDL and WQMP opened on September 27, 2011 and was extended by request through December 14, 2011. The public notice for the public comment period was sent to everyone on a list of interested parties maintained by DEQ. Direct mailings were sent to local officials and the notice was placed on DEQ's website. The public notice was advertised through local newspapers. The TMDL and WQMP were available for downloading from ODEQ's website throughout the comment period.

A public information open house and formal public hearing was held on November 16, 2011 at the Tualatin Valley Fire and Rescue North Operating Center in Aloha, OR. Four members of the public attended the open house and one provided oral comments. All other comments received by ODEQ were submitted in written (paper and electronic) form.

3. List of Comments Provided on the Tualatin Subbasin TMDL

The following people or entities provided comments on the TMDL during the Public Comment Period and were received prior to closure of the comment period 5:00 PM December 14, 2011. There were no comments received after the close of the comment period. Commenters are listed in the order that comments were received. The code is assigned here to identify each commenter on subsequent tables where the issues and responses are briefly summarized.

Code	Commenter	Media
1	Sue Manning	email
2	Tualatin Valley Irrigation District	written
3	Tualatin River Watershed Council	email
4	Eric Lindstrom	email
5	City of Hillsboro Water Department BRJOC	email

Code	Commenter	Media
6	Oregon Department of Agriculture	email
7	Group comments from 13 conservation organizations	email
8	Urban Greenspace Institute (Mike Houck)	email
9	Marissa Houlberg	email
10	Tualatin Riverkeepers	email
11	Bureau of Reclamation	written
12	Washington County	email
13	City of Rivergrove and Surface Water Management Agency of Clackamas County	email
14	Northwest Environmental Defense Center	email
15	Wild Salmon Center	email
16	Clean Water Services	email
17	Lake Oswego Corporation	email

4. General

In the following section, DEQ provides our response to the comments received. The format of this document is a listing of comments and questions grouped by issue, followed by DEQ's response. The commenter codes assigned above are used to identify which parties commented on which issues. The comments are provided in their entirety in the Appendix to this document. The changes referred to in Section 5 have been made to the TMDL submitted to EPA. Additional grammatical, editorial, and formatting errors are not addressed here but corrections have been made in the document. Additional clarifying language was also added to the TMDL document in several places.

5. Summary of Comments, Concerns and Questions

ISSUES	RESPONSE
Phosphorus and Ammonia TMDL Amendments	
Commenters requested that TMDL allocations be provided for daily and seasonal time intervals in order to provide operational flexibility in meeting the allocations. One commenter requested clarification regarding the treatment plant bubble load for phosphorus. Commenters also sought clarification on the dates that TMDLs apply, one suggesting that allocations for erosion should apply year-round, and one commenter requesting that the season for total phosphorus allocations be shortened for all sources. One commenter inquired whether phosphorus loads should be revised to address algal blooms. **Commenters 6, 13, 16, 17**	As required by the Clean Water Act, TMDLs must include load limits for pollutants calculated for a daily time period. These limits can be extrapolated to other time periods. This may be done to make implementation or compliance assessment easier. Providing TMDL targets in multiple but equivalent units in the TMDL may make it easier for permit writers and authors of implementation plans to adopt appropriate management strategies to decrease pollutant loads to waterways. For this reason, additional values for waste load allocations were added to Chapter 3, Phosphorus TMDL Amendment. Clarifying language was also added to the TMDL to indicate that permit limitations maybe be based on monthly and/or seasonal load allocations in lieu of meeting daily load limits specified. Equations for calculating the bubble load for P for Clean Water Services facilities were modified for clarity. One commenter requested that the TMDL critical period for phosphorus be shortened for additional DMAs

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	that do not contribute to the Tualatin River upstream of the Oswego canal. The critical period for phosphorus was altered for the waste water treatment plants specifically because they must make daily alum treatments in order to meet the waste load allocations for phosphorus. As outlined in Section 2.9 of the Phosphorus TMDL amendment, load allocations are generally met by implementing management practices that are not modified on a daily basis. In addition, while most of Clackamas county lands that drain to the Tualatin River do so downstream of Lake Oswego Canal, waste load allocations for runoff to Oswego Lake apply year round. These dates remain unchanged by this TMDL amendment. One commenter questioned why seasonal dates are set when the Phosphorus TMDL applies to riparian bank erosion, as erosion at any time of year could be a source of phosphorus. This load allocation was set in the 2001 TMDL, and there is no additional information for this amendment that demonstrated a need to change the dates during which the load allocation applies. The 2001 TMDL indicated that riparian bank erosion would be best addressed through the establishment of riparian restoration, as required by the TMDL for temperature. The establishment of riparian vegetation would stabilize banks year-round, effectively extending the benefit of the load allocation to address year round inputs.
The Commenter questions whether additional allocations should be adopted for nitrogen in order to address continuing algal problems in the basin. In addition, the commenter indicates that there are no load allocations assigned for ammonia. **Commenters 6**	This TMDL includes an amendment for ammonia that changes only the discharge locations for the point sources that were given waste load allocations in the 2001 TMDL for dissolved oxygen. Aside from the minor change of allowing some of the waste load for ammonia to be discharged further upstream, the load and waste load allocations for ammonia in the 2001 TMDL still apply. Figure 64 of the 2001 TMDL specifies load allocations for ammonia that apply to nonpoint sources. The TMDLs for total phosphorus and ammonia have been effective at addressing violations of the pH standard, and have lowered chlorophyll *a* concentrations in the basin. Dissolved oxygen concentrations have improved; a series of studies by the US Geological Survey indicate that by far the largest remaining sink for dissolved oxygen is sediment oxygen demand. Thus there is no apparent reason to alter the load allocation for ammonia or add a TMDL for other forms of nitrogen at this time.
Requests to Address Hydromodification from Storm Water Inputs with a TMDL	
Several commenters requested that DEQ develop a TMDL for biological impairments under DEQ's biocriteria standard, and proposed that the per cent of effective impervious surface be used as the surrogate parameter for TMDL allocations. **Commenters 1, 4, 7, 9, 10**	EPA and DEQ are currently reviewing the status of streams on Oregon's 303(d) list that have been identified as impaired because they do not meet DEQ's criteria for biocriteria. Currently these sites are listed in category 3c; classified as impaired but the impairing pollutant is unknown. The agencies are considering reclassifying these to Category 5, needing a TMDL. If these classifications changes are made to the 303(d) list,

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	DEQ will determine when TMDLs will be developed for these additional listings as the TMDL priorities and schedule are developed throughout the state. DEQ has assigned both waste load and load allocations for bacteria and total phosphorus in stormwater in the Tualatin Basin. Although these allocations may not be the most direct way to address hydromodification impacts from stormwater runoff, many of the techniques and best practices that can be used to reduce bacteria and P associated with stormwater are also effective in addressing hydromodification. While there are no TMDL allocations currently in effect that directly address the impacts of hydromodification, there are existing programs that do address hydromodification. Oregon's Municipal Separate Storm Sewer System NPDES permits (MS4) address impacts of hydromodification in the urban areas of Washington County. Both the counties in the Tualatin Basin and Metro have the authority to adopt building codes that ensure the use of Low Impact Development practices and green infrastructure. Most of the urban area in the Tualatin Basin is covered by the MS4 Permit held by Clean Water Services, as part of their watershed NPDES permit. This permit renewal is expected soon after this TMDL is finalized. It is anticipated that conditions in the reissued MS4 permit will be similar to recent MS4 permit renewals in the Portland metropolitan area. Several specific conditions in these permits address the impacts of hydromodification including requirements for onsite retention (e.g., infiltration, evapotranspiration, capture and reuse), adopting measures to reduce runoff volume and duration, prioritizing and adopting management measures such as LID and green infrastructure, and including a requirement to capture and treat 80% of runoff. The MS4 permittee must identify and minimize building code and development barriers that affect implementation of best management practices for dealing with stormwater. The permits also require the permittee to adopt a retrofit strategy from existing infrastructure which will address hydromodification under specified circumstances. Finally, the recently issued MS4 permits require the permittee to assess the impacts of hydromodification in the area covered by their permit. This information will be used to develop additional conditions in the subsequent MS4 permits.
Commenter requests that DEQ use its authority to develop and require NPDES permits for runoff from property that has more than 1 acre of impervious surface. **Commenters 10**	The commenter requests DEQ to use residual designation authority to develop a post construction stormwater permit for landowners who own more than 1 acre of impervious surface. DEQ is not planning to develop an additional permit to address stormwater discharges from these large commercial or multi-family residential properties because most of these areas in the Tualatin Basin are covered under the MS4 permit. As described in the previous comment, DEQ is anticipating that specific conditions will be added in the reissued MS4 permit to address runoff from impervious surfaces.

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Water Quality Management Plan, Designated Management Agencies and Responsible Parties, & TMDL Implementation	
Commenters identify insufficient monitoring of TMDL implementation in the past and request more extensive work in future. Others suggested that previous TMDL monitoring has not been sufficient to evaluate whether existing programs are working, including whether load allocations are being met, or how extensively implementation has occurred. One commenter suggested that there is not reasonable assurance that ODA can meet its allocations, especially for total phosphorus. Some commenters requested that the TMDL or WQMP require monitoring of specific indices to track TMDL implementation.	DMAs are required to develop and conduct TMDL implementation monitoring. DEQ plans to work with DMAs to build on existing monitoring efforts. Information about ongoing and future Tualatin activities has been added to the Adaptive Management Section of the WQMP 4.1.1. DEQ is also working closely with the Local Agricultural Committee and ODA during the biennial review of their local area plans to ensure that the revisions address the TMDL Implementation Plan requirements. DEQ does not include detailed requirements in the Tualatin TMDL for monitoring and other implementation issues, to provide each source with the flexibility to implement the most effective actions. DEQ thinks that impairments are best addressed with site-specific or sector-specific approaches developed and implemented by local partners.
Commenter requests that DEQ require DMAs to follow DEQ's 1997 guidance for WQMPs	DEQ's 1997 document provided guidance for developing watershed-scale water quality management plans that could serve as TMDLs in subbasins with only non-point sources of pollution. The guidance has since been replaced by the adoption of Oregon Administrative Rule Chapter 340, Division 0042, describing the TMDL process, as well as DEQ guidance documents for the development of Implementation Plans (http://www.deq.state.or.us/wq/tmdls/implementation.htm link also added to the WQMP).
Several commenters indicated that the DMA responsibilities for both new and existing DMAs were not clearly identified in the TMDL. One commenter suggested that DMAs who had previously submitted Implementation Plans may not need to submit new plans.	Table 5-3 has been added to the Water Quality Management Plan that identifies each DMA, provides a reference to their allocations, and identifies their Implementation Plan schedule. The WQMP was also modified to clarify DEQ's expectations from various DMAs. DEQ does intend that all existing implementation plans be reviewed for possible revision, and generally anticipates that older implementation plans will require at least some revision so that they comply with implementation plan requirements and reflect current DMA activities.
Commenters requested that DEQ include guidance and timelines for riparian enhancement as well as for erosion control efforts.	Commenters requested that the TMDL include additional guidance regarding riparian enhancement. The TMDL is a Department order, so including specific requirement for implementation could result in adopting inappropriate or less effective practices in some locations. In addition, detailed specific requirements could limit the use of newly developed approaches discovered after the TMDL is issued. To allow flexibility, DEQ has required that site potential shade be established across the basin, and has provided load allocations for total phosphorus that should be addressed with erosion control efforts. The 2001

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	Temperature TMDL included some subbasin indications of the status of shade in Tualatin subbasin streams. DEQ anticipates that DMAs will address these requirements and report site specific data that demonstrate that appropriate measures to improve both riparian condition and to control erosion have been implemented. A general timeline for attainment of water quality standards is a required element under Division 42, however DEQ has not included detailed timeline for implementing phosphorus and temperature TMDLs. DEQ requests participation from the DMAs and RPs in setting timelines for meeting the TMDL LA and WLA. DEQ recognizes that implementation of management practices requires funding, thus timelines for implementing TMDL practices should be approved as part of Implementation Plans.
One commenter noted that DMA requirements to address sources of pollution on private land could alter the relationship between the DMA and the private sector.	DEQ acknowledges that TMDL requirements and implementation may alter existing relationships between DMAs and other parties. DEQ also acknowledges the requirements of the Clean Water Act, and strives to identify the appropriate authorities in the TMDL for implementing the Clean Water Act.
Some commenters requested that DEQ require the adoption of financial plans for implementation.	DEQ agrees that cost is an important factor in implementing TMDL requirements, thus the Water Quality Management Plan requires DMAs and RPs to include a discussion of costs and funding in their Implementation Plans (WQMP, section 4.2.9). Many different sources of funding are currently available, and funding options may change over time, so DEQ does not require the identification of specific funding streams in the TMDL. Further, DEQ will require DMAs to have a strategy for acquiring adequate funding for TMDL implementation in their implementation plans.
One commenter noted that there are large areas of impervious surface in the Tualatin Subbasin that can affect water quality, and encouraged DEQ to err on conservative side in order to protect fish, wildlife and people. **Commenters 1, 2, 5, 6, 8, 9, 10, 12, 13, 14, 16**	As required under the Clean Water Act, each TMDL includes a margin of safety. This “cushion” is built into each TMDL to ensure that once the TMDL is implemented, water quality standards will be attained and beneficial uses will be protected. Thus TMDLs do “err on the conservative side” to protect fish, wildlife, people and all of the designated beneficial uses. In addition to the TMDL requirements, to further protect aquatic resources, DEQ will look for DMA’s implementation plans to address likely future changes to land use, population, and development.
One commenter requested that DEQ describe Watershed Assessment and Action Plans and require TMDL Implementation Plans to include action items in their Implementation Plans. The commenter also wanted DEQ to compare implementation-ready TMDLs and the expectations for DMAs to this TMDL revision.	DEQ has been completing basin assessments to identify the major water quality issues and actions to address those issues in basins around the state. These assessments are intended to be a holistic look at water quality issues and not restricted to water quality impairments and TMDLs. Examples are found on DEQ’s website at http://www.deq.state.or.us/wq/watershed/watershed.htm.

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Commenter 16	The Tualatin Basin assessment is slated for completion during 2012. DEQ encourages DMAs to consult this assessment and action plan in developing Implementation Plans. DEQ intends to work with DMAs as they develop their TMDL implementation plans, and will point out appropriate sections of the basin assessments to each DMA. DEQ is in preliminary stages of evaluating what components would be in an Implementation Ready TMDL. That process is not complete and will not be incorporated in the Tualatin TMDL revisions. With the current effort, DEQ is completing a revision to an existing Tualatin Subbasin TMDL, and anticipates that continuation of the work already initiated in the basin will meet the TMDL allocations.
The Commenter requests that DEQ require that Water Quality Management Plans or NPDES permits for the USFWS Refuge impoundments should specifically not allow summer discharge (May-October). **Commenters 10**	DEQ does not issue NPDES permits for discharges from impoundments. However, DEQ can and does require water quality management plans (OAR 340-042-0080(1)) for impoundments that contribute to water pollution. This TMDL requires such plans from the USFWS (refuge units including related impoundments and future acquisitions) and the Wapato Improvement District (as owners of the Wapato Lake Unit). For some impoundments, ceasing discharge during summer months may be a reasonable management strategy, while for others delivering water downstream is important. Whether summer discharges occur will not be dictated by this TMDL, but may be considered by DMAs or Responsible Parties in the TMDL Implementation Plans that must be approved by DEQ.
Commenters would like the TMDL to state explicitly that the Forest Practices Act is inadequate to protect fish, and request that the TMDL include a requirement that the Oregon Department of Forestry review the Forest Practices Act (FPA) rules and revise them to ensure that practices will meet temperature allocations assigned to forest land. Commenters also request that the TMDL require further analyses of the sufficiency of FPA and TMDL allocations. **Commenters 10, 14, 15**	An ongoing long term Riparian Function and Stream Temperature monitoring project, referred to as the Ripstream study, has identified that the Forest Practices Act requirements are insufficient to protect cold water temperatures on some forest lands. In January 2012, the Oregon Board of Forestry issued a finding of water resource degradation related to forestry practices and asked ODF to begin a rule analysis. DEQ continually works with ODF, and has provided funding to ODF to evaluate forest practices. DEQ's TMDL rule (Oregon Administrative Rule 340-042-0080(2) describes the process for aligning the Forest Practices Act with Oregon water quality standards and TMDLs. This TMDL relies on that existing rule language for TMDL implementation on state and private forest land, and therefore does not provide direction to the Department of Forestry. However, the TMDL has been revised to acknowledge the results of the Ripstream study and to identify DEQ's above-mentioned rule language regarding sufficiency of the Forest Practices Act. The TMDLs for temperature and total phosphorus both include load allocations for nonpoint sources that apply to forestry practices.
Add statistics about rural residential land because these lands are managed	DEQ has included rural residential land in Figure 1-5, but in general has not included detailed descriptions

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differently **Commenter 13**	of acreage for any landuse categories. DEQ recognizes that both management practices and legal authorities may differ among land uses, and has tried to make this clear in the Chapter 4, the Water Quality Management Plan.
Commenters requested that the TMDL add Metro as a DMA, and clarify their role as land use agency as well as landowner. **Commenters 7, 10**	Metro has been identified as a Designated Management Agency for its roles both as a landowner in the basin, and as a planning agency that implements Oregon's Land Use Planning laws. Chapter 4, the Water Quality Management Plan includes DEQ's TMDL expectations for Metro.
Commenter requests that the TMDL identify the USFWS as DMA for the Wapato Lake Area. **Commenters 10**	The USFWS is now the legal owner of the dikes that surround Wapato Lake, and the pumphouse used to manage Wapato water levels. The TMDL and WQMP revisions have been revised to identify the US Fish and Wildlife Service as the current party legally responsible for the Wapato unit.
Commenter requests that the TMDL identify the City of Rivergrove and the Surface Water Management Agency of Clackamas County as DMAs in table 3-10 and 3-15 (public comment draft reference numbers) **Commenter 13**	DEQ has added these designated management agencies to the Water Quality Management Plan. DEQ has not added these DMAs to Tables 2-10 and 2-15 because these tables were lifted directly from the 2001 TMDL for Total Phosphorus. The allocations from these tables do apply to the City of Rivergrove and the Surface Water Management Agency of Clackamas County as "other sources." DEQ has also added a table to the Water Quality Management Plan that identifies the allocations for which each DMA/RP is responsible.
Commenter requests that urban landowners with management responsibilities for small impoundments be identified as DMAs **Commenter 10**	Entities that are responsible for potentially substantial contributions to water quality are specifically called out as Designated Management Agencies or Responsible Parties in the Water Quality Management Plan of the Tualatin TMDL. These are parties for which there are documented pollutant contributions, or for which there is a reasonably high potential that the party has a significant contribution to water quality. However, the Water Quality Management Plan also makes it clear that every source of pollution has a responsibility to meet the TMDL allocations that apply to that source. There are many owners of small dams in the Tualatin Basin. Reservoir owners not identified specifically as DMAs are not required to submit TMDL implementation plans, but are required to understand and mitigate thermal impacts from their dams. The Water Quality Management Plan has been modified to clarify these responsibilities.
Comments on Trading Program	
One Commenter requests that DMAs with temperature load allocations be required to meet those load allocations so that temperature trade mitigation efforts can be focused on areas that are not already assigned allocations. Another commenter questions the allotment of long-term credit in Oregon's trading	Trading programs are designed to incentivize early action and increase the pace of restoration of priority areas within a watershed as specified by a TMDL; they are not based on the failure of DMAs to comply with their load allocations. NPDES permittees cannot obtain thermal credit for activities that are already required by statute or rule. Regulations adopted by DMAs to comply with TMDL requirements typically contain prohibitions on working within riparian areas but do not require active restoration

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program, and would like to see trades tied to priority areas. **Commenters 10, 14**	of these areas. As a result, NPDES permittees are allowed to obtain thermal credits for active restoration and maintenance (also referred to as "uplift") of riparian areas throughout a watershed. The CWS trading program is based in large part on the willingness of private landowners to participate and, as a result, restoration opportunities are often limited. Accordingly, DEQ provides CWS with the flexibility to develop its program accordingly within areas allowed by the TMDL. In addition, the trading program does provide measureable results. When a TMDL uses effective shade as a factor in modeling water quality, it is appropriate to allow permittees and DMAs to measure their progress by monitoring shade coverage at project sites. Permittees are required to actively monitor and maintain restoration sites to obtain thermal credits. Based on advice from conservation and restoration groups, annual monitoring and maintenance of restoration sites is needed for a minimum of five years. At five years, sites have typically reached the "free-to-grow" stage and yearly monitoring and maintenance is not needed; however, the permittee will still need to regularly verify that sites are performing as planned for the life of the credit and recalculate credit availability if a project is not functioning as initially intended. The TMDL does not require immediate compliance with thermal load and wasteload allocations. Based on the wasteload allocation for CWS from the 2001 TMDL, DEQ established a trading ratio of 2:1 for CWS's current trading program, which means that for every unit of excess heat load that CWS wishes to offset via shade planting, two units of solar radiation must be blocked by that planting. The ratio provides for a margin of safety to address uncertainties associated with the challenge of accurately assessing the benefits of riparian restoration activities and compensates for the time it takes for shade to establish. The CWS trading program is now well established, and has sufficient interest from the private sector that prioritizing restoration areas is necessary. CWS trading proposal will be available for public review as their watershed permit is renewed.
Clarifications and Other Comments	
The Tualatin River Watershed Council, who acted as the local advisory group for the TMDL, expressed support for the approach that DEQ used to engage the Council. **Commenter 3**	DEQ appreciates the input, and is glad to have made a successful effort.
Commenters provided clarifications on many topics. **Commenters 5, 6, 11, 12, 13, 16, 17**	Commenters offered numerous editorial comments to improve the accuracy and clarity of this document. DEQ improved the TMDL document by adopting these changes, and greatly appreciates the commenter's input. All of the comments are included in

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	the Appendix to this chapter, so the reader can review these comments as desired.

Tualatin Subbasin TMDL

Response to Public Comments: Appendix

State of Oregon
Department of
Environmental
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Contents

The following Table identifies the parties who contributed comments during the public comment period. The code is used to identify commenters in Section 5 of the Response to Comments chapter.

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1	Sue Manning	email
2	Tualatin Valley Irrigation District	written
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14	Northwest Environmental Defense Center	email
15	Wild Salmon Center	email
16	Clean Water Services	email
17	Lake Oswego Corporation	email

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November 16, 2011

Avis Newell
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

RE: Tualatin Basin TMDL Revisions

Dear Ms. Newell,

What happens upstream, affects what happens downstream.

For the past 12 years, students at Fowler Middle School have planted native trees and shrubs in the riparian area of Summer Creek. A portion of this creek flows by the school before meeting with the confluence of Fanno Creek at the edge of the school property boundary. Considering that there are about 850 students (11 – 14 yrs. old) who attend this school, and almost every student is involved in the plantings each year, that is a large number of shade trees which have been planted to protect the creek.

Students in 6th & 7th grade classes are also involved with ODFW's STEP Program (Salmon Trout Enhancement Program). For the past 8 years, students have been given 500 fish eggs to monitor their growth via water temperature and pH. When they are "buttoned up" and ready to release, students transport them from their refrigerated classroom aquarium to their new home: Summer Creek. Hopefully they make it to the Tualatin River, the Pacific Ocean and back again someday.

Students know that water quality of the creek is very important to support the native fish and invertebrates that reside there. Cooler temperatures created by shade, high oxygen levels due to ripples and log jams and low phosphate levels because of lack of upstream fertilizers are all very important factors for the health of the fish that they release. Dams like the ones at Summerlake Park and Murrayhill do the opposite of what students are trying to achieve, by warming up the creek water. These issues are not addressed in the current temperature TMDL. Please include a specific temperature allocation in the TMDL for dams that increase the temperature on Summer Creek and Fanno Creek.

The upstream dam at Summerlake is a major roadblock to students' efforts. The lake that is created behind the dam increases the water temperature which lowers oxygen levels. The dam also creates a barrier for fish to move upstream. FMS students have seen 5 – 6

inch steelhead trout in deeper pools in the creek just last month. The phosphates that run off of the fertilized lawn also degrade the water in the creek.

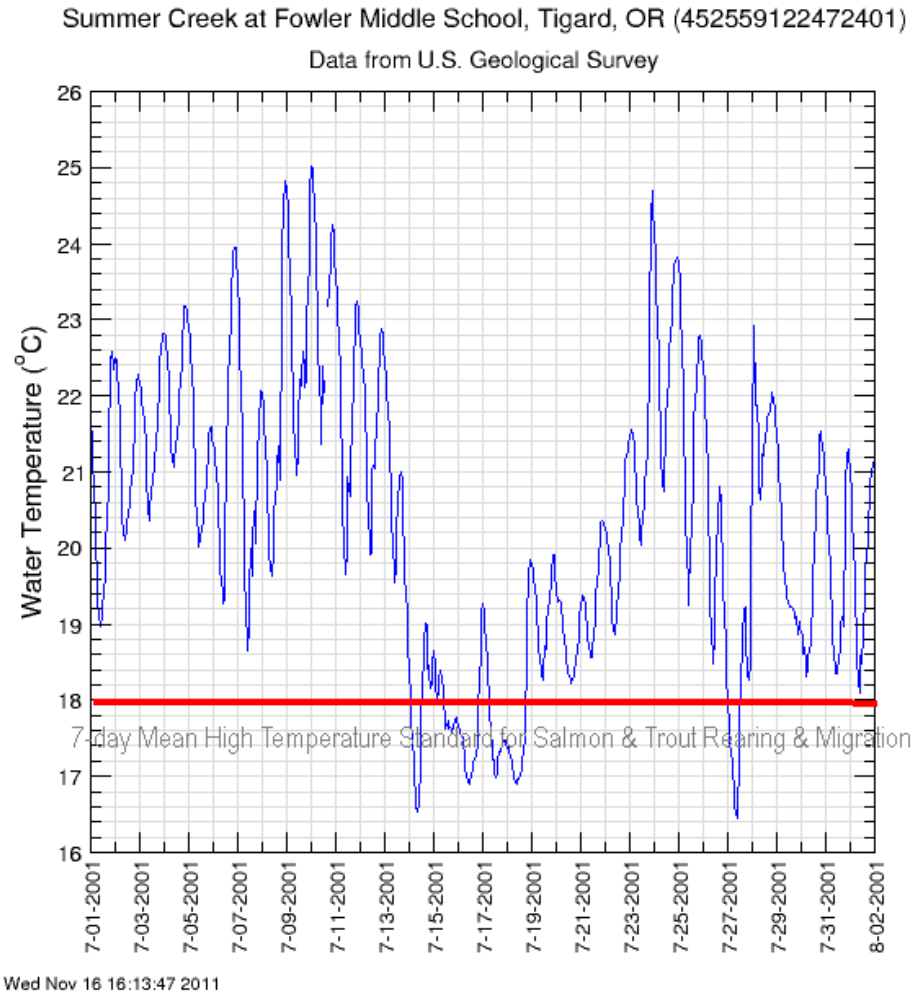
Summer Creek has been listed on DEQ's 303d list of water quality limited streams for biological criteria for years. Yet this listing has not resulted in a TMDL that addresses biological criteria. A significant body of research from NOAA Fisheries, University of Washington and the Center for Watershed Protection has built a strong correlation between the decline of biological communities in streams and impervious surfaces caused by urban development.

I am aware of TMDLs in New England that address biological criteria with an allocation for impervious cover. This kind of TMDL is needed for Summer Creek and Fanno Creek to help restore native macroinvertebrates and salmonid population.

My students have also invested time and effort in cleaning up Summer Creek by building two large rain gardens in the school's parking lot. The runoff from the impervious surface is diverted into the rain gardens which collect the water and allow it to slowly percolate through the soil instead of dumping directly "down the drain" and into the creek. (There are other culverts on the property that have not been diverted.)

Monitoring water quality, hatching fish and planting thousands of trees are all positive impacts on the creek. Student's efforts have built a strong sense of hope for the return of steelhead trout to our neighborhood, but their efforts cannot succeed without a watershed approach that protects Summer Creek from polluted runoff, excessive temperatures and unnatural hydrology. Please support my student's efforts and protect Summer Creek and Fanno Creek with TMDLs for impervious cover/biological criteria and dams that raise water temperature and block fish passage.

Sue Manning


Summer Creek at Fowler Middle School, Tigard, OR (452559122472401)
Data from U.S. Geological Survey
Water Temperature (°C)
26
25
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16
7-day Mean High Temperature Standard for Salmon & Trout Rearing & Migration
7-01-2001
7-03-2001
7-05-2001
7-07-2001
7-09-2001
7-11-2001
7-13-2001
7-15-2001
7-17-2001
7-19-2001
7-21-2001
7-23-2001
7-25-2001
7-27-2001
7-29-2001
7-31-2001
8-02-2001
Wed Nov 16 16:13:47 2011

TUALATIN VALLEY IRRIGATION DISTRICT

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November 15, 2011

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Re: Tualatin Subbasin TMDL

The 2011 Tualatin TMDL amendment identifies Tualatin Valley Irrigation District (TVID) as a Designated Management Agency (DMA) and requires TVID to develop a Water Quality Management Plan (WQMP). The DEQ expectations for TVID's WQMP are stated as follows:

TVID shall develop a TMDL Implementation Plan that describes best management practices, measures, and/or control technologies that the district will use to reduce its impact. Relevant TMDL parameters that shall be addressed for the Tualatin are heat, total phosphorus, settleable volatile solids, and bacteria.

The TMDL does not specify load allocations for TVID so the goals and objectives of the WQMP are unclear. Furthermore, without clear goals and objectives, it is not clear how DEQ would determine the adequacy of the management practices proposed in the WQMP. TVID controls the transport and delivery of irrigation water from the Bureau of Reclamation's Henry Hagg Lake to irrigators in the Tualatin Basin. TVID's transport and delivery system consists of pressurized pipeline without connections to surface waters. Since there are no connections to surface waters, TVID's transport and delivery system does not contribute heat or any other pollutants to the Tualatin River. As a result, TVID does not have allocations in the TMDL for any of these pollutants. For these very reasons, TVID should not be listed as a DMA and required to develop a WQMP.

Please call me if you have any question at 503-357-3118

Sincerely,

Joe Rutledge

District Manager

TUALATIN RIVER
WATERSHED COUNCIL
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Engaging the community to sustain our watershed

November 26, 2011

Ms. Avis Newell
DEQ Northwest Region
2020 SW Fourth Avenue, Suite 400
Portland, OR 97201

Dear Ms. Newell:

Re: RE: Tualatin Basin TMDL

The Tualatin River Watershed Council (TRWC) is a recognized resource by the Department of Environmental Quality (DEQ) and others as a significant stakeholder organization in the basin. We are keenly interested in the policy changes, water quality regulations and improvements in the river and related habitat. As such, Avis Newell, Water Quality Specialist for the Tualatin Basin, has appeared before the TRWC on at least five occasions over the last 18-24 months to explain the progress and process for amending the Total Maximum Daily Loadings (TMDL) for the Tualatin River. DEQ should know that she has been helpful, informative, responsive to our concerns and eager to answer the many questions at all of our meetings. These were always engaging conversations among our council members and Ms. Newell. In this way the stakeholder group representatives were able to further share information with their respective organizations throughout the process.

Ms. Newell began the process with an introduction to the TMDL program, explained the objectives of this year's study and provided background information especially regarding temperature of the river over time and from the headwaters to the mouth. She has gone on to keep us informed as the program and allocations became more specific as DEQ moves toward implementation.

Among the stakeholder members of the watershed council are:

- Soil and Water Conservation District
- Farm Bureau
- Nursery Industry
- Business/Industries/Chambers of Commerce
- Citizen & Neighborhood Participation organizations
- Citizens at-large
- Environmental Community
- Fisheries (Commercial/Recreational)
- Small Woodlands Association
- Cities and Washington County
- Water, Sewer and Parks & Recreation

We believe this type of process represents the very best of a collaborative process working with stakeholders and commend both DEQ and Ms. Newell for this approach. Thank you for involving us in this process.

Sincerely,

April Olbrich
Council Coordinator

Cc: Dave Waffle, TRWC Chair

To: Avis Newell / Oregon Department of Environmental Quality
From: Eric L. Lindstrom, EdD
Date: 11/29/2011
Re: Comments on TMDLs / Clean Water Services

It's too bad there's not a TMDL for something like "Total Stream Degradation." Focusing on a few key and easily quantified characteristics of stream behavior such as nutrient loads, water temperature and so on is certainly a positive and necessary step in monitoring stream health. But until the actual drivers of these kinds of indices are addressed in some concrete regulatory form or another we won't be dealing with the disease so much as we are its symptoms. For example, please regard the following photographs of Ball Creek.

Figure 1

These first two shots were taken above the culvert that directs the creek under 74th street in Tigard. These were taken on 5/2/2009, around 5:30 PM. A storm had passed over the Tualatin Hills area approximately an hour earlier. It was a good downpour but nothing for the record books by any means. The culvert lies less than 300 feet from the stream's confluence with Fanno Creek. Figure 1 shows the receiving side of the flow while Figure 2 shows the outflow on the downstream side.

Figure 2

The next shot (Figure 3) was taken just below the south rim of PCCs southernmost parking lot (45N 26.169 W122 43.892 approx.) in an area that lies immediately below the a catchment that is designed to reduce, at least in part, the full force of the water flowing off the parking lot. (I believe that drainage from areas other than the parking lot comes through this place as well but have no precise data as to where from or how much. At this particular spot the channel is about four feet deep and six feet wide.

Figure 3

About 100 feet further down the slope the channel is roughly 12 feet wide and 7 feet deep. For scale the rocks in the center of the photo range from baseball to basket ball size. The main channel has also been joined by three smaller but still impressive incisions entering from the west side. A fourth channel (Figure 4) is beginning to form on the east side as well.

Figure 4

I was so impressed by the dynamics of this site that I went to the trouble of working up a guess at the volume of silt that had to wash out of the first 100 feet of the single channel in order to leave this kind of scar tissue. Very approximately it came to 200 cubic yards. The college went operational in 1961 but I think this portion of the

parking area wasn't fully completed until the late 1990s. If that assumption and my rough numbers are even close, that means an average of better than 10 cubic yards of silt have been blown out of the first 100 feet of this channel every year. The quality and accuracy of my math notwithstanding, you don't need a calculator to tell you that this open wound contributes a huge amount of silt and parking lot byproducts – oils, anti-freeze, brake dust etc. – to the main-stem flow of Fanno Creek every time it rains even moderately in the area. All you have to do is stand there once and see it in the flesh.

The conditions on Ball Creek aren't unique. There are dozens of places such as this one in the Fanno Creek watershed alone and hundreds more throughout the Tualatin River Basin. The issues this kind of hydrology creates for the rest of the watershed are systemic and pernicious. The quantity of undesirable silt and other potentially damaging materials these open sores are sloughing off into the river must be absolutely stupendous. So too must be the damage that is being done to the biological communities downstream. None of the currently used indices directly measures the impacts of these festering sores on water quality. More importantly none of them provide a lever for getting at the specific stormwater runoff issues that literally and figuratively lie at the source of most of the river's major biological health issues.

The ratio of pervious to impervious surface area is relatively easy to quantify, particularly in the urban areas where control of this relationship is most critical. The correlation between this ratio and the biological health of a stream and its watershed is both significant and well understood. **Accordingly I am urging the adoption of a specific TMDL for Impervious Cover based on the Healthy Streams plan developed by Clean Water Services (pg. 59-60).** At the minimum such a TMDL would provide leverage for the more direct control of stormwater runoff and all its associated issues. But it has the added advantage of providing a reliable surrogate for evaluating the biological health of the system as well.

The 303d list of biologically impaired streams in the Fanno Creek watershed does not include several tributaries whose impacts on the overall health of the creek are almost certainly significant. These include Sylvan Creek (all three of its upland stems), Columbia Creek, No Name Creek and the Bridlemile-Ivey creek complex in the northern headwaters of the system, and Bell and Derry Dell creeks in the southern reaches. Some of these creeks are very short in terms of total stream length, but all are heavily incised and becoming more so every day. Both Sylvan and Derry Dale creeks are of particular concern due to the landslides frequently associated with their behaviors. None are adequately monitored, if monitored at all. Until some semblance of measurement of their respective contributions to the overall health of the system is determined the full dimensions of Fanno Creek's degradation will not be fully known. **Accordingly I am requesting that these streams be covered under the pervious cover/biological health TMDL proposed above.**

I have more photographs on hand that provide some visual evidence for the degree of degradation these streams endure and would be happy to make them available to DEQ if so desired. I would also be happy to provide further narrative and acquire additional photography should such action be deemed necessary for advancement of the Impervious Cover TMDL and the clean water cause. However, photographs generally fail to adequately portray the full dimensions of the problem so I suggest that a tour of some of these areas might prove to be even more useful in the decision making process. In such an event please let me know and I would be happy to provide some rough GPS coordinates to some of the more typical and easily accessed places.

Respectfully submitted 11/28/2011

Eric L. Lindstrom, EdD
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Portland, Oregon 97225
503-358-7144
el.lindstrom@comcast.net

CITY OF HILLSBORO

Water Department

November 29, 2011

Ms. Avis Newell
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

Dear Ms. Newell:

The following comments reflect the Barney Reservoir Joint Ownership Commission's (BRJOC) position regarding the draft update to the Tualatin River Total Maximum Daily Load (TMDL). BRJOC is comprised of the Tualatin Valley Water District, Clean Water Services and the cities of Hillsboro, Beaverton and Forest Grove. The City of Hillsboro is the managing agency for the Commission and therefore, operates and manages the Eldon Mills Dam, Barney Reservoir and all water released via the water rights associated with the reservoir. The municipal water suppliers within the BRJOC rely largely on releases from Barney Reservoir and Hagg Lake to meet peak summertime demands.

BRJOC recognizes that it is not a responsible party or Designated Management Agency (DMA) within the TMDL. Further, the TMDL appoints Clean Water Services (CWS) as the DMA for the Barney Reservoir and requires CWS to initiate a Temperature Monitoring Plan and, if necessary, create a Temperature Implementation Plan which may impact releases from the reservoir that are solely under the control of CWS. This policy is clearly articulated in the 2nd Chapter, page 55. While CWS is a member of BRJOC, it does not have authority over the management of the reservoir or releases from the reservoir outside of those allocated for "pollution abatement". With the potential exception of the releases allocated for "pollution abatement", BRJOC will continue to manage the facility to meet its allocated uses. To clarify the authority of CWS, the last sentence of the Barney Reservoir paragraph on pages 5-18 of the draft TMDL should be revised to read: "As the party with responsibility for *flow augmentation discharges* from Barney Reservoir...."

Given the understanding stated above, BRJOC can accept the TMDL as drafted. The Commission does, however, question the implementation of the TMDL to the upper Tualatin River. While the lower river is listed as impaired for temperature and other constituents, the upper river remains unlisted. Further, releases are made from Barney Reservoir in the upper river and either diverted at the Spring Hill pump station (still in the upper river) or used as pollution abatement to meet discharge requirements in the lower river. Because the upper river is not listed and, in fact, releases from the Barney Reservoir are used to meet standards in the lower river, it would be inappropriate to consider any future load allocation for Barney Reservoir.

In Chapter 2 on pages 30 and 55, the descriptions of operations at Barney Reservoir refer to water being pumped from the Reservoir to the upper Tualatin River. These statements are not accurate as water is gravity fed to the upper Tualatin from the reservoir. No pumping occurs.

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Finally, in CWS's implementation of the TMDL with respect to the Barney Reservoir, BRJOC requests that within Chapter 5 that a management plan would also include a monitoring component to assess the effectiveness of the management measures. If monitoring indicates that the allocations are not being met, a revised management plan that identifies additional management strategies may be required. This section should include language that recognizes that there are limited opportunities to change the temperature regime of the release from the reservoir. Including such language in the TMDL amendment would clarify that the scope of the management practices includes an ecological cost-benefit analysis within the management plan.

Thank you for the opportunity to provide comments on the draft Tualatin TMDL. If you have any questions regarding these comments please feel free to contact me.

Sincerely,

Kevin Hanway
General Manager, BRJOC

MEMO

Oregon Department of Agriculture

Date: November 30, 2011

To: Avis Newell, Tualatin Basin Coordinator
Oregon Department of Environmental Quality, Northwest Region
Newell.Avis@deq.state.or.us

From: David Wilkinson, Water Quality Program Manager
Oregon Department of Agriculture
(503) 986-4712
dwilkinson@oda.state.or.us

Regarding: Comments on the DRAFT Tualatin Subbasin Total Maximum Daily Load and Water Quality Management Plan dated September 2011

Thank you for the opportunity to comment on the DRAFT Tualatin Subbasin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) dated September 2011.

Summary Comments

Information presented in Chapter 2, the Revised Temperature TMDL, appeared reasonable and well developed. We have no concerns with Department of Environmental Quality's (DEQ's) approach as detailed in this chapter.

Chapter 3 of the TMDL, the pH, chlorophyll a/total phosphorus amendment, contains some statements and approaches that raises questions. On page 3-9 there is a discussion of work done by the United States Geological Survey (USGS) in the 1990's that showed background phosphorus (P) concentrations were higher than the 1988 TMDL targets. Though P concentrations have reportedly decreased since the 2001 TMDL, you state that there are still problems with algae blooms in various parts of the basin. Would it be practical to expand this current TMDL to include nitrogen (N) load reductions? Reducing N loading would also reduce the occurrence of algae blooms. Some of this is already being accomplished with the ammonia TMDL amendment, but that only applies to wastewater treatment plants.

On page 3-31 there is a discussion about riparian bank erosion as it relates to P loading. It's good to see this potential source of P addressed, but the load allocation described should not include the phrase

"…during the TMDL season."

Bank erosion can deposit P into a stream channel at any time, and P can be mobilized by higher flows. Bank erosion should not be allowed seasonally. This also conflicts with our water quality rules related to sediment and waste discharges.

Priority Areas

The Oregon Department of Agriculture (ODA) continues to expand discussion and coordination with the Oregon DEQ to improve integration of the TMDLs with the Water Quality Program and local Agricultural Water Quality Management Area Plans (Area Plans). As part of this effort, ODA looks to this TMDL document to help set agricultural water quality improvement priority areas. To our understanding, discussion in this TMDL document pertaining to creating and implementing priority areas may be summarized as follows:

- Temperature
    - The temperature TMDL applies to all streams in the Tualatin Subbasin
    - DEQ does not provide guidance for riparian protection or enhancement
    - DEQ does not provide a timeline to achieve desired conditions

- Phosphorus
    - The phosphorus TMDL applies to all streams in the Tualatin Subbasin
    - DEQ identifies maximum phosphorus concentrations for identified tributaries
    - DEQ assigns a load allocation of 26.4 mg/L to the Department, as the Designated Management Agency (DMA), for the Upper Tualatin
    - DEQ does not provide guidance for erosion control efforts within the Subbasin
    - DEQ does not provide a timeline to achieve desired conditions

- Ammonia
    - DEQ ammends the ammonia TMDL waste load allocations; load allocations are not assigned

ODA welcomes future opportunities to work with DEQ staff to identify priority areas in which to focus resources to improve agricultural water quality. We will continue to rely on the TMDL, and other information, to guide implementation of the Tualatin River Subbasin Area Plan.

DEQ describes expectations for implementing the Tualatin TMDLs through local area plans on page 5-14. ODA looks forward to working with DEQ as we work to set priorities for monitoring, restoration, and outreach.

Specific Comments

Page 5-9, Table 5-1, in the subsection titled “Agriculture and Irrigation”

The use of the term “Senate Bill 1010” or “SB 1010” should be replaced by “Agricultural Water Quality Management Act” or “Agricultural Water Quality Program” or “ORS 568.900 – 568.933”, depending on the use and context. Because senate bill numbers are recycled over time, the Department is moving away from the use of SB 1010 and referring directly to the Oregon Revised Statute or the program created by the legislation.

In this case we recommend replacement of "Implement SB 1010 Ag Water Quality Management Plans" with

"Implement Agricultural Water Quality Management Area Plans".

Page 5-11, Table 5-2

The term "Tualatin Basin Agricultural Water …" should read

"Tualatin River Subbasin Agricultural Water …"

Page 5-13, Land Use: Agriculture section

CAFO Permitting and Enforcement appears to be listed in a category describing activities and programs of agricultural water quality management area plans.

CAFO is a separate and distinct program within the Natural Resources Division of the Department. The CAFO Program addresses point and nonpoint source of pollution.

Page 5-14, first line

We recommend replacement of "… (SB1010) to clearly address TMDL and Load Allocations as necessary (Tualatin Basin Oregon Administrative Rules 603-095-0100—0180; Lower Willamette Basin OAR 603-095-3700-3760)" with

"… (formerly referred to as SB1010), recorded as ORS 568.900 – 568.933, to clearly address TMDL and Load Allocations as necessary (Tualatin River Subbasin Oregon Administrative Rules (OAR) 603-095-0100 – 603-095-0180; Lower Willamette Basin OAR 603-095-3700 – 603-095-3760.)"

Section titled "DEQ Expectations"

DEQ expects that the next biennial revisions for the Tualatin and Lower Willamette basins AgWQMAPs will address the TMDLs and include "pollution prevention and control measures deemed necessary by the department to achieve the goal, a schedule for implementation of the necessary measures that is adequate to meet applicable dates established by law, guidelines for public participation, and a strategy for ensuring that the necessary measures are implemented." (OAR 603-090-0030). Load allocations have been set for temperature, phosphorus, bacteria and settleable solids load allocations and surrogate measures throughout the subbasins; the Ag plan revision should identify how progress will be approached and assessed, as well as set priorities for monitoring, restoration, outreach, and if appropriate, rule compliance for each biennium. Ponds and impoundments should be included in planning to address load allocations applicable to impoundments.

We recommend the paragraph be revised to read as follows:

DEQ expects that the next biennial revisions for the Tualatin and Lower Willamette basins area plans will describe the TMDLs and include "pollution prevention and control measures deemed necessary by the department [DEQ] to achieve the goal, a schedule for implementation of the necessary measures that is adequate to meet applicable dates established by law, guidelines for public participation, and a strategy for ensuring that the

necessary measures are implemented." (OAR 603-090-0030). Load allocations have been set for temperature, phosphorus, bacteria and settleable solids and surrogate measures throughout the subbasins; the area plan revision should identify how progress will be demonstrated, as well as geographical water quality parameters to be addressed through monitoring, restoration, outreach, and if appropriate, rule compliance for each biennium. Ponds and impoundments should be included in planning to address load allocations applicable to impoundments. Area plans and rules must be designed to achieve and maintain water quality standards and load allocations. If DEQ determines that the area plan and rules are not adequate to achieve and maintain water quality standards, DEQ will provide ODA with comments on what would be sufficient to meet WQS or TMDL load allocations. If a resolution cannot be agreed upon, the department [DEQ] will request the Environmental Quality Commission (EQC) to petition ODA for a review of part or all of water quality management area plan and rules. If a person subject to an ODA area plan and implementing rules causes or contributes to water quality standards violations, the department [DEQ] will refer the activity to ODA for further evaluation and potential requirements (OAR 340-041-0061(11)).

Page 5-21, first paragraph, second line

We recommend replacement of "… the Agricultural Water Quality Management Act (SB1010) and Senate Bill 502" with

"… the Agricultural Water Quality Management Act (ORS 568.900 – 568.933) and ORS 561.190 – 561.191."

first paragraph, fifth line

We recommend that "SB502" be replaced with

"ORS 561.190 – 561.191".

first paragraph, eighth line

The document says "Further, ODA policy states that plans and rules will be '*reviewed on a biennial basis and ODA in consultation with ODEQ will assess whether the plan and rules are sufficient to meet and address water quality concerns established under the 303(d) or TMDL process or other triggering mechanisms*"'.

We recommend that the language be replaced with the following:
"Area plans and rules are reviewed every two years so that each plan's Local Advisory Committee (LAC) may report on the progress of plan and rule implementation, and provide information on impediments and recommendations to the Board of Agriculture and the director (OAR 603-090-0020(4)).

Page 5-29, section 5.2.10.6,

The term “Agriculture Water Quality Management (AWQM) program” should read

“Agricultural Water Quality Program”

In the third line, we suggest that the statute reference ORS 568.900 – 568.933 should be added to the term

“Agricultural Water Quality Management Act”.

Starting on the sixth line, the term “agriculture water quality management plans” should read

“agricultural water quality management area plans”.

December 1, 2011

Avis Newell
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

RE: Tualatin Basin TMDL Revisions: Protecting Urban Streams

Dear Ms. Newell,

We, the individuals listed below, represent various conservation groups with an interest in the urban streams of the Tualatin Basin. We request the following three changes to the Tualatin Basin TMDL to address deficiencies that perpetuate damage to urban streams and their biological communities.

Address Biological Criteria More Broadly with an Impervious Cover TMDL

Twelve urban streams are listed on DEQ's 303d list as water quality limited for "Biological Criteria". DEQ has made the assumption that no TMDL is needed and that the biological criteria will be addressed by the temperature and nutrient TMDLs. This is inadequate for protecting the physical, chemical, and biological integrity of urban streams in the Tualatin Basin.

Urban streams are impacted by unnatural hydrology and a diversity of pollutants in urban runoff including pesticides, toxic metals, and petrochemicals. While individual pollutants may or may not justify a TMDL for their control, the synergistic impact of the mix of pollutants can have very significant impacts on native salmonids.[1]

The correlation between watershed urbanization and stream health is well documented.[2] Watershed impervious cover is correlated with biological diversity, hydrology, and chemistry. A significant body of research concludes that stream degradation occurs at a very low level of imperviousness, less than 10% total impervious area.[3]

EPA Region 1 has commissioned studies of the practicality of using impervious cover as a surrogate for biological criteria and issued several such TMDLs.[4] The experience of EPA Region 1 is a valuable model for protecting urban streams in the Tualatin Basin.

Recommendation #1
To address biological criteria in urban streams listed on the 303d list, the Tualatin TMDL should use Effective Impervious Area (EIA) as a surrogate for biological criteria. Load allocations for all sources should be set at 9% EIA.

Address Temperature in Urban Streams with a Load Allocation for Small Dams

Local municipalities under the leadership of Clean Water Services have taken positive actions to reduce temperature in urban streams by planting trees in riparian areas. This strategy however does not work where streams are impounded by dams. Impoundments act as large solar collectors, heating up the water. The temperature impact is exacerbated when streams are impounded by top-flow dams that only allow the top layer of water (epilimnion) to pass downstream.[5] These temperature impacts happen at the time of year when flow is lowest, having a critical impact on aquatic biological communities.

Recommendation #2: To address temperature criteria in urban streams listed on the 303d list, the Tualatin TMDL should include a load allocation for impoundments on small streams.

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[1] Scholz, N.L., Myers, M.S., Incardona, J.P., Labenia, J.S., Rhodes, L.D. and Collier, T.K. (2004). Impacts of stormwater runoff on coho salmon in restored urban streams. Proceedings of the Society of Environmental Toxicology and Chemistry's 4th World Congress, Portland, OR. Oral presentation.

[2] Center for Watershed Protection (CWP). 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. CWP, Ellicott City, MD. 142 pp.

[3] Clean Water Services (2005), Healthy Streams Plan. pp. 59-61

[4] ENSR Corporation. 2004. Draft, Pilot TMDL Applications using the Impervious Cover Method. Document # 10598-001-002.

[5] Lessard, J. L. and Hayes, D. B. (2003), Effects of elevated water temperature on fish and macroinvertebrate communities below small dams. River Research and Applications, 19: 721–732. doi: 10.1002/rra.713

Address Impacts of Land Use Decisions by Identifying Metro as a DMA for Land Use Policy

Metro is a regional government that addresses land use policy. The current TMDL lists Metro as a designated management agency (DMA) for its role as a significant land owner. Metro has a significant impact on urban streams by its land use policy. This fall approved 2000 acres for urban development within the Tualatin Basin. As urbanization impacts streams, this land use decision will have a significant impact on streams. Metro needs to be held accountable for its land use decisions that impact streams listed for biological criteria, temperature, and other pollutants. Metro has demonstrated its ability to serve as a DMA with its past stormwater management plan, but has rescinded that plan.

Recommendation #3: To address the impacts of urbanization on urban streams, Metro should be identified as a designated management agency in the revised Tualatin TMDL.

These three recommendations will do much to protect the beneficial uses of urban streams in the Tualatin Basin. We urge your adoption of these recommendations in the revised Tualatin TMDL.

Sincerely,

Tom Wolf, Chair
Oregon Council Trout Unlimited

Mike Houck, Director
Urban Greenspaces Institute

Virginia Bruce, Chair
Rock Creek Watershed Partners

Lauren Goldberg, Staff Attorney
Columbia Riverkeeper

Teresa Huntsinger, Program Director
Clean & Healthy Rivers
Oregon Environmental Council

Gayle Killam, Deputy Director
Rivers and Habitat Program
River Network

Lisa Jo Frech, Executive Director
Raindrops to Refuge

Brian Wegener, Riverkeeper
Advocacy & Communications Manager
Tualatin Riverkeepers

Cheryl Turoczy Hart, Ph.D., President
Friends of Tualatin River National
Wildlife Refuge

Jim Labbe
Urban Conservationist
Audubon Society of Portland

April Ann Fong, Instructor &
Coordinator, Sylvania Habitat
Restoration Team
Portland Community College

Travis Williams, Executive Director
Willamette Riverkeeper

Ramsay Weit, Chair
Washington County Steering Committee
Oregon League of Conservation Voters

December 8, 2011

Avis Newell,
Tualatin Basin Coordinator
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

Subject: Tualatin TMDL Water Quality Management Plans

Dear Ms. Newell,

Thank you for the opportunity to comment on revisions to the Tualatin TMDL. My focus is on Water Quality Management Plans which are supposed to be a mechanism for addressing nonpoint source pollution. The success of any plan depends on specific, measureable outcomes necessary to achieve its ultimate goal. The ultimate goal of the Tualatin TMDL is to attain water quality sufficient to support beneficial uses (native fish, irrigation, drinking water, water contact recreation, etc.). The measureable outcomes are the Load Allocations assigned to various Designated Management Agencies.

I am particularly interested in the agricultural load allocations as I formerly served on the SB 1010 Advisory Committee a number of years ago. Since the first Tualatin Agricultural Water Quality Plan was adopted in 1999, it is reasonable to ask, “Have the Load Allocations been achieved?”

In reviewing the November 2010 Progress Report on the ODA website, I noticed that the progress report did not answer my question, “Have the Load Allocations been achieved?” In fact, the only mention of Load Allocations in the progress report was on the page that you wrote describing the TMDL update process. Therefore, after 15 years of implementing the Tualatin Ag Plan, I have to ask the question, shouldn’t the Progress Report mention the primary metric of progress?

Designated Management Agencies responsible for Load Allocations and Water Quality Management Plans should be required to measure and report progress toward achieving Load Allocations in a statistically valid way supported by actual monitoring data. There is no monitoring plan in the latest Tualatin Ag Plan (2010). This needs to be addressed, and remedied.

As written, the Tualatin Ag Plan does not provide “reasonable assurance that management measures will meet load allocations.” In order for Water Quality Management Plans to be useful tools in achieving Load Allocations, Designated Management Agencies need appropriate guidance that is objective, clear, and holds DMAs accountable. DEQ’s 1997 Guidance for Developing Water Quality Management Plans That Will Function as TMDLs for Nonpoint Sources, if followed by DMAs would result in much better Water Quality Management Plans. The third paragraph of the Guidance provides a general overview of what this Ag WQMP should be:
To be acceptable as a nonpoint source TMDL, a Water Quality Management Plan must be thorough, objective-driven, adequately funded, fully monitored, long-term, watershed enhancement approach with significant commitment demonstrated by local land owners and managers. Most importantly, the goals and objectives of the WQMP must focus on achieving water quality standards at the earliest possible date.

An appropriate revision to the Chapter 5 of this TMDL would ensure that DMAs adhere to this guidance. Thank you for your consideration of these ideas to improve the effectiveness of the Tualatin TMDL.

Respectfully,

Mike Houck, Director

From: Marissa Houlberg
To: NEWELL Avis
Subject: Comment on proposed revisions
Date: Thursday, December 08, 2011 2:48:57 PM

Dear Mr. Newell,

I have only read the Tualatin Times article today and have not reviewed DEQ's proposed changes to the Tualatin River basin's TMDL levels. So I will just make a general comment. We have experienced considerable building over the last couple of decades and I have been amazed at how much blacktop and other impermeable surfaces we have created. The majority of us care about our interconnected surface waters but often lack the knowledge to know what is best for the watershed. I would much rather error on the conservative side of surface water health than continue to see our waters have issues for fish, wildlife and people.

Again, a general statement in support of doing the best we can for the health of the system.

Marissa
Tualatin, OR

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December 8, 2011

Avis Newell,
Tualatin Basin Coordinator
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
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Subject: Tualatin TMDL Revisions

Dear Avis,

Attached you will find the comments of Tualatin Riverkeepers on revisions to the Tualatin TMDL. We are proposing some significant changes that will better protect urban streams and provide reasonable assurance that Designated Management Agencies will meet Load Allocations through their Water Quality Management Plans. Here are some of the highlights of our comments:

- The Temperature TMDL should include a load allocation for small top-flow dams.
- Oregon Board of Forestry should revise Forest Practices Act rules to meet the load allocation for temperature.
- Biological criteria on urban streams should be addressed through a TMDL that uses impervious cover as a surrogate for a variety of pollutants.
- DEQ should use its residual designation authority to require NPDES permits for discharges from real property with one acre or more of impervious cover.
- Water Quality Management Plans should follow DEQ's 1997 Guidance for Water Quality Management Plans Serving as TMDLs in order to provide reasonable assurance that load allocations are met.
- Discharging effluent from CWS facilities in Hillsboro and Forest Grove would increase temperature above the standard in a stretch of identified for salmonid rearing. Alternative discharge strategies, including effluent reuse should be used to avoid this impact.

Thank you for the opportunity to help shape the revisions of the Tualatin TMDL. Wishing you a speedy recovery.

Sincerely,

Brian Wegener
Advocacy & Communications Manager

Comments on the Draft Tualatin Subbasin TMDL

December 2011

Brian Wegener, Riverkeeper
Advocacy & Communications Manager
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www.tualatinriverkeepers.org

Biological Criteria Should be Addressed with a TMDL that Specifies 9% Effective Impervious Area as Surrogate Waste Load Allocation

Twelve urban streams in the Tualatin Basin with a total length of 82 miles are on the 303(d) list for biological criteria, but are not specifically addressed with TMDLs for biological criteria. Instead, it is assumed that the TMDLs for temperature and nutrient would address the biological impairment.

Tualatin Basin 303d Listed Streams for Biological Criteria

Status	Water Body	Miles	Notes:
TMDL Approved	Ash Creek	3.7	Addressed through temperature & nutrient TMDLs
TMDL Approved	Fanno Creek	13.9	Addressed through temperature & nutrient TMDLs
TMDL Approved	Johnson Creek	4	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Beaverton Creek	9.8	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Bronson Creek	6.5	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Butternut Creek	5.3	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Cedar Creek	6.8	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Dawson Creek	4.1	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Hedges Creek	0	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Rock Creek (S)	5.7	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Rock Creek (N)	18.2	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Summer Creek	4	Addressed through temperature & nutrient TMDLs
Water Quality Limited Not Needing a TMDL	Williams Canyon(rural)	2.4	Addressed through temperature & nutrient TMDLs
Total Miles Addressed Through Temperature & Nutrient TMDLS		**84.4**	

A significant body of research indicates that urban streams are affected by more factors than just temperature and nutrients that impact resident fish and aquatic life, including altered hydrology, toxics, channel morphology, and suspended sediments.[1] Further, the synergistic impact of combinations of these factors is not addressed by individual listing of specific pollutants.

The 2005–2006 Assessment of Fish and Macroinvertebrate Communities commissioned by Clean Water Services compared their survey results with the 2001 survey and found,

> *"…these consistent results provide compelling evidence that rural and urban development of the Tualatin River basin has had a measurable effect on physical habitat and water quality in basin streams, which in turn, have measurably impaired biological integrity."*[2]

EPA Region 10 emphasize the importance of addressing urbanization in their comments on the draft of the 2001 TMDL.

> *"EPA recognizes that much of the remaining water quality impairments in the Tualatin Subbasin are related to impacts due to urban stormwater runoff. As such, implementation of stormwater control programs will be a critical element in determining the future success of these TMDLs*."[3]

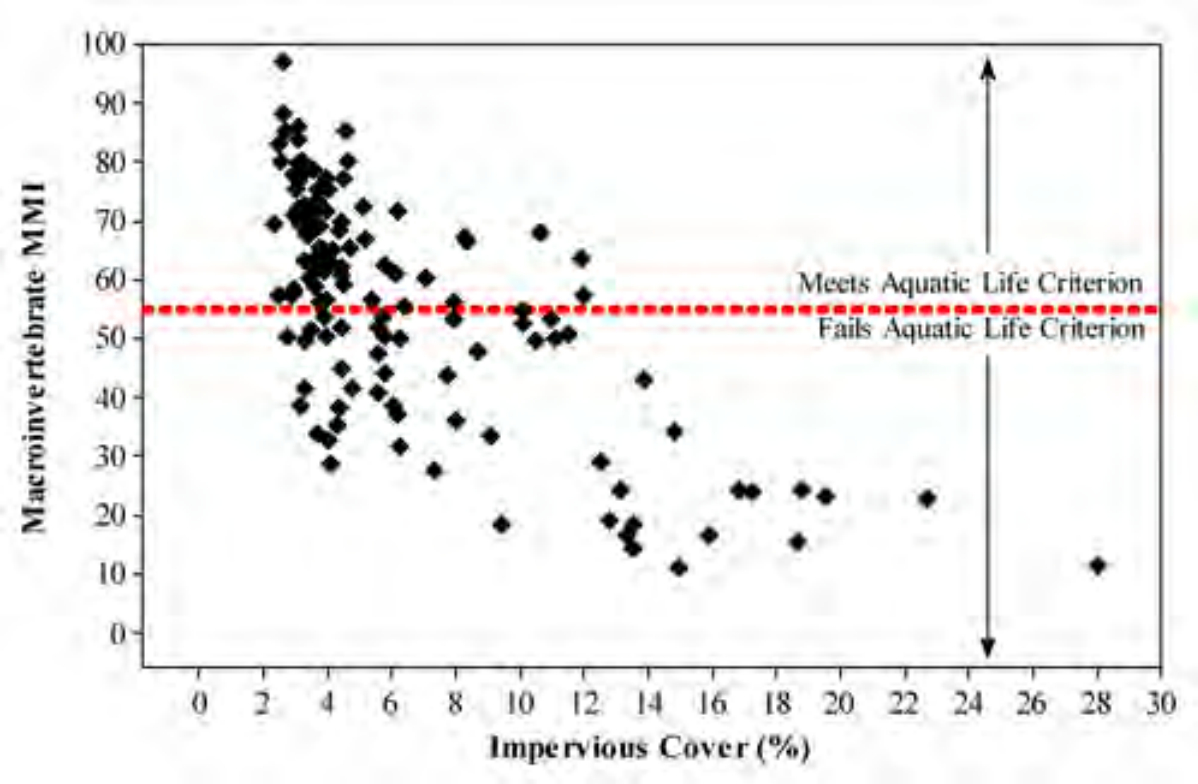
[1] Walsh, C. J., A. H. Roy, J. W. Feminella, P. D. Cottingham, P. M. Groffman, and R. P. Morgan II. 2005. **The urban stream syndrome: current knowledge and the search for a cure**. Journal of the North American Benthological Society 24(3): 706–723.

[2] FINAL REPORT 2005–2006 ASSESSMENT OF FISH AND MACROINVERTEBRATE COMMUNITIES OF THE TUALATIN RIVER BASIN, OREGON, MICHAEL B. COLE, JENA L. LEMKE, CHRISTOPHER R. CURRENS. PREPARED FOR CLEAN WATER SERVICES, HILLSBORO, OREGON. PREPARED BY ABR, INC.–ENVIRONMENTAL RESEARCH & SERVICES

[3] Letter from Jannine Jennings of EPA Region 10 to Rob Burkhart of DEQ (November 3, 2000)

A TMDL that recognizes impervious cover is an important step in addressing these "remaining water quality impairments".

In 2005–2006, the Connecticut Department of Environmental Protection conducted statewide research comparing stream health, as indicated by metrics for benthic macroinvertebrate populations, to watershed impervious cover estimates. A total of 125 stream segments were studied; no stream segment with over 12% impervious cover in its immediate upstream catchment area met the state's aquatic life criteria for a healthy stream.[4]



Scatter plot of the percentage of total impervious cover and macroinvertebrate multimetric index (MMI) for 125 stream monitoring locations in Connecticut. The MMI score is the average score of seven metrics and ranges from 0 to 100, with higher values representing the least stressed sites. Sites that plot above the horizontal line meet Connecticut's water quality criterion to support aquatic life.

This study resulted in the state of Connecticut issuing in 2007 the first TMDL in the nation based on impervious cover for Eagleville Brook. A 2010 review of the status and findings of this TMDL made this assessment: *"The team's preliminary conclusion is that combining the simple framework of impervious cover with the force and accounting rigor of a TMDL can be an effective way to catalyze communities to plan and implement actions to remediate stormwater problems."*[5]

[4] Bellucci, Christopher. 2007. **Stormwater and aquatic life: making the connection between impervious cover and aquatic life impairments for TMDL development in Connecticut streams**. In Proceedings of the Water Environment Federation TMDL Conference, Bellevue, WA. Alexandria, VA: Water Environment Federation, 1003–1018.

[5] Arnold, C.L., C.J. Bellucci, K. Collins and R. Claytor. 2010. Responding to the first impervious cover-based TMDL in the nation. Watershed Science Bulletin, Journal of the Association of Watershed & Stormwater Professionals 1(1): 11-18.

Using impervious cover in a watershed as a surrogate TMDL target is appropriate for aquatic impairments caused by stormwater runoff.[6] The Barberry Creek TMDL (Maine), among others, has both load allocations and waste load allocations for impervious cover, thus using impervious cover as a surrogate for biological criteria is not unprecedented.

Clean Water Services found "correlations between macro-invertebrate community condition and the percentage of effective impervious area"[7] consistent with the findings of the University of Washington's Center for Water and Watershed Studies. According to NOAA-Fisheries, *"…the most consistent and pervasive effect of urbanization is an increase in impervious surface cover, which alters the hydrology and geomorphology of streams, and causes predictable changes in stream habitat and water quality".*[8] Clean Water Services' scientists who conducted field observations found in urban and urbanizing areas of the Tualatin Basin found stream conditions consistent with those described by researchers from NOAA, The Center for Watershed Protection and University of Washington: *"scoured stream beds, limited channel diversity, conversion of forested wetlands to reed canarygrass, and low to nonexistent stream flows in the summer months…*[9]*"*

Due to the multiple impacts of urbanization that affect urban streams and aquatic life in those streams, we request that Effective Impervious Cover as a surrogate target for biological criteria for 303d listed urban streams in the Tualatin Basin. Tualatin Riverkeepers believes that temperature and nutrient TMDLs are insufficient for addressing these impacts. Based on studies correlating impervious cover to various indices of biological integrity, and due to the EPA's general recommendation of 9% impervious cover as a target,[10] we recommend that 9% Effective Impervious Area be used for load allocations for urban designated management agencies (including Metro) and waste load allocations for the MS4 permit.

<u>Recommendation #1:</u> A TMDL target of 9% Effective Impervious Area should be included as load allocations and waste load allocations for urban streams in the Tualatin Basin on the 303(d) list for biological criteria.

In 2001, DEQ responded to requests for a Biological Criteria TMDL with the following explanation:

> *The 303(d) List is intended to identify all waters not meeting water quality standards. EPA has interpreted that Total Maximum Daily Loads (TMDLs) are to be established only where a waterbody is water quality limited by a "pollutant." In the case of the listings such as for Habitat Modification and Flow Modification which are not pollutants, TMDLs would not need to be established and other approaches to address these concerns, such as through Management Plans, should be used to address these impairments. In the case of a Biological Criteria listing which could be due to either a pollutant (e.g. excessive temperature, low dissolved oxygen or sedimentation) or some form of pollution (flow or habitat modification), the likely cause for the Biological Criteria exceedence needs to be determined. If pollutants were the likely cause, a TMDL would need to be established. If some other form of pollution was involved, other appropriate measures could be used.*[11]

[6] ENSR Corporation, Pilot TMDL Applications Using the Impervious Cover Method, October 2005. Submitted to USEPA Region 1
[7] Clean Water Services, June 2005. Healthy Streams Plan. p. 59.
[8] National Oceanic and Atmospheric Administration – Fisheries, Northwest Region. March 2003. ESA Guidance for Analyzing Stormwater Effects.
[9] Clean Water Services, June 2005. Healthy Streams Plan. p.87.
[10] ENSR Corporation, Pilot TMDL Applications Using the Impervious Cover Method, October 2005. Submitted to USEPA Region 1 (Page 1-1)
[11] Tualatin Subbasin TOTAL MAXIMUM DAILY LOAD (TMDL) & WATER QUALITY MANAGEMENT PLAN (WQMP), Response to Public Comment . Oregon Department of Environmental Quality. January 31, 2001

We suggest that a synergistic influence of numerous pollutants from stormwater are responsible for the biological criteria listing including zinc, copper, and other metals, PAH and other toxics and fine sediment. We also believe that "erosive kinetic energy" is a pollutant impacting the aquatic biological communities in urban streams. Since one form of energy, heat, is recognized as a pollutant in this TMDL, it is not unreasonable to recognize and regulate another anthropogenic form of energy, "erosive kinetic energy" as a pollutant. Using impervious cover as a surrogate could address "erosive kinetic energy" while addressing the synergistic impact of a list of pollutants which singly would not warrant a listing.

The DEQ response to public comments on the 2001 Tualatin TMDL also included the following statement:

> *The Department also recognizes that some parameters such as sedimentation and toxics were not fully addressed at this time, as they were not listed for the Tualatin. The Department will be seeking and reviewing data for these parameters in the Tualatin under its watershed approach and will revise TMDLs accordingly on a five-year cycle.*

Ten years later, we see an impervious cover TMDL as an appropriate revision to more fully address these parameters.

Much work has been done to guide the implementation of the impervious cover TMDL in the Tualatin Basin. The Tualatin Basin Effective Impervious Area Reduction Task Force Report (2002) lists 37 recommendations for reducing impervious cover. Many of these recommendations were echoed in the Healthy Streams Plan (2005). Adopting an impervious cover TMDL would strengthen these recommendations through NPDES permits and water quality management plans produced and implemented by designated management agencies.

Enforcement Mechanisms for Biological Criteria, Impervious Cover and Urban Runoff from Private Facilities

Assigning allocations for impervious cover alone will not cause transformation of urban infrastructure impacting streams and aquatic biological communities without effective enforcement mechanisms. Clean Water Services has identified 1339 private water quality facilities treating 7496.3 acres of runoff.[12] Of these private facilities only 95 have 1200-Z permits requiring annual inspections. Overall, 32% of private facilities were inspected in the last reporting year.

Inspection of the 95 1200-Z facilities resulted in 62 administrative permit violations and 67 benchmark exceedances. For the 1244 private facilities not covered by the 1200-Z program, CWS scores the functioning of the inspected facility on a scale of 1-5. Ratings statistics were not reported in the Stormwater Annual Report, however these statistics could provide insight to support adaptive management decisions for the private stormwater facility program.

Clean Water Services only inspects and rates catch basins which are part of a treatment train for a water quality facility. Catch basins in standard parking lots (i.e. those without any supplemental water quality

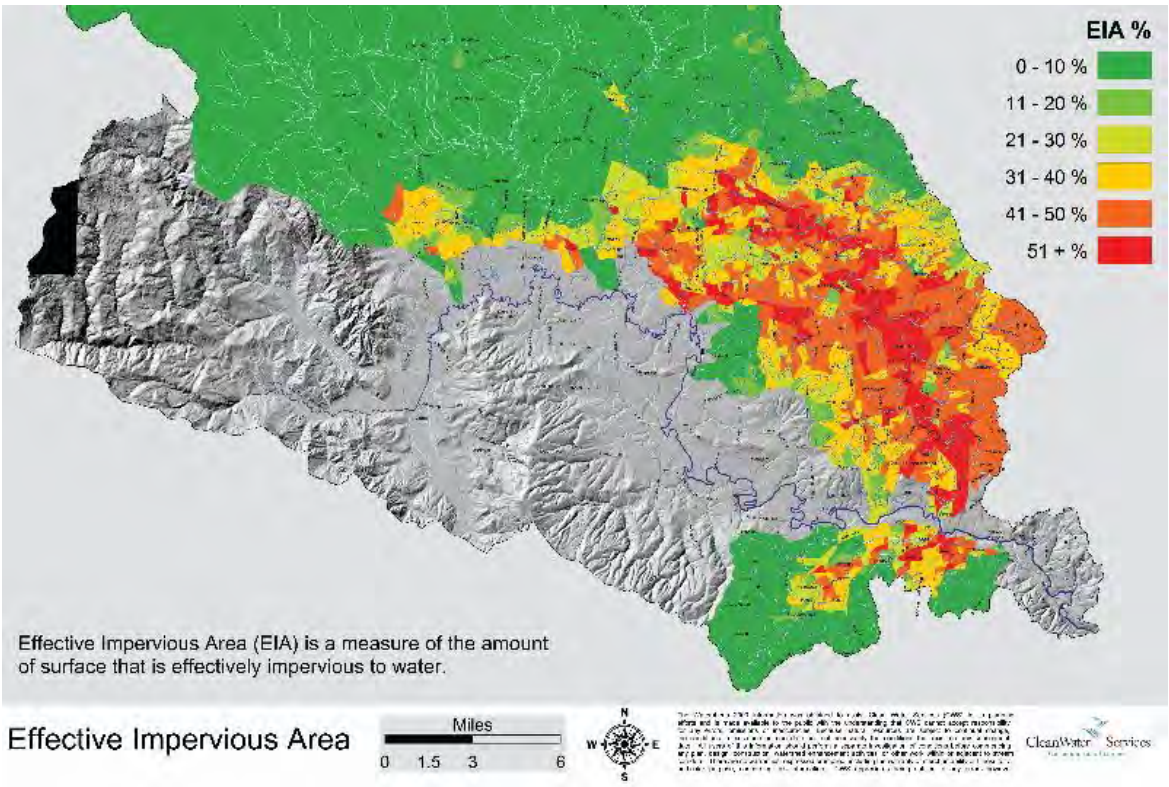
[12] Clean Water Services, November 2011. Stormwater Annual Report.

elements such as swales or biofilters) are not inspected as it has been determined by CWS that these catch basins provide little benefit for water quality improvement.[13]

The impact of private impervious cover on the watershed is significant. The Tualatin Basin Effective Impervious Area Reduction Task Force Report (2002) estimated that there was over 17,500 acres of impervious cover, including over 5,000 acres of parking lots and 7,840 acres of building footprint within the urban growth boundary of the Tualatin basin, compared with 2,319 acres of roads. Effective Impervious Area Private impervious cover produces the majority of runoff in the basin. Based upon the definition of "Effective Impervious Area" in the 2002 task force report, we assume that this acreage is in addition to the 7496.3 acres of treated impervious cover.

> ***What is effective impervious area?***
>
> *Impervious area such as rooftops, streets, sidewalks, and parking areas do not allow water to drain into the soil. Impervious area that collects and drains the water directly to a stream or wetland system via pipes or sheet flow is considered "effective impervious area", because it effectively drains the landscape. Impervious area that drains to landscaping, swales, parks and other impervious areas is considered "ineffective" because the water is allowed to infiltrate through the soil and into ground water, without a direct connection to the stream or wetland.*[14]

A map of the basin shows that the highest density of impervious cover is in commercial areas along major transportation corridors (I-5, 99W, US26, Hwy 217).



Source: Clean Water Services Healthy Streams Plan (2005)

[13] E-mail from Peter Ruffier, Regulatory Affairs Department Director, Clean Water Services December 5, 2011.
[14] Tualatin Basin Effective Impervious Area Reduction Task Force Report, Clean Water Services. July 2002 DRAFT

We suggest such a significant volume of runoff coming from commercial and multi-family residential areas warrants regulations with NPDES permits. While industrial and commercial with specific Standard Industrial Classification (SIC) codes are regulated by permits, the vast majority of commercial acreage is not regulated by permits that hold individual property owners and managers accountable.

DEQ could require NPDES permits for impervious cover. Under "residual designation authority" (RDA) a state may on a case-by-case basis after balancing certain factors designate a stormwater discharge as requiring a NPDES permit because it contributes to a violation of a water quality standard or is a significant contributor of pollutants. (See 40 CFR 122.26)

This residual designation authority has been used three times in EPA Region 1 to address runoff and pollutants coming from impervious cover. An NPDES permit is required for stormwater discharges from real property containing impervious surfaces equal to or greater than two acres in Milford, Bellingham or Franklin, Massachusetts. Maine Department of Environmental Protection issued an RDA general permit for Long Creek in November 2009. The state of Vermont has issued combination of MS4 permit and RDA permit to implement stormwater TMDLs.

Recommendation #2: Whereas the Tualatin Basin has 12 urban streams on the 303(d) list for biological criteria; and impervious cover has been positively shown to cause the decline of aquatic biological communities; and the Tualatin Basin has 7500 acres treated by private stormwater facilities; and there is approximately 18,000 acres of impervious cover within the urban growth boundary of the Tualatin Basin; and catch basins from thousands of acres of parking lots are uninspected and presumably unmaintained**; Tualatin Riverkeepers requests that DEQ use its residual designation authority under 40 CFR 122.26 to require National Pollutant Discharge Elimination System permits for all stormwater discharges from real property containing impervious surfaces equal to or greater than one acre.**

Comments on Chapter 2: Revised Temperature TMDL

Discharging From Hillsboro and Forest Grove WWTPs Impacts Mainstem

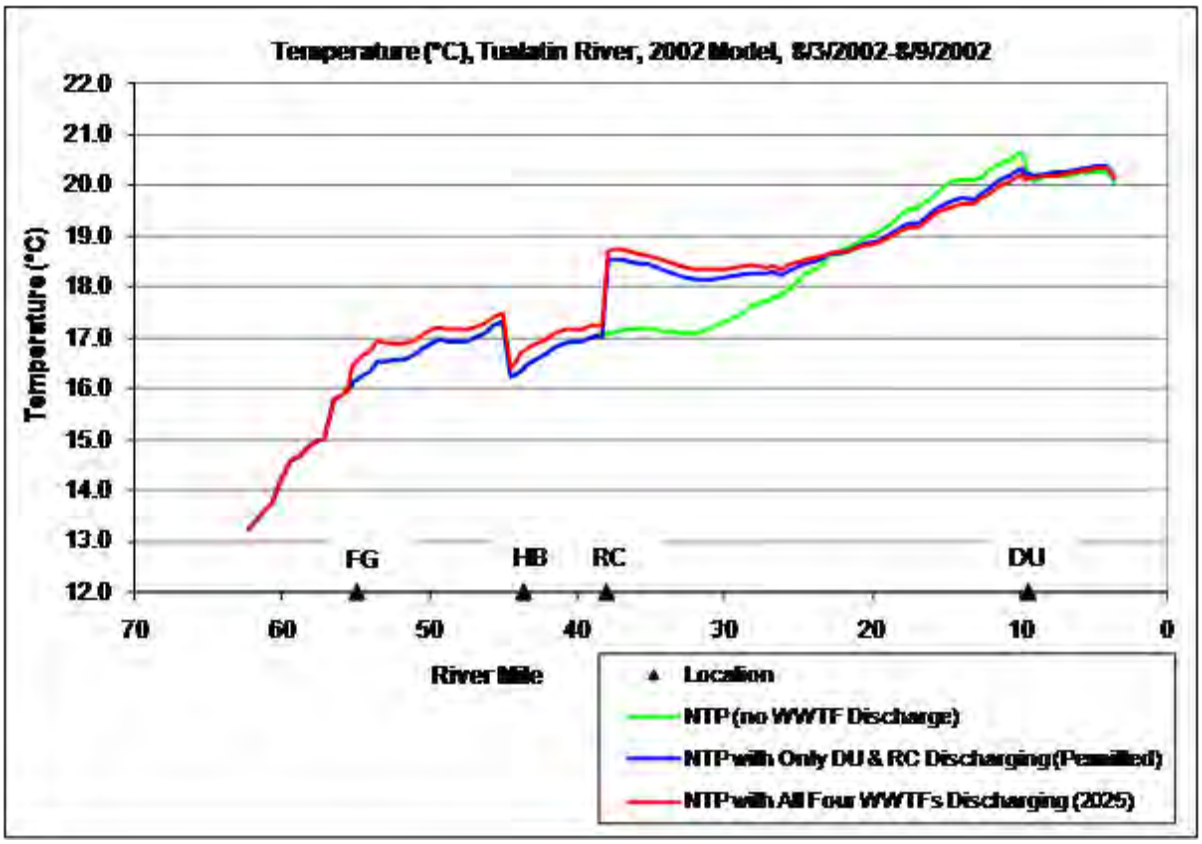


Figure 2-12 from Draft TMDL

TRK is concerned that the proposed bubble allocation for temperature that allow future discharges from the Forest Grove and Hillsboro treatment plants. As the above graph (Figure 2-12) shows, an increase in temperature is expected with the new discharges between River Mile 55 (FG) and River Mile 22. In effect, there is a 33-mile long thermal mixing zone.

These new point sources during the TMDL season will raise the river temperature creating a temperature impact in upper reaches of the river where salmonid rearing occurs (see Appendix F of 2001 Tualatin TMDL). Figure 2-12 depicts an increase in temperature with all four treatment plants discharging that would bring the river temperature to within 1 to .5 degree C. of violating the temperature standard of 18 degrees between RM 55 to RM 44.

Between Rock Creek (RM 38) and RM 25 the additional temperature load prevents the attainment of the 18°C standard. This appears to be a violation of DEQ's antidegradation rules OAR 340-041-0004.

<u>Recommendation #3</u>: This revised TMDL should require alternatives methods of effluent disposal that do not raise the river's temperatures.

Refocusing the Temperature Trade Program

CWS temperature trade needs to be focused on the tributaries and targeted so that a measurable improvement in temperature can be achieved with adequate monitoring to inform adaptive management over time. It should be targeted as well to protect the beneficial use of cool water species on those tributaries where the most sensitive uses of spawning and rearing. The data exists to achieve this and should as well be coordinated with ODA and ODF land management DMAs.

In part, the rational for the temperature trade is predicated on failure of nonpoint sources, agriculture and forest land uses to achieve shading to meet their load allocations. This should be corrected in the implementation of the TMDL so that CWS efforts to shade streams can focus on additional areas that are not already assigned a load allocation.

Reuse is a Viable Alternative to Mitigate Temperature for WWTP Discharges

The Executive Summary for Temperature on page ii states that, "Instead of installing large-scale chillers to cool effluent, Clean Water Services established a temperature trading program that included supplementing summer river flows with stored water, and establishing shade along tributaries." This statement erroneously implies that the only alternative to flow augmentation and shade is "large-scale chillers". Additional alternatives are available including reuse programs that re-uses effluent as a water resource. Promotion of wastewater reuse which is proven temperature management strategy and will help address anticipated growth and municipal water demand.

Unified Sewerage Agency (now CWS) developed a Recycled Wastewater Master Plan in 1991. This plan came up with a whole array of recommended policies, system alternatives, program elements, and financing. As part of the work on this plan, a survey of more than 90 potential users found that "Sufficient demand for recycled wastewater exists to warrant implementation of a large scale system."

Recommendation #4: Reuse should be an increasing part of the temperature mitigation for the CWS wastewater treatment plants.

Temperature Impacts of Urban Stormwater Management

While no WLA has been assigned to urban stormwater, stormwater can influence stream temperature via changes to the historic geomorphology and hydrologic function of the streams. This impact is ignored in the TMDL. Groundwater recharge should be encouraged to moderate flows and cool tributaries.

Recommendation #5: A Waste Load Allocation should be assigned to urban storm water to address its temperature impact related to channel structure, geomorphology and hydrologic function.

Load Allocation Needed for Small Dams

Thank you for recognizing the potential thermal impact of Scoggins Dam and Barney Reservoirs and including load allocations for these sources.

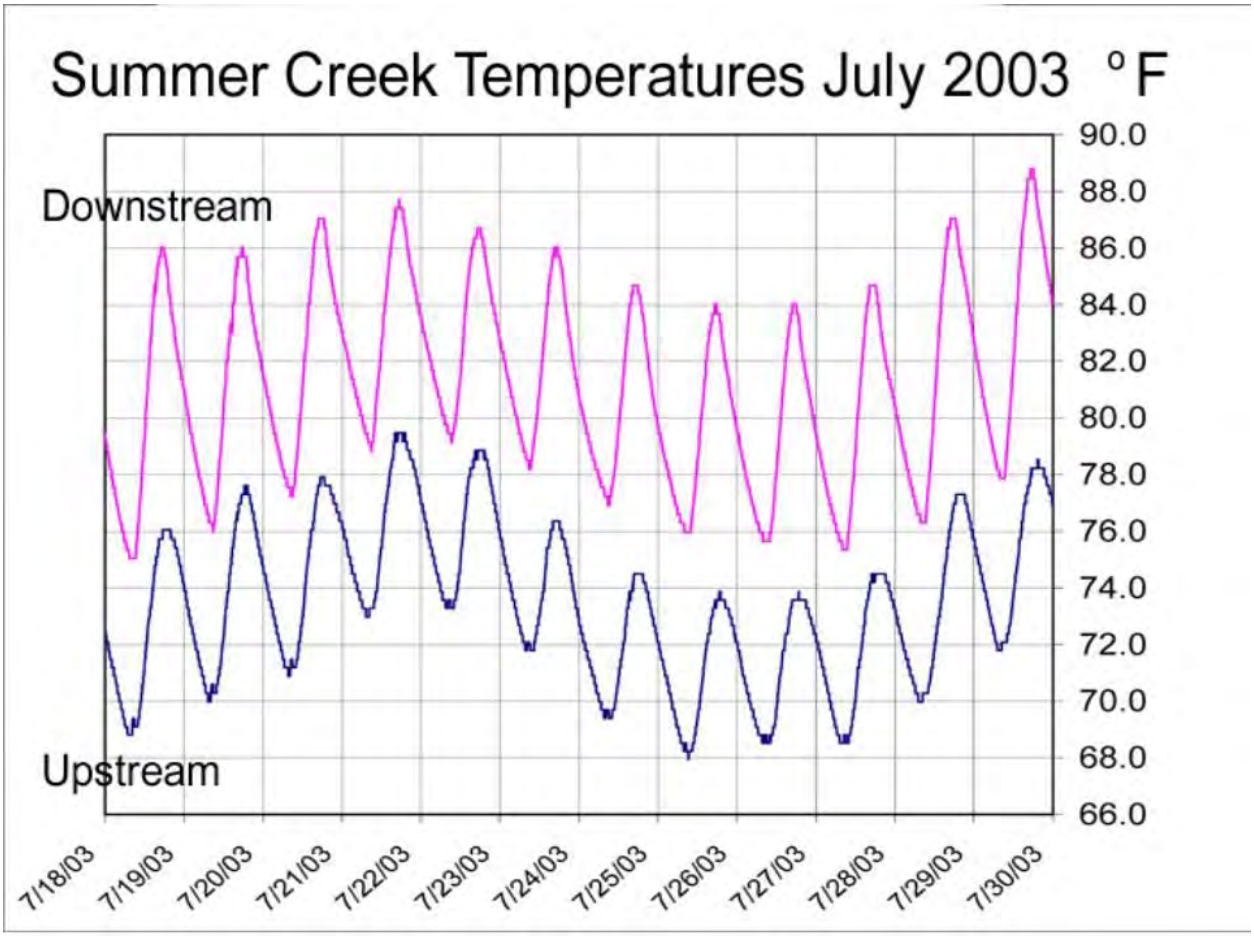
Tualatin Riverkeepers requests a TMDL thermal load allocation for small surface release dams on tributaries of the Tualatin River. The TMDL already recognizes that reservoir and dam operations are considered nonpoint sources that affect the quantity and timing of heat delivery to downstream river reaches.

Small surface release dams on streams increase water temperature downstream of the dams. Spreading the water surface over a larger area and slowing the flow increases solar gain. A reservoir's top layer of water will warm and decrease in density, while cooler, denser water will sink to the bottom layer of the reservoir.[15] The warmer upper layer of water (epilimnion) is selectively spilled over surface release dams, increasing downstream temperatures.

Tualatin Riverkeepers demonstrated this effect at Summerlake Park in Tigard. In the Summer of 2003, we placed two StowAway®Tidbit® temperature loggers in Summer Creek, one just upstream from the lake at Summerlake Park and one just below the dam that forms the lake.

The dam is approximately 5 feet high and all flow comes over the top edge of the dam.

[15] American Rivers 2002, The Ecology of Dam Removal: A Summary of Benefits and Impacts



Data collected by Tualatin Riverkeepers at Summerlake Park

The data collected showed that the downstream temperature was elevated 7°F to 11°F (3.9°C to 6.1°C) (over the temperature at the upstream monitoring point throughout the month of July. This is far above the 0.05°C of the 0.3°C human use allowance allocated to non-point sources. Note that the temperature at both monitoring sites exceeded the 18.0°C (64.4°F) standard for trout and salmon rearing and migration for the entire month.

Our results were not surprising. Lessard and Hayes found in a study of 9 small dams in Michigan that the mean summer temperature increased 2.7°C on average and that the increases in temperatures were maintained at least 2-3km below the dams.[16] Clean Water Services (CWS), has identified "instream ponds as a major **point-source** water quality problem because of their tendency to increase stream temperature, decreased dissolved oxygen, and alter sediment transport processes."[17] TRK agrees with this assessment of instream ponds as point sources. As major point sources of temperature load, a waste load allocation is called for as well as regulation through NPDES permits.

[16] EFFECTS OF ELEVATED WATER TEMPERATURE ON FISH AND MACROINVERTEBRATE COMMUNITIES BELOW SMALL DAMS, JOANNA L. LESSARD* and DANIEL B. HAYES, *Department of Fisheries and Wildlife, Michigan State University. East Lansing, MI 48824, USA*

[17] Clean Water Services, Healthy Streams Plan (2005). pp. 76-79.

The extent of temperature loading from small dams in the Tualatin Basin is significant. The Oregon Water Resources Department lists 96 dams in Washington County, ranging in height from 6 feet to 122 feet and storage capacity ranging from 3 acre-feet to 60,000 acre-feet. This includes Barney Reservoir and Scoggins Dam, for which a TMDL allocation is already proposed. This does not include all dams in the Tualatin Basin, as those less than 10 feet in height or less than 9.2 acre-feet in capacity are generally exempt from state reservoir permits. In fact, the Summerlake Park dam that we did our temperature monitoring on is not in the inventory of the Water Resources Department.

Assigning a zero thermal load allocation to dams in the Tualatin Basin would not be precedent setting. There is a TMDL temperature allocation for Albeni Falls Dam in Idaho. DEQ has issued TMDL allocations for Emigrant Dam southeast of Ashland and for PGE's hydroelectric project on the Clackamas River. The California Water Resources Control Board has already addressed this issue in their TMDL for the Klamath River, and this TMDL was approved by USEPA on December 28, 2010:

> *Iron Gate and Copco Reservoirs discharge elevated temperature waste, as defined by the Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (Thermal Plan). The discharge of elevated temperature waste to the Klamath River is prohibited by the Thermal Plan. Furthermore, temperature alterations caused by the reservoirs adversely affect beneficial uses. Thus, there is no allowable temperature increase that can be allocated to waters from Iron Gate and Copco 1 and 2 Reservoirs. Accordingly, the temperature load allocation for these reservoirs equals zero temperature increase above natural temperatures.*[18]

Mitigation for these temperature loads could take a number of forms that should be outlined in Water Quality Management Plans and/or NPDES permits. Dam removal could also address sediment, fish passage issues and accommodate streamside planting for shade. Pond by-pass, as demonstrated by Clean Water Services Tanasbrook Ponds Stream Enhancement Project is another example of a potential mitigation strategy with multiple benefits (photos below). Structural modification of surface release dams so that cooler water from lower levels is passed also has potential as a mitigation strategy.

The CWS healthy streams plan identified 9 ponds on Dairy Creek and two dams on Rock Creek for potential flow restoration projects.[19] Again, mitigation to meet temperature load allocations or waste load allocations should be specified in Water Quality Management Plans and NPDES permits.

Tualatin Riverkeepers requests that this TMDL include a temperature load allocation or waste load allocation for small impoundments or surface flow dams. This allocation is supported by scientific literature, the assessment of local agencies and our own monitoring. This temperature load impacts tributary streams that should be rearing habitat for native salmonids.

<u>Recommendation #6:</u> This TMDL should include thermal load allocation of 0.05°C for small surface release dams on tributaries of the Tualatin River.

[18] California Environmental Protection Agency, Northcoast, Northcoast Regional Water Quality Control Board. KLAMATH RIVER TMDLs – CHAPTER 5. ALLOCATIONS and NUMERIC TARGETS.

[19] Clean Water Services, HEALTHY STREAMS PLAN, June 2005. p.29.

Figure 1 - Tanasbrook Ponds before CWS Bypass Project

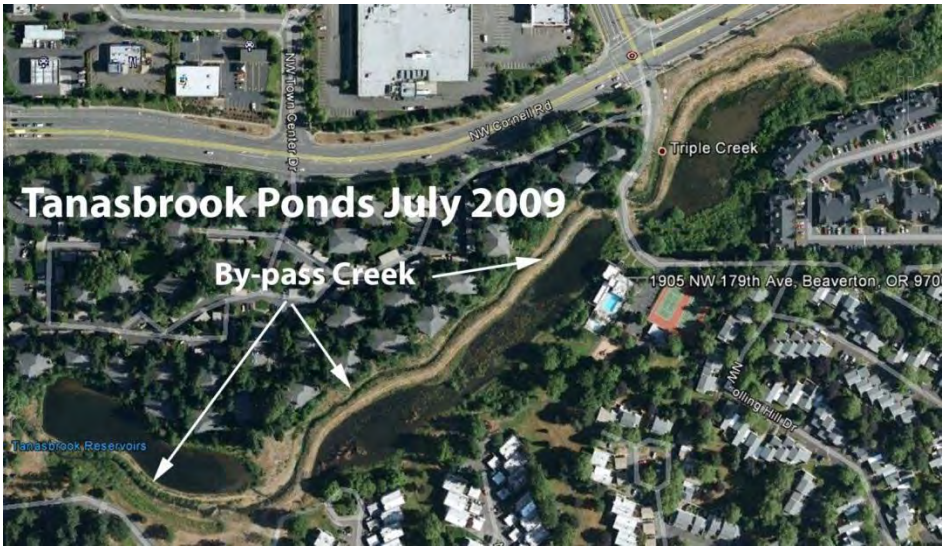


Figure 2 - Tanasbrook Ponds after CWS Bypass Project

Comments on Chapter 3: Amendment for the Total Phosphorus TMDL

Thank you for assigning an allocation for Wapato Lake. This was a significant source that led to a serious blue-green algae outbreak in 2008.

What accounts for the spike in chlorophyll a at Rood Bridge [upstream of RCTP] during the period from late May through early July – is this Wapato or other agricultural operations? This is depicted in Figure 3-8.

Reasonable assurance that ODA can meet the assigned load allocations has not been demonstrated. See comments on Chapter 5.

Comments on Chapter 5: Water Quality Management Plan

Management plans need to include specific timelines when allocations will be met. DMAs need to provide for adequate budget and monitoring, essential to inform adaptive management in order to meet the allocations. These concerns are nothing new.

Excerpt of Letter from Jannine Jennings of EPA Region 10 to Rob Burkhart of DEQ (November 3, 2000)

Water Quality Management Plan

Inclusion of the Water Quality Management Plan (WQMP) as part of a TMDL is valuable and progressive. The implementation plan is the key to getting measures on the ground where needed in order to meet specific targets and goals laid out in the TMDL. We are pleased that development of WQMPs is an integral part of Oregon's TMDL process.

We recognize that while the Water Quality Management Plan is being submitted by DEQ as part of the TMDL, the Plan was developed by groups and agencies who have responsibility for the various components of the Plan (designated management agencies or DMAs). Therefore EPA's comments on this Plan are directed toward the applicable DMAs.

The Tualatin Basin TMDL is a scientifically sound analysis of excellent data, establishing a connection between landscape condition and water quality, and translating loads into understandable and achievable surrogate targets such as site potential effective shade. As such, the TMDL is the primary mechanism to use in order to ultimately meet water quality standards. It is an excellent tool for improving overall watershed health. It is the tool that should provide the basis for this Water Quality Management Plan. On page 9 of the TMDL it states that "It is the expectation, however, that WQMPs will address how human activities will be managed to achieve the surrogates." A similar statement is made on page 18 of the WQMP. Indeed if the surrogates are kept firmly in mind while projects and plans are drawn up, there is a high probability that they will be reached.

Therefore it is surprising and disappointing that this WQMP for the Tualatin is general and vague. The TMDL provides a sound, geographically specific analysis. Why have the designated management agencies not used this information and existing implementation information to provide more substance to this plan? It is understood that this WQMP is a "first iteration" of implementation planning; more detailed plans will be prepared according to a timeline with DEQ's participation (WQMP page 1). However, we find it surprising that in this basin where TMDL implementation has been underway for a number of years that there is so little detail on planned actions aimed at reaching the load allocations. Many of the practices being implemented for phosphorus control will also control bacteria and sediment. Where is the detail on these? A schedule? A budget? What are the benchmarks for attainment which will be used to measure progress?

On page 3, under "Adaptive Management" it is stated that the management agencies will develop benchmarks for attainment of TMDL surrogates which will then be used to measure progress. This is so crucial in order to do effective adaptive management. Yet in the plan, I see no discussion of, or commitment to developing benchmarks that specifically show progress towards meeting load allocations such as site potential effective shade.

Even reporting of program activities is often vague (ODA - talking, encouraging, promoting, monitoring). How is the water quality monitoring data being used? Tracking compliance with no prohibited conditions is useful but how does that relate to achievement of the load allocations? Some of the reporting information has potential to be linked to load allocations. Practices implemented in voluntary farm plans could include estimates of bacteria, nutrient, and sediment load reductions related to a water body, at least at the 6th field watershed scale; riparian plantings could be linked to estimates for attaining site potential shade, width to depth channel morphology changes, and reduced bank erosion. However, so much of the plan and reporting language is so vague and general, that we simply cannot see how DMA's will be able to decide where and how actions are achieving the desired results or not and what specific modifications are needed. In the more general approaches like the Forest Practices Act, is anyone looking to see if the provisions will meet the load allocations of this basin? What actions will be taken to correct legacy conditions on forest lands contributing to sediment and temperature problems?

The implementation plans from the local governments are almost carbon copy letters of intent that refer to other documents and talk about further planning.

There is good information in Appendix H on biological criteria which could help focus high priority protection and restoration efforts. There is no reference to it in the WQMP. Will the information be used?

As a whole, this WQMP is disappointing. It seems as if the DMAs work independently, with little if any cooperative, watershed-based coordination. Actions and information seem disjointed such that it will be difficult to understand how this sub-basin functions and responds as a whole.

These comments made by EPA 11 years ago are just as appropriate today. These issues would be explicitly addressed if DMAs were required to adhere to DEQ's 1997 *Guidance for Developing Water Quality Management Plans That Will Function as TMDLs for Nonpoint Source.*

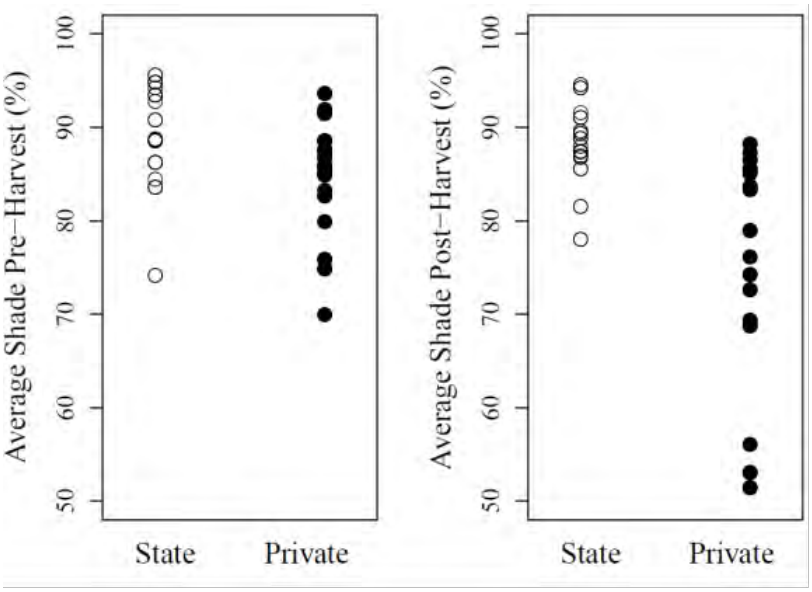
Recommendation #7: All DMAs should be required to follow DEQ's 1997 *Guidance for Developing Water Quality Management Plans That Will Function as TMDLs for Nonpoint Source* when producing Water Quality Management Plans.

Land Use: Forestry on Private Lands
DMA: Oregon Department of Forestry

ORS 527.765 requires the Oregon Board of Forestry (the Board), in consultation with the EQC, to establish Best Management Practices (BMPs) and other rules applying to forest practices to ensure that to the maximum extent practicable non-point source discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of water quality standards established by the EQC. The Oregon Department of Forestry (ODF) is the Designated Management Agency (DMA) by DEQ for regulation of water quality on nonfederal forestlands.

A 1998 memorandum of understanding between DEQ and the Oregon Department of Forestry (DOF) requires that TMDLs must be incorporated into the continuing planning process required by Section 303(e) of the Act and the continuing planning process must be included in the state's water quality management plan.

The recent RIPSTREAM study by ODF and Oregon State University comes to the conclusion "that FPA riparian protection measures for small and medium fish streams do not maintain stream temperatures similar to control conditions, and are inadequate to insure forest operations meet the state water quality standard for protecting cold water."



Source: Oregon Department of Forestry RIPSTREAM Study

While the 2001 TMDL temperature standard specifies that "*no measurable surface water temperature increase resulting from anthropogenic activities is allowed*". Nonpoint sources are allocated zero pollutant loading thus meeting the "*no measurable surface water temperature increase resulting from anthropogenic activities…"* Under the proposed standard, all nonpoint is allocated .05 c. This is shared by all nonpoint sources including agriculture and forest land uses.

This research indicates that on average, private lands compliant with the FPA rules experienced an average .7°C increase in temperature post-harvest, while state forest lands showed no increase in temperature. Harvest on private lands compliant with FPA rules, are not compliant with the temperature standard and allocation. The surrogate measurement, Effective Shade (system potential shade) targets translate the nonpoint source solar radiation loading capacity. This research also indicates that private forest lands compliant with FPA rules are not meeting the surrogate target post-harvest, while state managed lands are.

Changes to the FPA rules are required to bring about compliance and reasonable assurance that the TMDL is being implemented.

Recommendation #8: Tualatin Riverkeepers request that section 5.6.6.2 of this revised Tualatin Subbasin TMDL include the following statement:

Oregon Board of Forestry must adopt rule changes for riparian management areas under the Forest Practices Act to provide reasonable assurance assure that temperature standard and allocation (*no measurable surface water temperature increase resulting from anthropogenic activities is allowed*), and the surrogate measure (*system potential shade*) is achieved on private forest lands.

Land Use: Wapato Lake
Responsible Party: U.S. Fish & Wildlife Service

Recommendation #9: Include U.S. Fish & Wildlife Service as a responsible party for Wapato Lake Dike and Pumphouse.

U.S. Fish & Wildlife Service is the majority landowner in the Wapato Improvement District and owns enough land within the district that it has the authority do dissolve the district. The district's financial status is precarious and it is risky to assume that it has the capability to perform the necessary functions to protect water quality. U.S. Fish and Wildlife Service has the resources and technical expertise to better protect water quality.

USF&WS manages several impoundments on the refuge besides Wapato Lake. These impoundments can be sources of thermal load and nutrient and bacteria load due to heavy use by waterfowl and rodents. Management practices should prohibit discharge of impounded water during the TMDL season.

Recommendation #10: Water quality management plans and NPDES permits should prohibit the discharge of impounded water between May 1 and October 1.

Land Use: Agriculture
DMA: Oregon Department of Agriculture (ODA)

In 2003, Tualatin Riverkeepers raised the following concerns to the Local Advisory Committee (LAC) of the Tualatin Basin Agricultural Water Quality Management Plan (TBAWQMP):

- Objectives are not quantified, measured, directly linked to Load Allocations.
- Lack timeframes and milestones for implementation of measures and achievement of load allocation.
- Costs are not estimated.
- Adequate funding is not secured for measures.
- No adaptive management actions for lack of participation of voluntary programs.
- Prohibited conditions for shading are passive, inadequate to achieve system-wide site potential shading specified in the TMDL.
- Monitoring plan is insufficient, lacking in details, does not link measures to load allocations.
- In general, reasonable assurance that this plan will achieve water quality standards at the soonest possible date is lacking.

We continue to have these concerns with the biennial TBAWQMPs. If ODA and the local advisory committee had followed DEQ's 1997 *Guidance for Developing Water Quality Management Plans That Will Function as TMDLs for Nonpoint Sources* as specified in Recommendation #6, all of these concerns would have been addressed in the TBAWQM.

The Tualatin Basin Agricultural Water Quality Management Plan fails to provide reasonable assurance that the Tualatin TMDL and associated load allocations will be met. There is a lack of sufficient monitoring to correlate actions of the local operators with changes in water quality. At the November 11, 2010 meeting of the Local Advisory Committee, "Members of the LAC agreed that without water quality monitoring, it is difficult to assess Area Plan effectiveness."

Recommendation #11: DEQ should specify a statistically valid sampling plan to assess the effectiveness of the TBAWQMP in achieving TMDL load allocations assigned to agriculture. This sampling should take full advantage of sampling performed by other agencies (USGS, Joint Water Commission, CWS and DEQ) but must also specify monitoring actions to be taken by ODA to fill data gaps.

While Oregon Department of Agriculture is the DMA, most of the work on carrying out pollutant and temperature reduction strategies by other partners, largely the Tualatin Soil & Water Conservation District (TSWCD) and the federal Natural Resources Conservation Service (NRCS) relying on voluntary participation from individual property owners. The TSWCD is at a disadvantage compared to Soil & Water Conservation Districts in other counties in that it is not supported by a permanent tax base. The financial difficulty that ODA and local partners have experienced in implementing a plan to achieve the

agricultural load allocations is incongruous with the economic status of the agricultural industry in the Tualatin Basin. According to the 2010 TBAWQMP:

> *Agriculture is a significant land use within the watershed. Approximately one-fourth of the watershed's land base is used for production agriculture. Agriculture is very important to the economy of the area, and agricultural lands in the watershed provide a high dollar return per acre. Washington County ranked third for agricultural gross income in the state in 2007. Gross agricultural sales in Washington County alone exceeded $321,600,000 in 2007. Ag-related jobs in Oregon, including input suppliers, on-farm workers, food processing, transportation, warehousing, etc. account for approximately 150,000 jobs or eight percent of the state's workforce. This equates to 43 jobs per $1 million in agricultural sales.*

With agriculture being such a significant economic force in the Tualatin Basin, it is unclear why much of the agricultural temperature reduction activity in the Tualatin basin needs to be subsidized by the urban ratepayers of Clean Water Services through the "temperature trade".

<u>Recommendation #12:</u> This TMDL should specify that the agricultural water quality management plan should specify a financial plan that will support the achievement of the agricultural load allocations within 10 years of the adoption of this TMDL.

The lack of measureable progress towards achieving agricultural load allocations is not unique to the Tualatin Basin. The existing Memorandum Of Agreement (MOA)between DEQ and ODA must be revised in order for the Agricultural Water Quality Management Program to move toward effective and accountable program implementation. Given the Governor's commitment to protecting human health, water quality, and Oregon's threatened and endangered fish populations, a clear MOA that moves the program into maturity is essential.

It is important to acknowledge and appreciate that ODA staff are currently working on designing a more strategic, accountable Agricultural Water Quality Management Program, and that ODA and DEQ staff are working to increase and formalize their coordination for the program. Additional funding for the program this biennium will assist with these improvements. These are important steps in the right direction. However, we must also acknowledge that currently, neither ODA nor DEQ are able to demonstrate that the Agricultural Water Quality Management Program has been effective in meeting water quality standards or load allocations, or is making progress toward doing so. While the Plans may in some instances be extensive, the Rules lack sufficient detail to serve as a measuring stick for landowners' performance, to provide clarity to landowners, and to support ODA landowner assistance and enforcement actions. Only the Agricultural Water Quality Management Program Rules are enforceable by ODA. The Area Plans are not. Currently program outreach and enforcement is solely complaint-driven, rather than based on pollution reduction priorities, or achieving agricultural load allocations. Moreover, the positive work being done to protect water quality and watershed health on agricultural land through landowner partnership with a number of public and nonprofit organizations is not necessarily targeted toward achieving TMDL load allocations, and is not measured and correlated to progress toward these benchmarks. As a result, DEQ is unable to provide reasonable assurance that Oregon's nonpoint source pollution control program for agriculture is effective in achieving load allocations or will be effective in doing so in the future.

It is clear that several new measures are required to bring the Agricultural Water Quality Management Program to a state of effectiveness and accountability in meeting water quality standards and load allocations. An essential first step is to include these measures in a revised MOA between ODA and DEQ for the program.

Land Use: Urban Stream Impoundments
DMA: Cities, THPRD, Clean Water Services, and private owners

Small urban dams have various owners. Several are owned by cities (e.g. Summerlake Park, City of Tigard) or by Tualatin Hills Park and Recreation District (e.g. Bethany Lake, Commonwealth Lake). Others are owned by neighborhood associations (e.g. Tanasbrook Ponds), commercial developments (e.g. Murrayhill Pond) and golf courses (e.g. Portland Golf Club). Lake Oswego Corporation owns a low head dam on the Tualatin River that backs the river up 30 miles. All those with legal authority to manage such impoundments should be identified as designated management agencies.

Recommendation #13: All entities with ownership or legal authority to manage small urban dams on tributaries and the mainstem of the Tualatin River should be identified as designated management agencies with a 0.05°C thermal load allocation.

Land Use: Urban Areas
DMA: Metro

A Designated Management Agency (DMA) is a "federal, state, or local government agency that has legal authority of a sector or source contributing pollutants, and is identified as such by the DEQ in a TMDL."

Recommendation #14: This TMDL should identify Metro to be a DMA Urban Areas. Metro should be required to address conditions of this TMDL in its land use decisions. Further we ask that this TMDL require that Metro prepare a water quality management plan within 18 months of the adoption of this TMDL that specifies how and when the Biological Criteria -10% Effective Impervious Area Load Allocation will be met through its land use planning and decisions.

Metro is listed Designated Management Agency (DMA) in Chapter 5 of the Draft Tualatin Subbasin TMDL as a land owner "throughout the basin with potential water quality impact". Metro has far greater water quality impact in its role as a land use authority. The preamble of Metro's charter states that Metro "… undertakes, as its most important service, planning and policy making to preserve and enhance the quality of life and the environment for ourselves and future generations;"

The state of California has found that urban development increases pollutant load, volume and velocity of runoff.

> **URBAN DEVELOPMENT INCREASES POLLUTANT LOAD, VOLUME, AND VELOCITY OF RUNOFF:** During urban development two important changes occur. First, natural vegetated pervious ground cover is converted to impervious surfaces such as paved

> highways, streets, rooftops, and parking lots. Natural vegetated soil can both absorb rainwater and remove pollutants providing a very effective natural purification process. Because pavement and concrete can neither absorb water nor remove pollutants, the natural purification characteristics of the land are lost.
>
> Secondly, urban development creates new pollution sources as human population density increases and brings with it proportionately higher levels of car emissions, car maintenance wastes, municipal sewage, pesticides, household hazardous wastes, pet wastes, trash, etc. which can either be washed or directly dumped into the MS4.
>
> As a result of these two changes, the runoff leaving the developed urban area is significantly greater in volume, velocity and pollutant load than the pre-development runoff from the same area.[20]

This finding is supported by a large body of research and the Clean Water Services Healthy Streams plan. This fall Metro approved the addition of 2000 acres of land into the Urban Growth Boundary. Tualatin Riverkeepers requested that Metro avoid urbanizing areas not suitable for stormwater infiltration to avoid impacts to the Tualatin River and its tributary streams.

One such area that TRK identified was South Cooper Mountain. Cooper Mountain has shallow, slow draining soils on slopes. The Natural Resources Conservation Service (NRCS) soil survey reveals that 100% of the acreage in the South Cooper Mountain area brought into the UGB my Metro is "Very Limited" for "disposal of wastewater by rapid infiltration".

The National Marine Fisheries Service (NMFS) 4(d) Rule for Threatened Salmon and Steelhead on the West Coast limits (Limit No. 12) Municipal, Residential, Commercial and Industrial Development and Redevelopment (MRCI) to protect salmon and steelhead. In particular NMFS states that "An MRCI development ordinance or plan ensures that development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, and similar constrained sites. Metro's 2007 Natural Features Inventory identifies 74% of South Cooper Mountain with these constraints. NMFS also states in the 4(d) rule, "An MRCI development ordinance or plan adequately prevents stormwater discharge impacts on water quality and quantity and stream flow patterns in the watershed - including peak and base flows in perennial streams.

Metro could have avoided impacts to water quality, quantity and stream flow patterns by avoiding urbanizing South Cooper Mountain, or by limiting imperviousness as a condition of urbanization. Metro previously developed a stormwater management plan, but rescinded that plan in 2002. As the regional land use authority Metro must address state planning goals including Goal 6.

> GOAL 6: AIR, WATER AND LAND RESOURCES QUALITY - OAR 660-015-0000(6) To maintain and improve the quality of the air, water and land resources of the state. All waste and process discharges from future development, when combined with such discharges from existing developments shall not threaten to violate, or violate applicable state or federal environmental quality statutes, rules and standards. With respect to the air, water and land

[20] CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION, ORDER NO. 2001-01
NPDES NO. CAS0108758

> resources of the applicable air sheds and river basins described or included in state environmental quality statutes, rules, standards and implementation plans, such discharges shall not (1) exceed the carrying capacity of such resources, considering long range needs; (2) degrade such resources; or (3) threaten the availability of such resources.

Guidance for Goal 6 states that…

> 4. Plans which provide for the maintenance and improvement of air, land and water resources of the planning area should consider as a major determinant the carrying capacity of the air, land and water resources of the planning area. The land conservation and development actions provided for by such plans should not exceed the carrying capacity of such resources.
>
> 5. All plans and programs affecting waste and process discharges should be coordinated within the applicable air sheds and river basins described or included in state environmental quality statutes, rules, standards and implementation plan.

Clearly Metro's role as a regional land use planning authority qualifies it as a "local government agency that has legal authority of a sector or source contributing pollutants, and is identified as such by the DEQ in a TMDL".

Thus Metro should be identified as a Designated Management Agency <u>for its planning role</u> and not just for the property it holds and manages. Further, Metro should provide a stormwater management plan that provides reasonable assurance that all waste and process discharges from future development, when combined with such discharges from existing developments shall not threaten to violate, or violate applicable state or federal environmental quality statutes, rules and standards including the Tualatin Basin TMDLs.

5.4 – Trading as a Management Strategy

CWS temperature trade needs to be focused on the tributaries and targeted so that a measurable improvement in temperature can be achieved with adequate monitoring to inform adaptive management over time. It should be targeted as well to protect the beneficial use of cool water species on those tributaries where the most sensitive uses of spawning and rearing. The data exists to achieve this and should as well be coordinated with ODA and ODF land management DMAs.

Successful trials of flow augmentation on tributaries have been conducted by CWS in cooperation with Tualatin Valley Irrigation District. Such effective practices should be expanded.

CWS also constructed an in-stream pond bypass project at Tanasbrook Ponds. The CWS Healthy Streams Plan identified 9 potential in-stream pond reconfiguration projects on Dairy Creek alone. There are opportunities for similar projects at numerous in-stream ponds on other tributaries which could be encouraged through the temperature trade program and a load allocation for small top-flow dams.

In part, the rational for the temperature trade is predicated on failure of nonpoint sources, agriculture and forest land uses to achieve shading to meet their load allocations. This should be corrected in the

implementation of the TMDL so that CWS efforts to shade streams can focus on additional areas that are not already assigned a load allocation.

<u>Recommendation #15:</u> DMAs with temperature load allocations should be required to meet these allocations so that Clean Water Services temperature trade mitigation efforts can be focused on areas that are not already assigned a load allocation.

United States Department of the Interior

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Columbia-Cascades Area Office
Bend Field Office
1375 SE Wilson Avenue, Suite 100
Bend, OR 97702-2607

IN REPLY REFER TO:
BFO-1400
RES-1.10

DEC 0 6 2011

Avis Newell
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

Subject: Comments on *Draft Tualatin River Basin Total Maximum Daily Loads*

Dear Ms. Newell:

The U.S. Bureau of Reclamation appreciates the opportunity to provide comments on the subject document. Our comments are attached. Please contact Mr. Clyde Lay at 208-685-6926 if you have any questions regarding our comments.

Sincerely,

Scott Boelman
Field Office Manager

Attachment

cc: PN-6520 (Clay), CCA-1002 (DWiedmeier), CCA-1605 (SWilley),
Joe Rutledge Tualatin Valley Irrigation District,
Tom VanderPlaat Clean Water Services

Comments on the *Draft* Tualatin River Basin Total Maximum Daily Load
U.S. Bureau of Reclamation (Reclamation)

General comments

The 2011 Tualatin TMDL amendment designates Reclamation as Designated Management Agency – and gives Reclamation a temperature load allocation specified in the TMDL for the fall critical period. In the original 2001 TMDL, the reservoir and creek were not identified as water quality limited. Because it is a load allocation ODEQ recognizes that Reclamation is a non-point source. However, it is not clear if there are management practices available just to Reclamation to accomplish the fall temperature reduction. Furthermore, the temperature reductions in the TMDL for Reclamation are in conflict with the temperature reductions required in the TMDL for the space and water users of the reservoir. ODEQ is asking that Reclamation reduce temperatures in the fall, while the space holders are being asked to reduce temperatures in the summer. The conflict arises due to the fact that one of the only ways to reduce fall temperatures is to limit the amount of water delivered in the summer, and one of the best ways for the space holders to reduce temperatures in the summer is to release extra water.

Reclamation has limited opportunities to alter the delivery of water from Scoggins Dam; Reclamation delivers the water when called upon. In addition, ODEQ has approved a temperature trading plan with one of the space holders to deliver extra water in the summer to offset the temperature increase their wastewater treatment plants introduce into the river. It is clear that ODEQ recognizes, based upon that approval, that the space holders are the responsible parties that makes the decisions of when and how much water to release. Consequently, the space holders should be identified as the DMA for Scoggins Reservoir not Reclamation

The expectations for the Reclamation's WQMP are specified as follows: Reclamation shall develop a TMDL Implementation Plan that describes how current operations will be modified to address autumnal heating, and that also describes how planning for future changes at the reservoir will address thermal impacts. Rather than focusing on the autumnal heating, the WQMP should include language that would allow the demonstration of "overall environmental benefit" associated with the releases from the reservoir. The WQMP should also note that there are ecological conflicts built into the TDML to meet the summer critical period that are mutually exclusive with meeting a fall temperature reduction. Furthermore, there are limited opportunities to change the temperature regime of the release from the reservoir. Including such language in the TMDL amendment would clarify the scope of the management practices that would be included in the TMP.

Temperature TMDL

Page 2-10, Paragraph 5: This paragraph indicates that watershed-specific timing and use information was used to determine more precisely where and when numeric criteria apply. Additional information is needed to determine what species of indigenous salmon and steelhead spawning is being protected during the October 15 to May 15 period. Section 303 d (3), of the Clean Water Act that authorizes states to prepare TMDLs indicates that loads should be set "at a

level that would assure protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife".

Listed species in the Scoggins Creek area include Upper Willamette River steelhead (*Oncorhynchus mykiss*) and Upper Willamette River Spring Chinook salmon (*O. tshawytscha*). Critical habitat was also designated for these two species (70 FR 52630) although critical habitat for spring Chinook salmon was not designated within the Tualatin Basin. From this listing, it can be inferred that spring Chinook and winter steelhead are indigenous species that should be protected by pollutant load allocations. In addition, where steelhead populations exist or once existed, resident rainbow trout are also common and are considered indigenous.

Historically a naturally occurring fish barrier, Willamette Falls, excluded many species of salmon from the upper Willamette River tributaries. For example, winter steelhead and spring Chinook salmon occurred historically above the falls, but summer steelhead, fall Chinook salmon, and coho salmon did not (PGE 1994). Consequently, these species are not considered indigenous to Scoggins Creek or other tributaries in the Tualatin Basin In addition, no critical habitat was designated for lower Columbia River coho and upper Willamette River Chinook within the Tualatin River watershed. This may serve as another indicator that these species were not indigenous to Scoggins creek and other tributaries in the basin.

Life history traits of spring steelhead include an active spawning period of February through May. Consequently, there is no need to use a spawning criteria in October through December, when these fish are simply rearing in the system. The life history traits for resident rainbow trout would be similar to that of the steelhead as well.

While, the life history traits of spring Chinook indicates that they actively spawn from September through November, the Tualatin River basin is not considered to include Chinook salmon spawning habitat (Alsbury 2006 as cited in Reclamation 2009). Chinook salmon use of the Tualatin basin is limited to rearing habitat for juvenile fish that have likely moved upstream from the Willamette River into lower reaches of the Tualatin River near the confluence. Consequently, there is no need to use a spawning criteria in October through May, when these fish are simply rearing in the system.

Page 2-12 Paragraph 2; Human Use Allowance: Reclamation agrees that the human use allowance is a key element in the Tualatin Subbasin TMDLS. Further discussion of the human use allowance needs to occur concerning the appropriate timing and allocation of the HUA. For example, Henry Hagg Lake (Scoggins Reservoir) was given a small portion of the HUA during the summer critical period. Justification for this allocation is not included in the document. This structure has limited opportunities to decrease or mitigate their temperature effects on Scoggins Creek. Ultimately, these types of heat sources were the reason for HUA, rather than other types of nonpoint sources that can mitigate or change their temperature effects through implementation of best management practices. Reclamation disagrees with the allocation of the HUA for dams within the basin and requests that the HUA be reallocated to those sources with high economic costs associated with mitigation and BMP implementation.

In addition, the year round critical time period in which the load allocations for the Scoggins' Reservoir occur at a time when no other entity is required to meet waste load or load allocations for temperature. As a result, the HUA for the fall and winter period is not allocated to any point or nonpoint source within the Scoggins watershed. As a result the entire HUA for the fall critical period should be allocated to dams.

Page 2-13 Paragraph 8; Analytical approaches: This paragraph indicates that Natural Thermal Potential estimates from CE_QUAL-W2 modeling are available for Scoggins Creek. However, the document does not provide figures or estimate of what the NTP temperatures may be.

Page 2-14 Paragraph 8; Natural thermal potential: The description of system potential vegetation, while indicating it is not an estimate of presettlement conditions does in fact model or describe vegetation where human disturbance is not represented. If the only disturbance allowed into the model includes natural disturbance then your estimates are presettelment conditions, or pre-human existence conditions. The TMDL process for other pollutants includes the concept of assimilative capacity and then the TMDL goes forward to indicate what loading the stream assimilate before the beneficial uses are impacted. NTP and SP models ignores this very basic concept of assimilative capacity and allocates all the available load to natural background. Ultimately, shade TMDLs and NTP will prove unattainable until assimilative capacity is included as rigorously as it is applied in nutrient, sediment, and other pollutant TMDLs. Reclamation agrees with the concept of using system potential for riparian shade targets, with the understanding that dams have changed the system hydrology, and some human disturbance is allowable within the assimilative capacity of a system.

Aquatic systems with NTP TMDLs should also include a threshold concept that when the beneficial uses are fully supported the existing temperature regime supersedes the NTP or the biological criteria. This concept is already understood and implemented by ODEQ in regards to NTP and the biological criteria it is simply and extension of the concept to include the actual goal of the TMDL to restore beneficial uses to fully supporting conditions (see page 2-15 paragraph 2).

Page 2-20 paragraph 1: Daily discharge records for Scoggins Dam are available for the period of record from January 1, 1975 to date from the USBOR Hydromet web site. The reservoir was completed in 1975.

Page 2-21 Paragraph 1: This paragraph indicates that a stream system is not impaired when the stream temperature does not exceed the biological criteria. The paragraph continues on to indicate that streams are not impaired if they are at or below the NTP but above the biological criteria. This implies that beneficial uses functionality and loading capacity exists above the biological criteria during the critical period in all streams with NTP TMDLS. The true measure of impairment and loading capacity in not then temperature, but some measure of functioning beneficial uses, of which DEQ uses NTP or shade as that surrogate. In the case of Scoggins Creek Salmon Spawning is the beneficial use in question, and an existing population of introduced coho salmon are successfully spawning below the reservoir. In effect, this population as well as populations of resident rainbow trout are a direct measure of the beneficial use, and

not a surrogate like NTP or the flawed biological criteria that requires exemptions in all the watersheds throughout Oregon where NTP TMDLs have been written.

If there is loading capacity in a stream above the biological criteria during the summer, then additional loading capacity must also exist in proportion to the differences between NTP and the biological criteria in all other times of the year. However, unlike the summer critical periods in the fall and in cooler periods loading capacity is not consumed by the natural background levels of solar radiation as DEQ states is the case for the summer critical period. Consequently, a loading capacity should be developed during the fall that expresses the differences between the biological criteria and the loading capacity when solar inputs are reduced and climate acts to cool the system yielding excess load capacity.

Page 2-22: See comment above concerning Human Use Allowance.

Page 2-24, Paragraph 3: Scoggins Reservoir currently has a refill probability greater than 90 percent. In examining the period of record, Reclamation has found 2 of the 35 years that the reservoir has been in operation that it did not fill. These years were 1977 and 2001 and were very extreme examples of a naturally occurring phenomena of regional drought. However, in the case of reservoirs DEQ does not give any allowance for natural disturbance in the development of the load allocations for the reservoir and in determining why water quality standards may be exceeded. This is in direct conflict with the NTP concepts where wildfire, landslides, and other natural disturbances are afforded exclusion from the riparian shade and NTP discussions. Other nonpoint sources are not held accountable for these naturally occurring events. Reclamation request that DEQ investigate methods to address exceptions to regional drought before assigning load allocations to the reservoir and forcing Reclamation and its partners to incur costs of developing a water temperature management plan that may not be warranted based on the current operations of the reservoir in 95 percent of the period of record.

Page 2-28, Paragraph 6: The values given for Henry Hagg Lake (Scoggins Reservoir) are incorrect. Based on the authorized project description Scoggins Reservoir has a total capacity of 59,910 acre-feet with active storage of approximately 53,600 acre-feet. Reservoir volume data collected over the 35-year period of record indicates that the average active pool volume (excluding 1977 and 2001) is 53,637 acre-feet.

Page 2-29, Paragraph 1: Please consider changing the last sentence to read " During these times, the warmer surface waters are closer to the outlet works".

However, Reclamation questions the need to include Scoggins reservoir in this TMDL based on the refill probability of the reservoir and the current location of the outlet works deep in the hypolimnion of the reservoir. The data from 2002 presented in figure 2-9 clearly indicates that temperature exceedances are rare when the reservoir fills, the period of record also clearly indicates that not refilling is also very rare and is generally the result of naturally occurring events beyond the control of Reclamation and its partners. In addition, the Clean Water Act provides for the inclusion of storage and the delivery of water to fulfill water rights. Please see CWA section 102(a) an excerpt of which reads:

> In the development of such comprehensive programs due regard shall be given to the improvements which are necessary to conserve such waters for the protection and propagation of fish and aquatic life and wildlife, recreational purposes, and the withdrawal of such waters for public water supply, agricultural, industrial, and other purposes.

Page 2-29, Paragraph 2: Please discuss frequency of not refilling and the causes of not refilling.

Page 2-29: Excluded from this discussion is the effect the reservoir has on cooling Scoggins Creek, which experiences several instances of elevated temperature during the summer critical period.

Additionally, the flow augmentation and cold water delivered downstream to the Tualatin River, while seemingly accounted for in scope of the TMDL is ignored in allocating fall load reductions to Reclamation. It is apparent that a trading scheme (see page 2-35), and the TMDL itself, developed for other point sources takes advantage of the water storage and the cold water delivers to offset the thermal impacts at other locations in the basin and in the Tualatin River. These same concepts and trading should be used to offset the 7 to 20 days where temperatures in the fall are slightly elevated below Scoggins Dam if in the unlikely event the reservoir fails to fill.

Additional discussion needs to include the affected area below the reservoir. As the fall progresses, the reservoir begins to cool rapidly. Stream temperatures fall at a rate of 0.17 °C per day. Coupled with the modulation of the diel variation from the reservoir, the potentially impacted area is limited appreciably. In addition, the affected area is reduced, especially in the latter portion of the fall critical period, when water leaving the reservoir is 14°C or less. This reduction is due in part to the facts that solar loading is minimal and losses of heat to the atmosphere and ground are greater during the fall critical period.

In light of a spawning population of coho salmon, it is evident that spawning activities are not impacted by the slightly elevated temperatures delivered from the reservoir in the fall. The fish may delay reaching the pool below the dam by a few days as they wait for temperatures to reach optimum levels, or they may begin spawning in the lower reaches of Scoggins Creek and additional fish may move upstream as the area above 13 °C is reduced as time progresses.

Ultimately, Reclamation believes that ODEQ should remove the Scoggins Creek Temperature TMDLS from this document. The system has not been determined to be impaired through the processes that ODEQ normally uses. The system was not listed as impaired on any of the recent integrated reports or 303(d) lists indicating impairment. Also, the data presented do not warrant a temperature TMDL. It appears to simply be an attempt to direct the future plans and efforts of Reclamation in regards to the scope and design of the dam should they change. A TMDL is not the appropriate venue for this type of action.

REFERENCES

PGE 1994 Portland General Electric (PGE). 1994. Fish runs: Willamette Falls, Sandy River, Clackamas River, Deschutes River. 38pp.

Reclamation 2009 Bureau of Reclamation. 2009. Biological Assessment for Bureau of Reclamation Future Operations and Maintenance in the Tualatin River Subbasin.

WASHINGTON COUNTY
OREGON

December 9, 2011

Avis Newell, NW Region
Oregon Department of Environmental Quality
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987

Dear Ms. Newell:

Thank you for the opportunity to review revisions to the Tualatin Basin TMDLs for temperature, phosphorus, and ammonia. It is delivered to you today within the public comment deadline of December 14, 2011. The DEQ revisions have been reviewed by Washington County and our technical consultants, with particular attention to potential impacts on the current Washington County TMDL Nonpoint Source Management Plan for the rural area of the Tualatin Basin.

Our review focused on changes to the existing TMDL that would impact management measures for relevant discharges in rural areas. In general, we are confident that the revisions to the temperature and/or phosphorus TMDL's will not result in necessary changes to the existing extensive management measures as explained in detail in the Washington County Nonpoint Source Management Plan for the rural area (applicable to measures and BMPs within the authority and jurisdiction of Washington County). This is particularly true if meeting the instream temperature standards remain an acceptable demonstration of attaining the TMDL.

A summary of comments and/or questions for DEQ are as follows:

Technical:

- In Washington County's TMDL annual reports, monitoring results for instream temperature have been compared to instream temperatures that would represent attainment of the previous 1999 temperature standards. These target instream temperatures were provided by DEQ in Figures 31 through 37 of the previous temperature TMDL. The revised TMDL does not include similar Figures to show targeted instream temperatures for each water body representing attainment of the new standards. Instead, effective shade graphics are provided (Figures 2-13 through 2-18) to indicate percent effective shade (as a surrogate measure) necessary for attainment of the load allocations. Once the revised temperature TMDL is adopted,

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could future annual reports continue to include a comparison of instream temperatures to relevant temperature standards?

- In the previous temperature TMDL, anthropogenic (human-caused) Nonpoint sources are given a heat load of zero. In the revised 2011 temperature TMDL, it defines the load allocation as follows:

  System potential solar radiation is the targeted thermal load allocation for nonpoint source activities in the Tualatin Subbasin. A small portion, 0.05C of the 0.3 C human use allowance is allocated to non-point sources. For solar radiation, a load allocation consistent with site potential vegetation is targeted. The 0.05 C allocation for non-point sources is for anthropogenic heat loads in landscapes that are not likely to achieve a natural condition characterized by native plant communities in streamside areas, and for other small nonpoint sources of heat. This allocation was not divided among specific nonpoint sources as part of this TMDL and can include reservoir operations.

  As stated in the last sentence, an allocation was not divided among nonpoint sources. Figures are no longer provided showing instream temperatures that should be met to achieve attainment. Instead, only the effective shade targets are provided as they were in the 2001 TMDL. The document continues to state the following: *"Attainment of the effective shade surrogate measures is equivalent to attainment of the nonpoint source load allocations."*

- It would be helpful if the document could clarify language with respect to TMDL parameters. For example, in the Executive Summary, the list of TMDLs is in terms of "pH, chlorophyll a, and dissolved oxygen. Later in the document, it refers to "ammonia, phosphorus and volatile solids" as TMDL parameters. If it is to refer to chlorophyll a, it would be helpful to say that TMDL is implemented through the reduction of phosphorus and hence phosphorus waste load allocations. Otherwise, the document is very confusing regarding the actual TMDL parameters.

- In the fourth paragraph of the Executive Summary, it states that the Tualatin River Basin TMDLs for temperature and dissolved oxygen apply to all perennial and intermittent streams, rivers, and lakes with the Tualatin River Basin in Oregon. Then it states that the TMDLs for pH and chlorophyll a that regulate total phosphorus concentrations apply to the entire Tualatin River subbasin and to the Oswego Lake watershed. What is the difference between these two conditions? Is the Oswego Lake included in the Tualatin River Basin?

- The document says revised Water Quality Management Plans should identify constraints of achieving system potential (e.g., effective shading), and gives an example that an existing road or highway may preclude attainment of system potential. It also suggests consideration should be given of designs that support TMDL load allocations (i.e., shading, etc.) whenever construction or restoration activities occur. There is considerable research that even large open parking lots do

not increase instream temperatures due to summer rains: there is potential for increased temperatures on extremely hot days, although there is also evidence that the cooling rains do not significantly increase instream temperature. Section 5.2.5.2 of your document states "because stormwater is not a significant source of heat to subbasin streams during the TMDL period, temperature impacts are not addressed by the MS4 (urban) permit". Rural road runoff is even less likely to cause any changes to instream temperature. Assumptions should not be included in these revisions, particularly where they could cause changes to rural road construction standards. Washington County practices include a "Riparian Management Area", or RMA, which is essentially a 250' vegetated buffer at any road-stream crossing. We believe that is sufficient to avoid the unlikely event of rural road runoff causing instream temperature increase.

We hope to meet with you in 2012 to discuss these issues and identify any expectations of 2013 revisions to the Washington County Water Quality Implementation Plan.

You may contact Greg Clemmons, 503-846-7653 if you have any questions. Thank you.

Sincerely,

Dave Schamp
Division Manager, Operations & Maintenance

c: Greg Clemmons
Janet Oatney
c/file

WATER ENVIRONMENT SERVICES
Beyond clean water.

Water Quality Protection
Surface Water Management
Wastewater Collection & Treatment

Michael S. Kuenzi, P.E.
Director

December 12, 2011

Oregon Department of Environmental Quality
Attn. Avis Newell
2020 SW 4th Ave., Suite 400
Portland, Oregon 97201

Subject: Comment Letter for September 27, 2011 draft Tualatin River TMDLs

Dear Avis:

The purpose of this letter is to provide comments on the Department of Environmental Quality's (Department) September 27, 2011 draft TMDLs for the Tualatin River watershed. This letter has been prepared, and is provided to the Department on behalf of, the Surface Water Management Agency of Clackamas County (SWMACC) and the City of Rivergrove. We appreciate your consideration and response to the following comments.

Executive Summary:
A) On page i, the document states that land use in the watershed is 35% agriculture. Please consider adding a Rural Residential (RR) land use percentage. Since RR lands are regulated and managed somewhat differently than agricultural lands, providing this information would be useful. In other locations in the document (Figure 1-5, for example), RR land use information is provided.

B) On page iv, in the Water Quality Management Plan (WQMP) section, please add the City and Rivergrove and the Surface Water Management Agency of Clackamas County (SWMACC) to the Urban DMA list. Please note that SWMACC also includes thousands of rural acres as well.

C) On page iv, in the WQMP section, please consider changing the term "Urban DMAs" to "Local governmental DMAs", since many of these DMAs also include many rural acres, and State Agencies and Federal Agencies are provided with their own category in this part of the document.

D) On page iv, in the WQMP section, the term "Irrigation-related issues" is used to describe two Districts who are involved in drainage management and

irrigation. Please consider using another term here. "Irrigation and Drainage" entities may be an alternative.

Chapter 1: Overview and Background

A) On page 1-5, in Figure 1-4, both "BLM" and "O & C Lands" are listed separately. Since the BLM manages the O & C Lands, and since the figure appears to show there aren't any BLM lands present, please consider consolidating these into one category.

B) On page 1-5, in Figure 1-4, "City Boundaries" are provided. Since there are thousands of urbanized yet unincorporated acres in the watershed (the community of Aloha is an example), please consider also displaying Urban Growth Boundaries on this figure to more accurately depict the urbanized locations in the watershed. A layer of data titled "urban" is displayed in Figure 1-5, so the Department already has the same data, or a comparable type of data, for this watershed.

C) On page 1-5, in Figure 1-4, County boundaries appear to be provided, yet they aren't shown on the legend. Please consider adding a County boundary item to the legend if County boundaries are provided on this Figure. This layer of data could also be displayed on Figure 1-5.

D) On page 1-7, the document mentions steelhead and coho salmon, then states that Winter steelhead are listed as Threatened under the ESA. In this location, please include an explanatory statement about coho salmon as well. If it is true that coho salmon weren't historically present in this watershed, rendering them ineligible for ESA protection, we recommend that the document briefly mention this. In many other locations in Oregon, if wild coho salmon are present in a watershed today, they're also currently protected under the ESA.

E) On page 1-9, in Figure 1-7, the number of hours that the pH standard was exceeded is provided. The most recent year with data is 2007 though. Please consider adding data for the years 2008-2010 here. Figure 3-3 on page 3-9 appears to display the number of hours that the pH standard was exceeded from 1989-2010, so the Department may already have the information that would be needed to populate Figure 1-7 with.

Chapter 3: Total Phosphorus:

A) Table 3-10, which displays Waste Load Allocations (WLA), and table 3-15, which displays Load Allocations (LA), should both also list the following Designated Management Agencies: SWMACC and the City of Rivergrove.

B) "Daily Maximum total phosphorus concentration" LAs are provided in table 3-15. Please provide "Daily Maximum total phosphorus concentration" WLAs in table 3-10. This information will provide us with additional operational flexibility for discharges from our MS4-permitted storm sewer outfalls.

C) The "season" for the total phosphorus LAs and WLAs are proposed to be un-changed, continuing to be from May 1st to October 31st (see tables 3-10 and 3-15). Yet the proposed "season" for the total phosphorus WLAs which apply to Clean Water Services' (CWS) wastewater treatment plants are proposed to be decreased from May 1st to October 31st to either: a) May 1st to Sept. 30th, or b) May 1st to Oct. 15th. Since CWS' rigorous analysis apparently shows that slightly higher instream levels of total phosphorus will not cause pH violations and/or algae blooms in the lower River in October if "seven day average River flows" at the Farmington gauge are above 129.9 CFS (see page 3-18), please provide SWMACC, Clackamas County, and the City of Rivergrove with a WLA and a LA which also applies from May 1st to Sept. 30th. Although pH violations and/or algae blooms have been documented as late as the month of November in the Lake Oswego Corp's reservoir in the City of Lake Oswego, none of the lands in the City of Rivergrove drains to this location, and less than 100 acres of land in the unincorporated portion of SWMACC drain into this reservoir.

D) In table 3-15 on page 3-32, a total phosphorus LA is proposed to be provided to the parties who manage drainage and irrigation in the Wapato Lake area. We support the Department's ongoing efforts to assign LAs and/or WLAs to all of the significant sources of total phosphorus loading in the watershed.

Chapter 4: Dissolved Oxygen

A) Figure 4-4 on page 4-10 depicts the percentage of time in Summer that dissolved oxygen levels have been below 6.5 mg/L in the Tualatin River at River Mile 3.4 in SWMACC. The most recent data in this figure is from 2006. Please consider adding data from 2007-2011 if the Department has this data.

Chapter 5: WQMP

A) The TMDL Implementation Plan (IP) for SWMACC, Rivergrove, and Clackamas County was most recently revised and submitted to the Department in January 2011, but it apparently hasn't been approved yet. The Department's September 27, 2011 proposal to make changes to the TMDL, if made final, may not require SWMACC or the City of Rivergrove to make any management changes. This is understandable, for as the Department explains throughout the document, most of the proposed changes to the TMDL pertain to providing WLAs to two CWS wastewater treatment plants (POTW). Yet on page 5-15, the following statement is present: "*For parties who are currently implementing approved IPs, this TMDL revision should trigger a review and update of existing plans.*" Please add a statement on page 5-16 which notifies the reader that if changes to a DMA's approved IP are deemed un-necessary, then the DMA is not required to revise their IP again simply because some of the TMDL's numerous requirements have been changed.

B) On page 5-13, two SWCDs are mentioned by name as resources which are available, but the Clackamas County SWCD isn't mentioned. Please consider

also mentioning the Clackamas County SWCD, since at least 11,000 acres of the watershed are in Clackamas County.

C) In section 5.2.5.2 on page 5-15, please add the City and Rivergrove and the Surface Water Management Agency of Clackamas County (SWMACC) to the list of DMAs. Please continue to keep Clackamas County on the list.

D) A list of bulleted items on page 5-16 includes terms such as "riparian area management" and "all non-agricultural, non-forestry land uses...". Please note that while riparian areas and various land uses are indeed found in both cities and counties, if those lands are privately owned, the ability of the city or the county to influence changes on these lands which improve water quality is quite limited in most instances. At this time, placing additional City/County regulations on owners of private property who aren't developing their property will yield only modest overall improvements in non-point source water quality if most property owners are unwilling to make voluntary changes. In the current economic and political climate, the placement of additional City/County regulations could drive a wedge between us and stakeholders who we're actively building relationships with.

We look forward to working with the Department and the U.S. EPA in the future to develop and administer incentive-based programs which will motivate more private property owners to choose to make changes on their land which will improve non-point source water quality.

E) Phase I MS4 permits are mentioned on page 5-16. The WQMP states that a permit is "held" by Clackamas County. While this is technically correct, we encourage the Department to revise this statement to say this permit is held by thirteen different co-permittees, including the Cities of Lake Oswego, West Linn, Rivergrove, and SWMACC.

F) Also on page 5-16, in the section where Phase I MS4 permits are mentioned (5.2.5.2), please mention that ODOT also holds a Phase I MS4 permit for their many highway miles in the watershed.

G) Also on page 5-16, please add a sentence which says "Phase I MS4 permits only regulate discharges into and from publicly-owned, surface-discharging storm sewer systems".

In urban areas, the following discharges aren't regulated by any MS4 permit: 1) to drywells, 2) from privately owned storm sewer systems which outfall directly to waters of the state, and 3) from overland sheet flow which proceeds directly to waters of the state. We have found that when urban drainage networks have been carefully mapped, a surprisingly high percentage of lands often end up being not regulated by any MS4 permit.

H) Also on page 5-16, please mention that many 1200Z-permitted facilities are in the watershed. Providing the exact number would be ideal. We also recommend that the Department briefly describe how the 1200Z permit supports the TMDL's goals for continued improvement in the quality of surface waters in the watershed.

I) In section 5.2.6.4 on page 5-23, please add the City and Rivergrove and the Surface Water Management Agency of Clackamas County (SWMACC) to the list of Urban DMAs. Please continue to keep Clackamas County on the list. As was previously recommended, since many of these local governmental units also include rural areas, changing the name of this group to "Local Governmental DMAs" may be prudent.

J) In section 5.2.6.4 on page 5-23, it says: *"...there is a high assurance that (Urban DMAs) will revise and update the existing (TMDL Implementation) plans in response to this TMDL revision."* As we stated previously, we urge the Department to add a statement on page 5-23 which notifies the reader that if changes to a DMA's approved IP are deemed un-necessary, then the DMA is not required to revise their IP again simply because some of the TMDL's numerous requirements have been changed.

Thank you for the opportunity to comment and for all the significant work you have undertaken to create the draft TMDLs. We look forward to moving forward with this process. Please call me at 503-742-4555 with any questions.

Sincerely,

Dan Henninger
Technical Services Manager

C Michael S. Kuenzi, WES- Director
Mona LaPierre, WES- Environmental Monitoring Manager
Andrew Swanson, WES- Water Quality Analyst
Chris Storey, WES- County Counsel
Carol Murdock, WES- Surface Water Program Coordinator

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December 14, 2011

Avis Newell
Oregon DEQ- Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

Re: Tualatin Basin TMDL Revisions

Dear Ms. Newell:

The Northwest Environmental Defense Center (NEDC) submits these comments concerning the Draft Total Maximum Daily Load (TMDL) Proposed for the Tualatin River Subbasins. NEDC urges the Oregon Department of Environmental Quality (DEQ) to take further action to ensure that the proposed TMDL will protect water-quality and species habitat in the Tualatin River Subbasins.

DISCUSSION

I. Revised Temperature TMDL

Historically, salmonids thrived in Oregon's waters, with millions of fish returning from the ocean each year to spawn and rear in the rivers and streams across the state. Today, however, salmonid populations have declined precipitously; many salmon runs and resident bull trout populations are threatened or endangered. While reasons for the dramatic decline are numerous, anthropogenic temperature increases are one of the most significant, making Oregon's current temperatures a serious threat to coldwater fish. Oregon's waters are simply too warm to support cold-water fish. Despite this, when Oregon revised its water quality standards for these degraded waters, rather than establishing water quality standards that would ensure the viability of these imperiled species, Oregon adopted standards that do not support the biological needs of the species, as required by the Clean Water Act ("CWA").

The CWA provides the framework "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). To this end, the CWA requires states to develop water quality standards that establish, and then protect, the desired conditions of each waterway within the state's regulatory jurisdiction. *Id.* § 1313(a). Water quality standards "serve both as a description of the desired water quality for particular waterbodies and as a means of ensuring that such quality is attained and maintained." 64 Fed. Reg. 37,073, 37,074 (July 9, 1999); 40 C.F.R. § 131.2. Water quality standards that protect and restore cold water are, therefore, vitally

important to coldwater species. Yet, the numeric and narrative water quality criteria Oregon adopted are woefully inadequate to protect salmonids. Numeric water quality criteria are central to ensuring protection of designated uses. 33 U.S.C. § 1313(c)(2)(A); 40 C.F.R. § 131.3(b). Criteria "must be based on sound scientific rationale and must . . . protect the designated use." 40 C.F.R. § 131.11(a). Importantly, criteria "shall support the most sensitive use" of the waterbody. *Id.* Water quality criteria of 20°C for Salmon and Steelhead Migration, 12°C for Bull Trout Spawning and Juvenile Rearing, 13°C for Salmon and Steelhead Spawning Through Fry Emergence, and 18°C for Salmon and Steelhead Juvenile Rearing and Migration, however, do not support these uses. *See* OAR 340-041-0028(4)(a), (4)(d), (4)(f).

Specifically, the overwhelming evidence demonstrates that the 20ºC criterion for Salmon and Steelhead Migration does not satisfy the biological demands of threatened and endangered salmonids in Oregon. As EPA's Technical Support Document supporting its decision to approve Oregon's proposed water quality standards explains, salmon migrating in 20°C water suffer serious detrimental effects, including a "high" disease risk, reduced ability to feed, decreased migration rates, and an inability to avoid predators. Indeed, even DEQ recognized that 20°C water presents serious risks to salmon survival. Similarly, Oregon's temperature criteria for salmon and steelhead spawning, egg incubation, and fry emergence are not protective of these important life stages and therefore are unlawful. These criteria rely on the faulty assumption that criterion will provide colder water than the established standard. Finally, DEQ ignored science and relied on unsupportable assumptions when establishing the 18°C criterion for the Salmon and Steelhead Juvenile Rearing & Migration.

In addition, Oregon included several exemptions, in the form of narrative criteria, in its temperature standards that allow significant warming above its already inadequate numeric criteria. Styled as "narrative criteria," these provisions—the "Natural Conditions" criterion and "Human Use Allowance"—are exemptions that allow waters to become even hotter than Oregon's biologically-based numeric criteria. These represent significant loopholes that serve only to further undermine the temperature standards. First, under Oregon's Natural Conditions provision, if Oregon decides the "natural thermal potential" of a waterbody is hotter than the biologically-based numeric criterion, this thermal potential automatically supersedes the otherwise applicable numeric criterion for that water. OAR 340-041-0028(8). Second, Oregon's "Human Use Allowance" ("HUA") exemption, in turn, allows sources to automatically add 0.3°C of heat to waters that are already violating temperature standards. OAR 340-041-0028(12)(b). Because of the way Oregon determines the "natural thermal potential" of a water—by including some unknown but potentially significant anthropogenic influences—Oregon has allowed one form of a human use allowance. The HUA exemption, therefore, adds a *second* allowance for human use on top of this.

Simply put, because this TMDL is based on the current temperature water quality standards it is aimed at the wrong target, is not protective of Oregon's waters and will not meet the goals of the CWA. As a result, DEQ must revise the TMDL once it has promulgated appropriate water quality standards for temperature.

Specifically, setting aside for the moment the question of whether DEQ's numeric criteria are actually protective of Oregon's imperiled salmonids, the fundamental flaw in relying on the current water quality standards is found in DEQ's use of and reliance on the Natural Conditions Criterion ("NCC"). Under the NCC, if Oregon decides the "natural thermal potential" of a waterbody is hotter than the biologically-based numeric criterion, this thermal potential

automatically supersedes the otherwise applicable numeric criterion for that water. OAR 340-041-0028(8). This provision, however, is based on flawed models, allows Oregon to improperly include anthropogenic warming in estimates of "natural" potential and fails to consider the stresses salmon face today, when many of Oregon's waters are now irreversibly and significantly degraded. Despite these significant flaws and DEQ's admitted inability to apply the criterion accurately and consistently, *see* TMDL at 2-14, DEQ relied on this provision when establishing waste load allocations here. DEQ must not carry this error forward to the final TMDL.

In addition to this fundamental and fatal flaw, the TMDL fails to address several other important issues, including:

- DEQ failed to assign a waste load allocation, or otherwise address, urban stormwater. Although DEQ asserts these discharges have "no reasonable potential to cause temperature criteria violations," stormwater management, and the associated discharges, can influence stream temperature via changes to the historic geomorphology and hydrologic function of groundwater and surface water. This impact is ignored in the TMDL.
- Although DEQ acknowledges "the impacts from smaller dams and ponds, which are prevalent in the Tualatin Subbasin, can affect stream temperature" TMDL at 2-30, the TMDL fails to account for this impact by establishing a load allocation for these structures.
- Despite the heavy reliance on planting new vegetation to increase the shade levels throughout the basin, DEQ provides little information on the actual benefit these actions will have and how long it may take to realize these benefits.

II. Water Quality Management Plan and Pollution Trading

A. DEQ must have Reasonable Assurances that the TMDL will be Implemented.

Although DEQ states, "[p]rograms are already in place, or will be put in place, to ensure that the Tualatin River Basin TMDL will be met," the agency failed to determine whether the existing mechanisms in fact result in compliance. For example, DEQ points to, with approval, the Oregon Department of Agriculture's "program that provides outreach offering education on pollution prevention as well as an inspection program that has the ability to issue fines for non-compliance with the basin rules." However, the TMDL lacks any discussion of whether these mechanisms have resulted in the agricultural sector actually complying with its LAs. Similarly, DEQ states that the Oregon Department of Forestry "has the authority to enforce the Forest Practices Act to assess penalties when local operators fail to follow the practices required in the Forest Practices Act." Yet recent evidence demonstrates that forestry activities on private land results in increased stream temperatures, in violation of established LAs. Thus, the mere existence of this enforcement authority is not sufficient to ensure compliance with the TMDL. Rather than simply providing a list of the ways a DMA *may* ensure compliance with the TMDL, DEQ must evaluate whether each DMA *is* ensuring compliance. Only through such a review will DEQ be assured of the implementation of the TMDL.

Further, DEQ states that it "plans to encourage better tracking in the future to improve the opportunities for adaptive management, allowing DMAs and RPs to more effectively utilize limited implementation funds." TMDL at 5-26. This falls short of the mark. As DEQ notes, the "monitoring and feedback mechanism is a major component of the "reasonable assurance for success" for the Tualatin Basin WQMP." *Id.* Thus, DEQ must establish specific monitoring requirements for each DMA and RP that will provide the information necessary to evaluate both the effectiveness of the proposed management measures and the overall progress towards compliance with the CWA.

B. A Pollutant Trading Program Must Result in Measurable Improvements in Water Quality

DEQ touts the use of a pollutant credit trading program as "one approach that may be used to achieve water quality goals more efficiently." TMDL at 5-33. The trading section states that trades must be approved by DEQ and meet certain requirements laid out in the Water Quality Trading in NPDES Permits Internal Management Directive (referred to as "the Directive"). The Directive sets out that Credits become effective once the vegetation is planted (Section 3.2 Credit definition and use), and that DEQ allows credit for such projects to be based on the amount of solar radiation they are projected to block (Appendix A, section 2. Methodology for credit qualification). Also, the Directive only requires monitoring of the planted riparian vegetation once a year for five years and after that may allow a relaxed monitoring schedule once the plantings are established (Appendix A section 3. Requirement for planting plan and goals). Credits will remain in effect for as long as the project area is maintained for shade generation (Appendix A, section 2. Methodology for credit qualification: credit duration).

DEQ leaves many questions unanswered, however. Specifically, it appears that a participant may use credits from planting before the trees are providing effective shade (based upon projections of future shade). The purpose of the TMDL, however, is to meet the requirements for the different pollutants now, not sometime in the future when mitigation strategies begin to have an impact. Moreover, it is unclear how DEQ will ensure that the projected reduction in solar radiation is accurate. The Directive states that after five years, DEQ will no longer require annual monitoring. Yet, DEQ insists on awarding credits based upon projections of future shade, there must be a mechanism to ensure these projections are met. Otherwise, DEQ may inadvertently over value the effectiveness of a proposed project. Indeed, inadequate monitoring may lead, over time, to a discord between the credits generated based on projected conditions and the actual conditions. DEQ should require a more stringent monitoring regime to ensure the projections are being attained.

In sum, any pollutant trading program must result in measurable improvements in water quality, include adequate monitoring and reporting requirements, and be enforceable. Further, to ensure the program provides the intended benefits the appropriate structure and oversight must be in place so that projects target those areas where there is both a need and potential benefit, such as, for example with regard to temperature trading projects, on tributaries where the most sensitive uses of spawning and rearing.

CONCLUSION

NEDC asks that DEQ review and assess the adequacy of the proposed TMDL for the Tualatin Subbasins to ensure that they are protecting water quality and species habitat. The first step toward that goal will be to develop appropriate, lawful water quality standards for temperature and then revise the TMDL to achieve the established criteria. Next, DEQ must ensure that the numerous parties capable of effecting the changes necessary improve water quality in the region are, with DEQ's leadership, taking those actions that are necessary to protect our river. Thank you for the opportunity to comment on the proposed TMDL.

Sincerely,

Hannah McCausland
Ben Saver
Student Volunteers

Maura Fahey
Project Coordinator

December 14, 2011

Avis Newell,
Tualatin Basin Coordinator
DEQ Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

Dear Ms. Newell,

I am writing regarding the revision of the TMDLs for the Tualatin Basin. I wish to call your attention to some of the recent science related to riparian protections and temperature, and to encourage you to consider this information in the TMDL documents.

This year Oregon State University and Oregon Department of Forestry (ODF) released a study on the impact of timber harvesting on stream temperatures in the Coast Range. The study, known as RipStream, found that stream temperatures increased when riparian areas on small and medium fish bearing streams were managed to be minimally compliant with harvest rules under Oregon's Forest Practices Act (FPA).

ODF staff reported the following policy implications of the study to the Board of Forestry at their meeting on November 3 in Forest Grove:

> *The results from this analysis and the regulatory analyses (i.e., Numeric Criteria and Protecting Cold Water) described the magnitude and expected frequency of the two year post-harvest temperature change, variability in change among sites, the management-related factors associated with the temperature change, and the degree to which that change appeared to meet regulatory water quality requirements. Together these findings indicate that FPA riparian protection measures for small and medium fish streams do not maintain stream temperatures similar to control conditions, and are inadequate to insure forest operations meet the state water quality standard for protecting cold water.*

Forty percent of the Tualatin basin is covered with forest. The majority of that land is under private ownership, both industrial forest and small woodlots. The most temperature sensitive spawning habitat in the Tualatin Basin for threatened steelhead trout is in the headwaters forest. The RipStream study shows management under the minimum standards of the Forest Practices Act frequently leads to significant warming of fish streams.

INTERNATIONAL HEADQUARTERS
721 NW Ninth Avenue, Suite 300 • Portland, Oregon 97209 USA • tel: 503.222.1804 • fax: 503.222.1805
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ORS 527.765 (1) states

> *The State Board of Forestry shall establish best management practices and other rules applying to forest practices as necessary to insure that to the maximum extent practicable nonpoint source discharges of pollutants resulting from forest operations on forestlands do not impair the achievement and maintenance of water quality standards established by the Environmental Quality Commission for the waters of the state. Such best management practices shall consist of forest practices rules adopted to prevent or reduce pollution of waters of the state.*

The RipStream study clearly indicates that FPA riparian protection measures for small and medium fish streams do not maintain stream temperatures similar to control conditions, and are inadequate to insure forest operations meet the state water quality standard for protecting cold water. We request that DEQ respond to this situation with the following actions:

1. State explicitly in the Tualatin TMDL that the Forest Practices Act rules for small and medium fish streams are inadequate to meet the requirement to protect streams from the temperature impacts of harvesting on private forest lands.

2. State explicitly in the Tualatin TMDL that the Oregon Board of Forestry should revise FPA rules in order to achieve the Temperature Load Allocation.

3. Consider petitioning the Oregon Board of Forestry to revise FPA rules to meet the Tualatin Temperature Load Allocation and the Protecting Cold Water Standard (PCW; OAR 340-041-0028 (11) (a)).

4. Further analyze whether the heating caused on forested streams may also contribute to downstream warming relevant to efforts to meet the state Biologically-Based Numeric Criteria (Numeric Criteria; OAR 340-041-0028 (4)).

The Wild Salmon Center is the only international conservation organization working to protect wild Pacific salmon throughout their entire range. We partner with governments, local communities, and businesses to create a network of healthy salmon ecosystems across the North Pacific. Our work is based on the best available science and our conservation solutions support sustainable economies, regional cultures, and the great rivers of the Pacific Rim.

Thank you for your efforts to protect wild salmon through the Tualatin TMDL.

Sincerely,

Bob Van Dyk
Forest Policy Manager
Wild Salmon Center
bvandyk@wildsalmoncenter.org

503-504-8471

Clean Water Services
Our commitment is clear.

December 14, 2011

Avis Newell
DEQ Northwest Region Office
2020 SW 4th Avenue
Portland, OR 97201

Dear Ms. Newell:

As you know, Clean Water Services provides wastewater and stormwater services to over 500,000 residents mostly in the urban portion of Washington County under the nation's first watershed based NPDES permit. Clean Water Services is committed to protecting water quality in the Tualatin River Watershed through innovative wastewater and stormwater services, water quality and stream enhancement projects, fish habitat protection and more. We appreciate the opportunity to provide comments on the proposed Tualatin TMDL amendment.

We believe that the Tualatin TMDL amendment will enable Clean Water Services to address the anticipated growth in the basin in an economically prudent, environmentally protective, and ecologically sustainable manner. However, we do have some comments regarding the load allocations for the reservoirs, designated management agencies, water quality management plans, implementation ready TMDLs, and the bubble load for total phosphorus. Our comments on the draft Tualatin TMDL amendment are attached. We believe that these comments will further clarify the TMDL allocations and implementation strategy.

If you have any questions regarding our comments, please contact me. I can be reached by phone at (503) 681-3604 or by e-mail at ruffierp@cleanwaterservices.org

Sincerely,

Peter Ruffier
Director, Regulatory Affairs Department
Clean Water Services

2011 Tualatin TMDL Amendment Comments

Executive Summary

Water Quality Management Plan (WQMPs)

The 2001 Tualatin TMDL requires the WQMPs from entities for which the TMDL includes load allocations. The 2011 Tualatin TMDL amendment designates a number of urban entities, irrigation districts, state agencies and federal agencies as Designated Management Agencies (DMAs). Many of the identified DMAs do not have a load allocation specified in the TMDL. Without specific load allocations in the TMDL, it is not clear what DEQ expects DMAs to present in their Water Quality Management plan(s) (WQMP). Without clear expectations, the DMAs may not be able to identify what management practices are needed or supposed to accomplish. For these very reasons, DEQ will also have difficulty in determining the adequacy of WQMPs. The DEQ should provide guidance for DMAs by describing the anticipated scope of responsibility and WQMP expectations for each DMA.

This section notes that 18 months would be allowed to develop a new WQMP or revise an existing WQMP. Since the 2011 Tualatin TMDL amendment updates only certain portions of the 2001 TMDL, it should not affect many of the existing WQMPs. Therefore, the TMDL amendment should include language to allow DMAs to first determine whether the 2011 Tualatin TMDL amendment would affect their WQMP; if so, the existing WQMP should be revised within 18 months. Additionally, it is our understanding that DEQ is planning to prepare a water quality status report for the Tualatin Basin, which would identify actions necessary to meet the goals and objectives of the TMDL. The WQMPs should include a reference to the water quality status report for the Tualatin Basin and the actions noted in the report.

Chapter 2

303(d) listing process

We believe that it premature to establish year-around load allocations for Hagg Lake and Barney Reservoir because the Tualatin River above Dairy Creek is not on the 303(d) list for temperature. Furthermore, the Tualatin River is listed as being water quality limited only during the summer. Thus, developing year-around load allocations for reservoirs in the upper Tualatin River is premature. We recommend that the following approach be used for the upper Tualatin River:

- Obtain/evaluate temperature data for the upper Tualatin River;
- If the data indicates that the water quality standards are not being met, DEQ can then list this segment of the stream on the 303(d) list and identify the uses that are not being met;
- DEQ can then develop a TMDL to address the listing.

Bypassing the water quality assessment process incorporated into the 303(d) listing procedures and moving straight into TMDL requirements and DMA assignments cuts out significant evaluations and determinations, such as: Does the data meet the meta-data and QA/QC requirements for evaluation? Does the data demonstrate attainment of applicable criteria or uses? Does the pollutant cause non-attainment? The listing process is important for providing stakeholders the opportunity to review the relevant data and provide input to the determinations that a TMDL is warranted. In addition, the listing process can provide insights to the focus and scope of the water quality management plans required of the DMAs. Furthermore, bypassing the listing process creates confusion about how a waterbody can be delisted at any point in the future. If the TMDL is not based upon a 303(d) listing to start with, what is the process to consider new data or re-evaluate the status of water quality standards?

Load allocations for reservoirs: The thermal load allocations for Hagg Lake and Barney Reservoir specify that the allocations apply year-around. We believe that the thermal load allocations should match the time frame when the stream is listed as being water quality limited. As noted above, the lower Tualatin River is listed as being water quality limited during the summer; thus, the thermal load allocations should apply only during the summer. If DEQ intends to apply the thermal allocations more broadly than the current listing, DEQ should follow the process

noted in the comment above. As temperature data is gathered in the upper river through management plans and if this data indicates that beneficial uses are not being protected during other times of the year (e.g. during fall), DEQ could develop allocations for other times of the year.

Hagg Lake management plan: The TMDL amendment requires the preparation of a Temperature Management Plan (TMP) for Hagg Lake and specifies that the plan is to contain "best management practices, measures, effluent trading, and control technologies for undertaking each measure"; the TMP would also include monitoring sufficient to demonstrate the success of the temperature management plan. Additionally, the TMP should note that there are limited opportunities to change the temperature regime of the release from the reservoir until a selective withdrawal structure is constructed as part of a reservoir modification/expansion. Therefore, the TMP should include language that would allow the demonstration of beneficial use protection and "overall environmental benefit" associated with the releases from the reservoir rather than focusing on the autumnal heating and the spawning criteria. Including such language in the TMDL amendment would clarify the scope of the management practices that would be included in the TMP and allow the demonstration of benefits associated with the releases from the current reservoir.

Barney Reservoir management plan
The TMDL amendment requires the submittal of a Monitoring Plan and if necessary a management plan that identifies measures based on the use and control of Clean Water Services' stored water releases. The management plan would also include a monitoring component to assess the effectiveness of the management measures; if monitoring indicates that the allocations are not being met, a revised management plan that identifies additional management strategies may be required. Similar to the provisions for the Hagg Lake management plan, this section should include language that recognizes that there are limited opportunities to change the temperature regime of the release from the reservoir and allow the demonstration of beneficial use protection and "overall environmental benefit" associated with the releases from the reservoir. Including such language in the TMDL amendment would clarify the scope of the management practices that would be included in the management plan and allow the demonstration of benefits associated with the releases from the current reservoir.

The Barney Reservoir management plan also requires a method for estimating the natural thermal potential temperature for the releases from Barney Reservoir. Note that the fourth element of the management plan for Barney Reservoir already references developing estimates of natural thermal potential temperatures for Barney Reservoir and the Upper Tualatin River as part of additional work that may be necessary. Thus, a requirement to develop a method for estimating the natural thermal potential temperature for the releases from Barney Reservoir as an initial step in developing the TMP is unnecessary and should be deleted.

Chapter 3

Total phosphorus wasteload allocations:
Table 3-13 presents the total phosphorus wasteload allocations for the District's four wastewater treatment facilities. To comply with EPA guidance regarding TMDL wasteload allocations, DEQ included daily maximum effluent concentrations in addition to the monthly median levels specified in the 2001 TMDL. As noted above, DEQ has implemented the monthly median wasteload allocations in the District's watershed based NPDES permit. Since the TMDL continues to be based on summer median concentrations, we believe that monthly median concentrations are still appropriate for use in the NPDES permit. We recommend including language in the TMDL indicating DEQ's intent to continue regulating total phosphorus levels using monthly median levels in the NPDES permit.

As noted above, the TMDL presents monthly median and maximum daily limits for total phosphorus. The maximum daily limits were calculated assuming a log-normal distribution using the procedures in EPA's Technical Support Document for Water Quality Based Toxics Control. While these assumptions reflect past operations at the wastewater treatment facilities, there is concern that they may not necessarily reflect future operations as biological phosphorus removal becomes the primary mechanism for phosphorus removal. Biological phosphorus removal is inherently more variable than chemical treatment. The TMDL should include language that recognizes

that the daily maximum levels may not reflect future levels with the operational changes noted above. The TMDL should also note that the daily maximum values are provided to satisfy TMDL guidelines; however, DEQ anticipates continuing to regulate based on the monthly median levels, which will ensure that the seasonal median phosphorus levels in the Tualatin River are met.

Total phosphorus bubbled load

The 2001 total phosphorus TMDL included tributary and mainstem loading capacities expressed as seasonal (summer) median total phosphorus concentrations (see Table 45 of the 2001 TMDL), which were derived from summer median natural background concentrations. The summer season was defined as May through October for background and loading capacities. The wasteload allocations for the District's Rock Creek and Durham Advanced Wastewater Treatment Facilities (AWTFs) were described in the 2001 TMDL as monthly median values, with the text noting that these WLAs will meet the loading capacities in Table 45, and also noting that the details are contained in Appendix C-5. Appendix C-5 shows results of mass balance calculations for a selected low flow period (July through October) for several variable flow years. The mass balances were used to show that the mainstem river would generally comply with the loading capacities with tributaries in compliance and with anthropogenic factors (like the AWTFs) removed. Neither the main text nor the Appendix discussed the need for the AWTFs to have monthly rather than seasonal WLAs. Nonetheless, all of the technical analyses in the 2001 TMDL were based on summer season median values.

The District accepted monthly median values as concentration-only WLAs (and subsequently as permit limitations) because anticipated treatment performance indicated that these limitations could be met and because concentration-only limits provided flexibility to accommodate growth in the District and still be protective of Tualatin River water quality.

When considering the bubble WLA mass loading concept (66.1 lbs/day) for this TMDL amendment, it is reasonable and protective to implement it as a summer season median, while maintaining the monthly median concentration WLAs for the Rock Creek and Durham AWTFs. As explained on page 3-29 in the 2011 Draft Amendment, the District has an innovative and highly touted intra-municipal trading program already in place, and the bubble trading for total phosphorus further enhances the program as a national model of innovation and flexibility. As noted by DEQ, this innovative approach is encouraged by EPA. Establishing the 66.1 lbs/day bubble WLA as a monthly rather than seasonal value is not only inconsistent with the underlying technical basis for the 2001 TMDL, but it will be problematic during some of the wetter months of the summer season when effluent flows at the Forest Grove and Hillsboro WWTFs are higher, and especially as these WWTFs grow to anticipated design capacities.

Further support for bubble trading on a longer-term averaging basis than monthly can be found in other nationally important, precedent-setting nutrient bubble trading programs. These large inter-municipal trading programs use annual compliance reconciliation consistent with the averaging periods in the respective TMDLs or watershed plans:

- Tar-Pamlico Basin Association: 15 municipal dischargers, North Carolina, TP bubble, initiated in 1990
- Neuse River Compliance Association: 20 municipal dischargers, North Carolina, TN bubble, initiated in 2003
- Connecticut Nitrogen Credit Exchange Program: 79 municipal dischargers in basins tributary to Long Island Sound, TN bubble, initiated in 2002
- Virginia Nutrient Credit Exchange: 120 municipal dischargers in 5 basins tributary to Chesapeake Bay, TP and TN bubbles, trading was to begin in 2011

If the bubble WLA is expressed as a summer season median, then the statistical derivation of the daily equivalent value would also need to be revised. The methodology in the 2007 EPA guidance establishes maximum daily values for a range of TMDL averaging periods and CVs. For WLAs that are summer seasonal values (about 180 days), the multiplier is 3.51 at a default CV of 0.6, consistent with how DEQ converted the other seasonal load allocations to daily values in the 2011 Draft Amendment. This would result in the 66.1 lbs/day seasonal WLA being converted to a maximum daily load of 232 lb/day. If a monthly WLA (or permit limit) is viewed as necessary by DEQ for the total

phosphorus bubble, then a variation of the statistical method in the 2007 guidance, as described in the Technical Support Document for Water Quality Based Toxics Control (TSD), should be used to convert to a monthly equivalent. As with the maximum daily calculation, this monthly approach uses the seasonal WLA as the long term average (LTA). A similar example is provided in a recent Fact Sheet for a NPDES permit in Idaho (City of Twin Falls) prepared by EPA Region 10 (the permitting authority in Idaho). In this case, EPA was converting an annual TMDL WLA into an average monthly limit (AML), see excerpt from the Fact Sheet below:

Calculating the Average Monthly Limit

The WLA in the TMDL is 146.4 tons per year.

146.4 tons/year × 2000 lbs/ton ÷ 365 days/year = 802 lbs/day (annual average)

Assume LTA = 802 lbs/day:

$AML = LTA \times exp[z\sigma_n - 0.5\sigma_n^2]$ *(from Table 5-2 of the TSD)*

Where:

CV = coefficient of variation = 0.51 (based on facility data from May 2003 – May 2008)

n = 16 (number of samples in a month)

$\sigma_{16}^2 = \ln(CV^2/n + 1) = \ln(0.51^2/16 + 1) = 0.016$

$\sigma_{16} = 0.127$

Z = percentile exceedance probability for AML (95%) = 1.645

$AML = 802 \times exp[(1.645 \times 0.127) - (0.5 \times 0.016)]$

AML = 980 lbs/day

For this calculation, the number of samples per month is used. The District's current watershed permit requires total phosphorus sampling for the effluents on a frequency of 5 times per week, or 20 per month during the TMDL period. Using a value of 20 for "n" and the default CV of 0.6, the 66.1 lbs/day seasonal bubble would equivalent to 81.6 lbs/day as an AML.

Converting the Seasonal Bubbled Load into Maximum Daily and Average Monthly Limits

MDL=LTA*e[zσ−0.5σ^2]
where:
MDL = Maximum daily limit
LTA = Long-term average (in the same units as the MDL)
Z = z-score associated with target recurrence interval
σ^2 = ln(CV2 + 1)
CV = Coefficient of variation

AML=LTA*e[zσ_n−0.5σ_n^2]
where:
AML = Average monthly limit
LTA = Long-term average (in the same units as the MDL)
Z = z-score associated with target recurrence interval
σ_n^2 = ln(CV^2/n+1)
CV = Coefficient of variation
n = # of samples per month

LTA	66.1	#/day	this is the seasonal TMDL allocation
# of Days in averaging period	180	days	
Acute Recurrence Interval	99.45%	%	Recurrence Interval = [k/k+1]% where k is the number of averaging period days.
Chronic Recurrence Interval	95.00%	%	Default for AML from section 5.5.4 of the TSD.
Acute Z-score	2.541		This is the Z score based on the corresponding recurrence interval in cell D18
Chronic Z-score	1.645		This is the Z score based on the default 95% probability for the AML in Section 5.5.4 of the TSD
CV	0.60		CV from EPA Fact Sheet for Twin Falls
σ^2	0.307		σ^2 = ln(CV^2 + 1)
σ_n^2	0.018		σ_n^2 = ln(CV^2/n+1)
n	20		number of samples per month (5 per week in current permit)

DWLA	231.948	Daily Wasteload Allocation (MDL)	3.50904	Multiplying factor from LTA to DWLA
AML	81.609	Average Monthly Limit	1.23464	Multiplying factor from LTA to AML

Total phosphorus bubbled load

As currently expressed, the bubbled load for total phosphorus is presented as a sum of the phosphorus loads from the Rock Creek, Hillsboro and Forest Grove treatment facilities. Additionally, the Rock Creek AWTF is subject to a concentration limit of 0.1 mg/L. Rather than having both a load and a concentration limit apply at the Rock Creek AWTF, the District would prefer to utilize a mathematically equivalent equation such as the one provided below to express the bubbled load.

> *Hillsboro WWTF TP load + Forest Grove WWTF TP load = Average Monthly Bubbled Load (81.6 lbs/day as noted above) – Rock Creek AWTF TP load*

This approach is consistent with the bubbled load in the TMDL and we request the TMDL include language that would allow the use of a mathematically equivalent expression of the bubbled total phosphorus load in Clean Water Services' NPDES permit.

Chapter 5

Clean Water Services as a DMA: Clean Water Services is identified as the DMA for the Barney Reservoir releases to the Tualatin River. This discussion indicates that Clean Water Services would incorporate the temperature monitoring provisions, and the temperature management plan for Barney Reservoir into its updated management plan for the thermal load trading program. Clean Water Services thermal load trading program focuses on offsetting the thermal load from its wastewater treatment facilities. The District does not believe that it would be appropriate to include the temperature monitoring provisions and temperature management plan for Barney Reservoir into its plan for implementing the thermal load trading program. Clean Water Services intends to develop a separate plan to conduct temperature monitoring and if necessary, develop a temperature management plan for the releases from Barney Reservoir.

DMAs without load allocations:

As noted earlier, the 2011 Tualatin TMDL amendment identifies several new DMAs. Many of the newly identified DMAs do not have load allocations specified in the 2011 Tualatin TMDL amendment. Examples of DMAs without load allocations include Metro, TVID, BLM, USFWS, etc. Without assigned allocations it is not clear what the goals/expectations of the management plan are. It is also not clear how would DEQ determine the adequacy of the management practices proposed in the WQMP. The DEQ could facilitate the DMAs development of WQMPs and DEQs review of these plans by describing expectations of the DMAs. This guidance could identify the reason(s) why DEQ believed that agency should be a DMA, the role for the DMAs, and the expectations of what the plan should cover. This guidance, even in general form, would provide opportunity for DMAs to provide effective feedback to DEQ on if they have been appropriately designated a DMA, and to facilitate the development of effective WQMPs for DEQs approval.

It should also be noted that being identified as a DMA and having to develop a WQMP can be a tremendous burden on an organization. As noted above, DEQ has taken a broad approach to designating DMAs and has identified many DMAs without specific load allocations. Before designating entities without load allocations as DMAs, DEQ should consider the benefits of identifying the entity as a DMA and the value of WQMP that would be developed by the entity in meeting the goals and objectives of the TMDL.

Bureau of Reclamation (BOR) WQMP expectations: The expectations for BOR's WQMP are presented in the TMDL: *BOR shall develop a TMDL Implementation Plan that describes how current operations will be modified to address autumnal heating, and that also describes how planning for future changes at the reservoir will address thermal impacts.* Rather than focusing on the autumnal heating, the WQMP should include language that would allow the demonstration of "overall environmental benefit" associated with the releases from the reservoir. The WQMP should also note that there are limited opportunities to change the temperature regime of the release from the reservoir until a selective withdrawal structure is constructed as part of a reservoir modification or expansion. Including such language in the TMDL amendment would clarify the scope of the management practices that would be included in the TMP.

Implementation ready TMDLs: Chapter 5 should include a brief discussion and reference to the agreements and conditions for "implementation ready TMDLs" set forth in the Final Settlement Agreement captioned *Northwest Environmental Advocates v. Locke. et al., Civil No. 09w0017-PK* and the related commitments made by the Department in the development of the revised water quality standards for protection of human health. The discussion should describe DEQ's expectations for the updates and modifications for the Tualatin TMDL. It would be helpful for the discussion to describe the anticipated process for a collaborative TMDL review report and the role that the report may have for guiding implementation. For example, the discussion may want to observe the long history of implementation with the Tualatin TMDLs and note that many of the implementation mechanisms already exist. The temperature TMDL provides a good case example. Table 5-1 lists the pollution sources and example management strategies to address the TMDL pollutants, and includes nonpoint sources. For temperature, the appropriate target for load allocations is the Natural Thermal Potential, as defined in Chapter 2. Clean Water Services has extensive experience in riparian restoration and stewardship. Clean Water Services also has extensive experience developing activities and management for restored riparian areas to achieve and maintain shade targets. This information and experience can be used by the Department or other DMAs for consideration in the development of example management strategies that will attain the natural thermal potential for riparian areas in the Tualatin basin.

Suggested Edits

(Specific edits to the existing text are presented as ~~strikethrough~~ and replacement text is underlined)

Executive Summary

The Ammonia TMDL section should note that raw wastewater from the Hillsboro and Forest Grove WWTFs is currently sent to the Rock Creek AWTF for treatment and discharge. The 2011 Tualatin TMDL amendment proposes to include ammonia allocation for the Forest Grove and Hillsboro WWTFs that will enable Clean Water Services to upgrade these WWTFs and discharge treated water locally. So loads are being distributed over the three facilities rather than discharged entirely from the Rock Creek AWTF.

The Ammonia TMDL section starts with "As for phosphorus…".

The Ammonia TMDL section notes that the "TMDL amendment for ammonia does not provide alternate allowable ammonia loads for point sources in the Tualatin River. It does, however, allow that some of the allowable ammonia load be discharged at new locations - specifically at the two upstream waste water treatment facilities at Forest Grove and Hillsboro." Rather than using the term "alternate allowable loads for point sources in the Tualatin River", it would be more accurate to state that the TMDL amendment does not allow additional ammonia loads that would necessitate a change to the dissolved oxygen TMDL for the lower Tualatin River.

Chapter 1

Table 1-1 presents flows and physical characteristics of the mainstem Tualatin River. Because of the large inputs and withdrawals, this table could benefit from additional explanation. For example, there is a large decrease in flow in the Tualatin River between Scoggins Creek and the Forest Grove WWTF; it would be helpful to note that this is due to irrigation and drinking water withdrawals. Also, the "Tualatin River at the Durham WWTF" does not include the flow from the Durham WWTF; it would be more accurate to present this location as "Tualatin River above the Durham WWTF".

Chapter 2

The 2011 Tualatin TMDL amendment should note that the dry season discharges from Hillsboro and Forest Grove WWTFs are the result of localized treatment and discharge of wastewater generated in the Hillsboro and Forest Grove service areas rather than pumping to the Rock Creek AWTF for treatment and discharge. Thus, it does not represent a "new load" to the Tualatin River but rather the distribution of an existing load to different locations in the watershed.

Page 2-17 of the Temperature TMDL chapter notes that Clean Water Services' four discharges contribute between 10 and 40 per cent of the flow in the Tualatin River, so that the discharges from each plant contribute significantly to river flow. It is not clear from the sentence that the "10 and 40 per cent of the flow in the Tualatin River" refers to the contribution from each individual WWTF. This statement should be revised to clarify that the "10 and 40 per cent of the flow in the Tualatin River" refers to the contribution from each individual WWTF.

Figure 2-11 and the accompanying table should be updated to refer to "Clean Water Services" rather than "USA".

Chapter 3

Page 3-5: The Lake Oswego Corporation manages Oswego Lake and holds a water right from the Tualatin for hydroelectric generation at the outlet of Oswego Lake. This shallow lake has historically received much of its water from the phosphorus ~~laden~~ containing Tualatin River, and has long experienced water quality problems associated with algal blooms and aquatic weeds.

Page 3-8: "dissolved oxygen is addressed under a separate TMDL, found in Chapter 4 of the 2001 TMDL (DEQ 2001), and amended here in Chapter ~~5~~4 of this document." Chapter ~~5~~4 includes a short summary of current dissolved oxygen conditions in the lower Tualatin River.

Table 3-13 notes that the total phosphorus allocations may be "relaxed" under certain conditions. Rather than using a term that is not previously defined, it would be better to refer to Table 3-9 for the time period for the applicability of the phosphorus allocations.

Page 3-20: The comments for Table 3-9 notes state that "alum treatment may cease after…". The District uses a combination of biological phosphorus removal and chemical treatment for phosphorus removal. Furthermore, the District may use chemicals other than alum in the future for phosphorus treatment. Therefore, we recommend that the phrase "phosphorus removal may cease after…" be used.

Page 3-24: The main purpose for this Total Phosphorus TMDL amendment is to provide Waste Load Allocations for two of the Clean Water Services municipal waste water treatment plants. These two facilities were online at the time of the 2001 TMDL, but they have not been discharging during the summer months. Instead, during the

summer, ~~effluent~~ raw wastewater from these treatments plants are piped down to the Rock Creek Advanced Waste Water Treatment Facility.

Page 3-24: As population in the Tualatin Basin increases, Clean Water Services proposes to increase their waste water treatment capacity by maintaining the current capacity at its' two downstream facilities, the Rock Creek and Durham plants, and by commencing summertime discharges at its' two upstream facilities at Forest Grove and Hillsboro. The two downstream plants at Rock Creek and ~~Hillsboro~~ Durham will increase capacity as needed once Forest Grove and Hillsboro are operating at full capacity during the summer.

Page 3-35: The impact of the resulting phosphorus loads along the mid-reach of the Tualatin River was then determined using the CE-QUAL-~~2E~~W2 model, calibrated for the 2001-2002 low water years. Thus while the bubble load was estimated based on average flow, the potential impacts of the bubble load were modeled using low flow years, when the bubble allocation may have a larger impact.

Page 3-35 of the report notes that the "model inputs used for Forest Grove and Hillsboro treatment plants are conservative because they assume no infiltration or evapotranspiration will occur, and that no phosphorus removal will occur in the wetland Natural Treatment Systems at Forest Grove and Hillsboro." The effectiveness of phosphorus treatment technologies at the Hillsboro and Forest Grove WWTFs were not considerations in defining the model inputs. Phosphorus loads at the Forest Grove and Hillsboro WWTFs were modeled such that the total load from the three wastewater treatment facilities would be less than 66.1 lbs/day.

Page 3-35 of the report notes that "Despite some flexibility for trading among plants, the phosphorus "savings" at the two upstream treatment plants cannot be transferred downstream to the Rock Creek Plant." If the upper two facilities are very effective at removing phosphorus, there is potential for a portion of the total phosphorus load to be transferred to the Rock Creek facility. But because the Rock Creek facility is subject to a total phosphorus concentration limit as well, it may not be possible to transfer the entire "savings" to the Rock Creek facility. This may have been the intent of the statement on page 3-35. If so, we suggest adding the phrase "because the Rock Creek Plant is subject to both the bubble load and a concentration based limit."

Chapter 4

The introductory section of this chapter does a good job of explaining the scope of the 2011 Tualatin TMDL amendment. We recommend that the other chapters of the report use this description to define the TMDL amendment as well.

Page 4-5: The first paragraph for the rationale for the ammonia TMDL amendment notes that during the wet season, discharge occurs discharge occurs at the Forest Grove and Hillsboro WWTFs but during the summer, effluent is piped to Rock Creek AWTF for discharge. It should be noted that *raw wastewater* is typically piped to the Rock Creek AWTF for treatment and discharge.

Pages 4-7 & 4-8: In this situation, no summer discharge currently occurs at the two upstream WWTFs; it is instead routed to the Rock Creek AWWTF. In order to accommodate the current operating scenario, as well as one including discharge at one ~~but not~~ or both upstream locations, no decay of NBOD or CBOD discharged from Forest Grove or Hillsboro will be estimated in the upper river reach. Decay of these pollutants will instead be estimated only for the river reach downstream of the Rock Creek AWWTF.

Chapter 5

Several terms are used to reference to implementation plans required under the TMDL. These include Temperature Management Plan, Water Quality Management Plan, and TMDL Implementation Plan. We recommend that the TMDL amendment include a statement that these are all references to the implementation plans required under the TMDL.

Table 5-2 should be updated to reflect that the District watershed-based permit is anticipated to be issued in 2012.

Page 5-18: Clean Water Services is identified as a DMA for the Barney Reservoir releases to the Tualatin Basin. However, it should be noted that Clean Water Services is not the "party with responsibility for discharges from Barney Reservoir…" as stated in this section. We recommend that this statement be modified as follows:

*"As the party with responsibility for **flow augmentation** discharges from Barney Reservoir...."*

Page 5-33: The report describes Clean Water Services' riparian planting program as follows: "*Clean Water Services hired crews to restore riparian zones in urban areas, and provided supplemental funding to the Tualatin Soil and Water Conservation District so they in turn could provide incentives to farmers who replaced crop land with riparian habitat."* We do not believe that this description fully captures the District's riparian planting program and suggest that the following be used to describe the program:

Clean Water Services conducts riparian planting in the urban areas of the watershed. The projects in the urban areas include riparian planting as well as stream enhancement activities such as channel reconfiguration, large wood placement, floodplain reconnection, and off-channel habitat. In rural areas, Clean Water Services contracts with the Tualatin Soil and Water Conservation District (TSWCD) to provide incentives for enrolling landowners in a modified version of the U.S. Department of Agriculture's Conservation Reserve Enhancement Program (ECREP) and Vegetated Buffer Areas for Conservation and Commerce (VEGBACC) programs. The rural ECREP and VEGBACC programs focus on riparian plantings and do not include stream enhancement activities.

Page 5-34: This page outlines the WWTF trading programs for dissolved oxygen and total phosphorus. To enable the expansion of the trading program, we recommend that the TMDL include general language that would allow the expansion of the trading program to include other potential sources subject to DEQ approval of management plans.

Page 5-34: The last sentence in this section notes that credit trading for augmented tributary flows will be determined in a DEQ approved Temperature Management Plan. In addition to temperature, tributary flow restoration has resulted in improvement in dissolved oxygen levels and reduction in phosphorus levels. Since tributary flow restoration is a strategy that is being considered to improve water quality in the tributaries, the trading language should be expanded to allow for the demonstration of water quality improvements for temperature as well as dissolved oxygen and phosphorus. Therefore, we recommend that this sentence be modified as follows: Details regarding trading credit for ~~augmented~~ tributary flow restoration will be determined in a DEQ-approved Temperature Management Plan or other DEQ approved management plan.

Draft Tualatin Subbasin TMDL

Chapter 3
pH and Chlorophyll a (Total Phosphorus) TMDL Amendment

September 2011

State of Oregon
Department of Environmental Quality

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Table of Contents

Figures

Tables

3.1 Summary of TMDL Development and Approach

This Section provides a summary of the Total Maximum Daily Load elements in Table format.

Table 3-1. Tualatin River Subbasin pH and Chlorophyll *a* (Phosphorus) TMDL Components

WATERBODIES OAR 340-042-004(4)(A)	All stream segments within the Tualatin River Basin, 4th field HUC (hydrologic unit code) 17090010 as well as the Oswego Lake subbasin including tributaries to the Lake.
POLLUTANT IDENTIFICATION OAR 340-042-004(4)(B)	*Pollutants:* Human caused increases of instream phosphorus concentrations have been shown to contribute to exceedances of the pH criteria, chlorophyll *a* threshold values, and low dissolved oxygen following algal bloom conditions.
BENEFICIAL USES OAR 340-042-004(C) OAR 340-041	Salmon & Trout Rearing and migration, Salmon & Steelhead spawning use, and resident fish and aquatic life, water supply, water contact recreation, aesthetic quality.
TARGET IDENTIFICATION (Applicable Water Quality Standards) ***CWA §303(d)(1)*** ***OAR 340-041-0019*, Nuisance Algae;** ***OAR 340-041-021* Willamette Basin pH:** ***OAR 340-041-0345***	Contained in: The Nuisance Phytoplankton Growth Rule (OAR 340-041-0019 sections 1 – 3, this section requires an evaluation of the need for an algae management plan when riverine chlorophyll *a* exceeds 0.015 mg/L), and; The relevant text of OAR 340-041-0345 (for pH): *pH (hydrogen ion concentration): pH values shall not fall outside the ranges identified in paragraphs (a) of this subsection: All other basin waters (except Cascade lakes): 6.5 – 8.5* *OAR 340-041-0021 pH: The following exception applies: Waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria shall not be considered in violation of the standard if DEQ determines that the exceedance would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria:*
EXISTING SOURCES OAR 340-042-040(4)(F) CWA §303(D)(1)	Agriculture, Forestry, Rural Residential, Transportation, Urban, Waste Water Treatment Facilities
SEASONAL VARIATION OAR 340-042-040(4)(F) *CWA §303(D)(1)*	The potential for excessive algal growth and resulting pH criterion violations occurs predominately in the summer. Phosphorus control from point sources for algal growth is necessary from May through mid September, or later depending on water diversion to Oswego Lake. Phosphorus control from runoff into Oswego lake is necessary year-round.
TMDL LOADING CAPACITY AND ALLOCATIONS OAR-340-042-0040(4)(E) OAR 340-042-0040(G) OAR 340-042-0040(4)(H) 40 CFR 130.2(F) 40 CFR 130.2(G) 40 CFR 130.2(H)	*Loading Capacity:* Based on background phosphorus concentrations, phosphorus loading capacities listed in **Table 3.5** and **3.6** were developed for specific stream segments. *Waste Load Allocations (Point Sources)*: WLAs for point sources other than WWTPs are presented in **Tables 3.10, 3.11** and **3.12**. WLAs for the WWTPs are presented as phosphorus concentrations in **Table 3.13**. *Load Allocations (Non-Point Sources)*: LAs are presented as loads in **Tables 3.14, 3.15, 3.16,** and **3.17**.
MARGINS OF SAFETY OAR 340-042-0040(I) CWA §303(D)(1)	Margins of Safety demonstrated in critical condition assumptions and is inherent to methodology
WATER QUALITY STANDARD ATTAINMENT ANALYSIS	Attainment of the pH standard is determined through the analysis of current and historical system response to phosphorus concentrations.

CWA §303(D)(1)	
WATER QUALITY TRADING ORS 468B.555 40CFR122.4(I)	Phosphorus load trading is allowed between individual sources and sectors provided that all applicable water quality criteria are attained and sufficient legal or other mechanisms are put in place that ensure the trade will be implemented as designed.

3.2 Amending the 2001 Phosphorus TMDL

This Section describes the reasons for amending the existing Total Maximum Daily Load.

DEQ issued a Phosphorus TMDL order that was approved by EPA in August 7, 2001. The 2001 TMDL was a revision of a previous Phosphorus TMDL adopted in 1988. The initial Total Maximum Daily Load (TMDL) was developed to address the mainstem Tualatin River chlorophyll *a* and associated pH violations in 1988.[1] These impairments occurred in the lower Tualatin River, but phosphorus controls were necessary throughout the basin to improve conditions in the lower River. The purpose of this TMDL amendment is to update the 2001 TMDL to include waste load allocations for additional pollutant sources, to provide the daily load equivalents for the monthly 2001 TMDL targets in order to comply with current EPA requirements, and to modify the time periods that the TMDL applies to the waste water treatment facilities.Public comment will be accepted only for the proposed amendments to the 2001 TMDL, and not to the already adopted allocations of the 2001 TMDL. However, previously adopted allocations have been included in this document to allow the reader to access all of the allocation values in a single document.

The 1988 TMDL identified total phosphorus concentrations using water quality models that would lower Chlorophyll *a* concentrations below the action level of 0.015 mg/L, and lower elevated pH values to between 6.5 and 8.5, the range allowed in OAR 340-41-0345. Based on subsequent water quality information, the 1988 TMDL target concentrations were found to be lower than estimates of background phosphorus concentrations in the basin. Due to this difficulty in achieving the 1988 TMDL targets, the 2001 TMDL revised the total phosphorus allocations commensurate with background phosphorus concentrations. Both TMDLs were developed to address elevated Chlorophyll *a*[2] concentrations and pH violations. The affected reaches are now included on Oregon's 303(d) list as having a TMDL approved for Chlorophyll *a*, phosphorus and pH. Water quality data from the lower Tualatin River show that total phosphorus concentrations meet the 2001 TMDL allocations, and violations of pH no longer occur in this reach.

This current TMDL amendment draws heavily on the success of the 2001 TMDL. The TMDL is being amended to include waste load allocations for new summertime discharge sources on the mainstem Tualatin River, to clarify the load allocations for applicable sites, and to allow trading of total Phosphorus allocations to occur among three of the four Clean Water Services discharges. The concentration-based allocations in the 2001 TMDL for Chlorophyll and pH are unchanged in this amendment. However, in addition to maintaining the seasonal median allocation values, this TMDL will also clarify the daily load equivalent for those allocations.

[1] The initial phosphorus TMDL was in the form of instream compliance concentrations, and originally adopted into rule. In 2001 these rules were rescinded, and the TMDL revision was adopted as an order from the Department of Environmental Quality. The1988 TMDL language can be found in Appendices to the 2001 TMDL (OAR 340-041-0470 [9][a], Appendix C-2 and mass load allocations TMDL Number 22M-02-004, Appendix C-3).

[2] Chlorophyll *a*, an algal pigment, is commonly used as an indicator of the concentration of phytoplankton (a type of algae).

This TMDL amendment addressing excess chlorophyll *a* and high pH values relies heavily on the 2001 TMDL, maintaining the same in-stream target concentration, load and wasteload allocations for total phosphorus in the lower Tualatin River. This amendment adds waste load allocations for two additional waste water treatment plants run by Clean Water Services, one at Forest Grove, and one in Hillsboro. These two sites do not currently discharge during summer. In order to accommodate growth in the basin, these two plants may begin discharging to the Tualatin River during the summer. Currently they divert summer discharges to the Rock Creek Plant for advanced treatment which is then discharged to the Tualatin River near the mouth of Rock Creek. This TMDL will also outline options for trading total phosphorus loads among three of the four Clean Water Services waste water treatment plants. In addition, the 2001 TMDL did not specify a load allocation for Wapato Creek, but instead included it by reference with all tributaries to the Tualatin River upstream of Dairy Creek. This load allocation will be clarified, and additional parties responsible for management at Wapato Lake will be identified in the Water Quality Management Plan, found in Chapter 5

3.3 Geographic area and waterbodies addressed

This element describes the geographic area for which the TMDL is developed and applies to the following stream segments of the Willamette Basin

This phosphorus TMDL amendment to the 2001 Tualatin Phosphorus TMDL addresses all perennial and intermittent streams in the Tualatin Basin. The basin is identified in OAR 340-41-0340, Figures 340A and 340B, and is also known as the 4th field hydrologic unit code (HUC) 17090010. Therefore, it addresses the entire Tualatin Subbasin.

Oswego Lake watershed is adjacent to the Tualatin Basin to the southeast. Oswego Lake and Creek were historic Tualatin River channels, and drain into the Willamette north of current mouth of the Tualatin River. At the time of European settlement, Oswego Lake was a wetland. The lake was formed by digging a canal from the modern-day Tualatin River, creating a diversion structure in the Tualatin River, and damming the outlet of Oswego Lake. The Lake Oswego Corporation manages Oswego Lake and holds a water right from the Tualatin for hydroelectric generation at the outlet of Oswego Lake. This shallow lake has historically received much of its water from the phosphorus-laden Tualatin River, and has long experienced water quality problems associated with algal blooms and aquatic weeds. This small basin, while no longer a part of the Tualatin Watershed Basin, is included in this Phosphorus TMDL because of the importance of Tualatin River water to the water quality of the lake. A map of Oswego Lake and its watershed is included in **Figure 3-1**, and **Table 3-3** below summarizes the water quality impairments that have been documented in Oswego Lake. Load and Waste Load Allocations for sources to Oswego Lake included in this TMDL apply to the entire Oswego Lake basin.

Water Quality Limited Streams in the Tualatin and Oswego Lake Basins that were identified in the 2004/2006 303(d) list are shown in **Figure 3-1** and **Tables 3-2** and **3-3.** The 2001 Tualatin Phosphorus TMDL has a more detailed discussion on phosphorus conditions in the Tualatin and its major tributaries (particularly Sections 4.4.3 Condition Assessment, and 4.4.4 Beneficial Use Impairment, of the 2001 TMDL), which is not repeated here.

Figure 3-1. 2004/2006 303(d) List for Phosphorus, pH or Chlorophyll *a* (Bolded Green Lines) in the Tualatin and Oswego Lake Subbasins

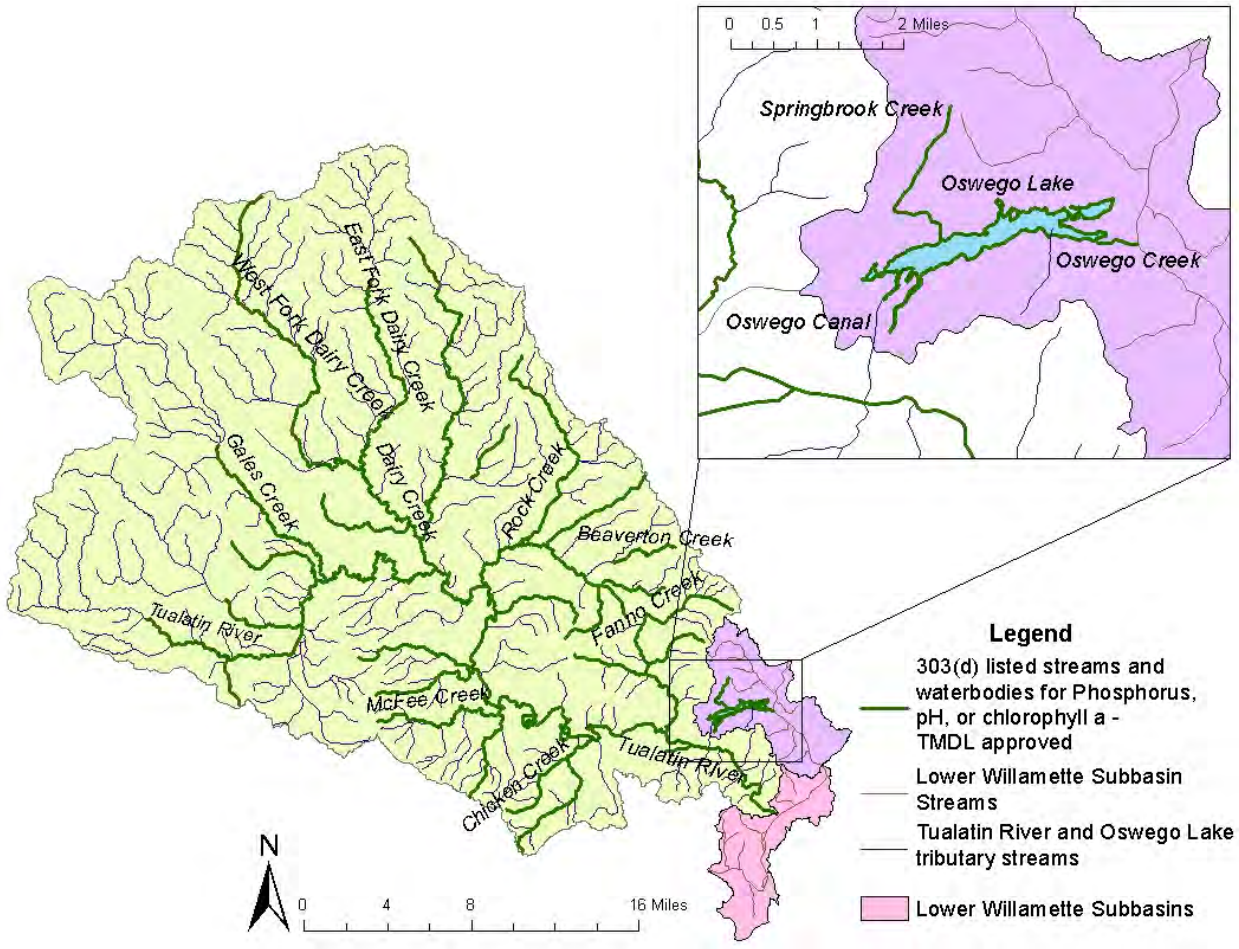


Table 3-2. Tualatin River Subbasin Stream Segments on the 2004/2006 303(d) List for Chlorophyll *a*, pH or Phosphorus

Stream Name	River Miles Listed	Parameter listed; TMDL Approved	Season
Ash Creek	0 - 3.7	Phosphorus	June 1-September 30
Beaverton Creek	0 - 9.8	Phosphorus	June 1-September 30
Bronson Creek	0 - 6.5	Chlorophyll *a*, Phosphorus	June 1-September 30
Burris Creek	0 - 6.0	Chlorophyll *a*, Phosphorus	June 1-September 30
Butternut Creek	0 - 5.3	Phosphorus	June 1-September 30
Carpenter Creek	0 - 6.3	Phosphorus	June 1-September 30
Cedar Creek	0 - 6.8	Chlorophyll *a*, Phosphorus	June 1-September 30
Chicken Creek	0 - 7.0	Phosphorus	June 1-September 30
Christensen Creek	0 – 6.4	Phosphorus	June 1-September 30
Council Creek	0 – 6.2	Phosphorus	June 1-September 30
Dairy Creek	0 – 10.1	Phosphorus	June 1-September 30
Dairy Creek, East Fork	0 – 13.5	pH, Phosphorus	June 1-September 30
Dairy Creek, West Fork	0 – 23.7	Phosphorus	June 1-September 30
Fanno Creek	0 – 13.9	Phosphorus	June 1-September 30

Gales Creek	0 – 11	Phosphorus	June 1-September 30
Heaton Creek	0 – 5.2	Phosphorus	June 1-September 30
Johnson Creek - North (Cedar Mill Creek)	0 – 3.7	Phosphorus	June 1-September 30
Johnson Creek - South (Beaverton Creek)	0 - 4	Phosphorus	June 1-September 30
McFee Creek	0 – 8.3	Phosphorus	June 1-September 30
McKay Creek	0 - 22.7	Phosphorus	June 1-September 30
Rock Creek	0 – 18.2	Chlorophyll *a*, Phosphorus	June 1-September 30
Summer Creek	0 - 4	Phosphorus	June 1-September 30
Tualatin River	0 – 44.7	Chlorophyll *a*	Fall/ Winter/ Spring
Tualatin River	0 – 69.9	Chlorophyll *a*, Phosphorus	June 1-September 30
Warble Creek	0 – 3.4	Phosphorus	June 1-September 30
Williams Canyon Creek	0 – 2.4	Phosphorus	June 1-September 30

Table 3-3. Oswego Lake Watershed. Subbasin Stream Segments on the 2004/2006 303(d) List for Aquatic Weeds, Dissolved oxygen, pH or Phosphorus

Stream Name	River Miles Listed	Parameter listed; TMDL Approved	Season
Oswego Creek/Lake Oswego	0.7 – 3	Aquatic Weeds or Algae	Summer
Oswego Creek/Lake Oswego	0.7 – 3	Dissolved Oxygen	Summer
Oswego Creek/Lake Oswego	0.7 – 3	pH	May 1-October 31
Oswego Creek/Lake Oswego	0.7 – 3	Phosphorus	Spring/Summer/Fall
Spring Brook Creek	0 – 2.3	Phosphorus	May 1-October 31

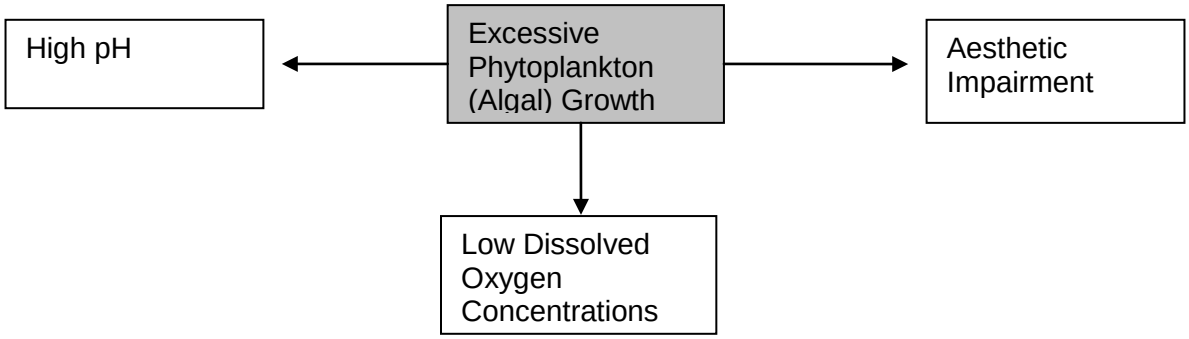
3.4 Pollutant Identification

This element identifies the pollutant causing the impairment of water quality addressed in this TMDL.

Historically, the Tualatin River was a common destination for summertime recreation. However, by the 1970's and 80's excessive algal growth had become common, and affected aesthetics, reduced water clarity, and restricted contact recreation. As described in more detail below, algal blooms can lead to high pH values and large daily swings in dissolved oxygen concentrations, both of which had also been observed in the lower river. In the Tualatin Basin, the TMDL for Total Phosphorus was adopted to address the pH violations, and the Dissolved Oxygen TMDL was adopted to address dissolved oxygen violations. Both of these 2001 TMDLs are amended here to provide waste load allocations for additional summer discharges. However loading capacities in the lower river are not amended by this TMDL, so the waste load allocations in the lower river where pH, chlorophyll and dissolved oxygen impairments have occurred historically are not being changed by this amendment. To some extent the Total Phosphorus TMDL contributes to improved dissolved oxygen conditions because nuisance algae blooms are controlled.

Figure 3-2 was presented in the 2001 TMDL (DEQ 2001), and presents a simplified schematic of the relationship between excessive algal growth and common related water quality impairments

Figure 3-2. Simplified Schematic of Possible Impacts of Excessive Algal Growth



Many streams experience excessive algal growth due to excessive solar radiation levels, high temperatures, high nutrient concentrations, and low flows. Excessive growth of algae and other autotrophs in natural waters can result in significant diel fluctuations in dissolved oxygen and pH which may adversely impact aquatic life. Autotrophs are organisms that obtain energy from sunlight and their materials from non-living sources (Allan, 1995). In streams, autotrophs include periphyton, phytoplankton, and macrophytes. Periphyton consists of algae and other small autotrophs that are attached to substrate, such as submerged rocks and vegetation. Phytoplankton are algae and other small autotrophs which are suspended in the water column. While they can dominate slow moving rivers and lakes, they generally are not present in significant quantities in fast flowing streams since their reproduction rates are low relative to retention times. Macrophytes include large vascular plants and bryophytes (mosses and liverworts).

Algae and other autotrophs impact pH and dissolved oxygen levels as they grow and respire. During the day, algae perform photosynthesis using sunlight and carbon dioxide to produce sugars, and release oxygen as a by-product. All algal cells respire, which is the process of using oxygen to utilize sugars for energy. Carbon dioxide is released as a by-product. Respiration occurs at a relatively constant rate both day and night, while photosynthesis occurs only under conditions of sufficient light. The net result is that during the day photosynthesis can occur at a greater rate than respiration, and increase water column concentrations of oxygen while decreasing carbon dioxide concentrations. At night respiration decreases oxygen concentrations and increases carbon dioxide concentrations.

Carbon dioxide, when introduced into an aqueous solution, combines with water to form carbonic acid (Chapra, 1997). The carbonic acid in turn dissociates into ionic form, releasing a hydrogen ion and consequently lowers the pH. Therefore, during the day as algae consume carbon dioxide pH increases, while at night algae produce carbon dioxide and pH decreases. Through this process algae can cause large diurnal fluctuations in both dissolved oxygen and pH which may result in water quality standards violations. Low oxygen levels can suffocate aquatic organisms, while excessively high or low pH levels can cause toxic effects ranging from growth and reproduction limitations to death.

Algae can also impact DO when it dies, settles to the stream bottom, and decays. Consumption of oxygen by decaying algae can contribute to sediment oxygen demand (SOD), particularly in deep, quiescent zones prone to algal deposition. While this mechanism can have an impact on water quality, in the Tualatin River TMDLs, dissolved oxygen is addressed under a separate TMDL, found in Chapter 4 of the 2001 TMDL (DEQ 2001), and amended here in Chapter 5 of this document. Chapter 5 includes a short summary of current dissolved oxygen conditions in the lower Tualatin River.

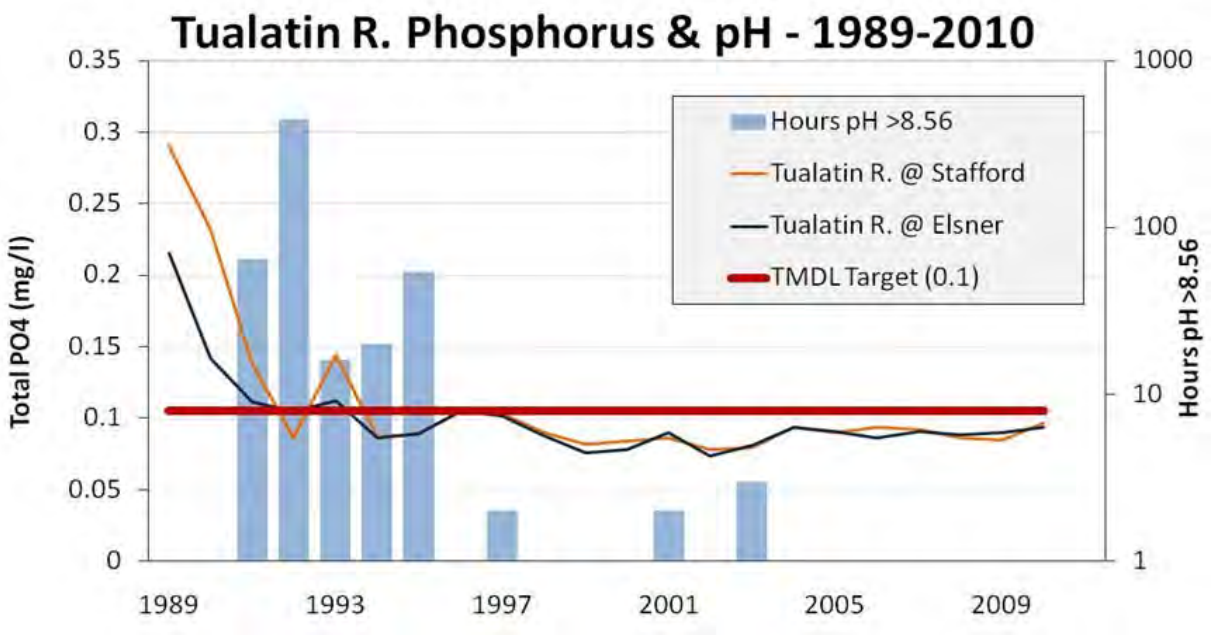
Algal growth is commonly limited by the nutrients available to support growth. Extensive data collection and modeling for the 1988 TMDL demonstrated that total phosphorus levels had a large influence on algal populations, such that limiting total phosphorus concentrations in water should reduce the incidence and density of algal blooms. Using water quality models, DEQ identified total phosphorus limits for streams in the Tualatin Watershed for the 1988 TMDL. During the 1970's sewage was rerouted to new

and updated treatment plants, and smaller plants in the basin were closed. In the 1980's and 1990's extensive efforts were made to decrease erosion as a main source of phosphorus from agricultural land, and changes were made to better manage stormwater across the basin.

During the 1990's, additional data were collected, and the USGS revised the water quality model, using a model that allowed further investigation of the relationship between phytoplankton growth and other factors. This modeling indicated that water temperature, travel time in the river, and incident solar radiation are the primary factors affecting the timing and extent of algal blooms on the river. The model predicts that substantial decreases in phosphorus concentrations would help limit the size of algal blooms (Rounds *et al*, 1999). However the additional data collected also showed that background concentrations of total phosphorus estimated from summer low flow seasons, when the main source of stream water is groundwater, were higher than the total phosphorus levels set in the 1988 TMDL (see Appendix C-2, DEQ 2001). Thus the 1988 TMDL targets for total phosphorus were lower than what could occur naturally during the critical summer season. The 2001 TMDL revised the total phosphorus TMDL targets upward to levels equal to the naturally occurring background concentrations.

Total phosphorus concentrations in Tualatin streams have declined since the adoption of the 1988 TMDL (**Figure 3-3**). The occurrence of pH violations has markedly declined in the same time period, and while the trend for chlorophyll has been more variable, it too has decreased in the Tualatin since 1989. While several factors influence bloom formation, both water quality models and experience to date indicate that maintaining lower total phosphorus concentrations does help control excess algal growth

Figure 3-3. Total Phosphorus concentrations at two sites in the Lower Tualatin, juxtaposed with the number of hours of pH violations each summer at the Lake Oswego Diversion Dam. The bar graph reflects zero hours of pH violations since 2004, not missing data. The Elsner and Stafford sites are at river miles 16.5 and 5.4 respectively.



Despite the improvements in the Tualatin River, a series of nuisance cyanophyte blooms (photosynthetic bacteria, previously known as blue green algae) were observed in Oswego Lake in 2004 from July through November. In-depth studies following these blooms (Gibbons and Welch, 2004) identified surface water concentrations of total phosphorus as a contributing factor to bloom formation, and collected samples that showed sediment release of phosphorus could be a significant source of phosphorus in the lake. Following the blooms and in-depth study, new management practices were established for Oswego Lake to limit phosphorus concentrations. Two major actions were adding alum in the canals and shallow lake sections to precipitate total phosphorus, and greatly limiting water

withdrawals from the Tualatin River, both in volume and dates of intake. Historic diversion of Tualatin River water was as high as 57 cfs year round. Currently diversions of Tualatin River water are restricted to 5-7 cfs, beginning in July, and ending as late as mid-October in dry years, and as early as late-August in wet years. This practice limits the contribution of phosphorus to Oswego Lake form the Tualatin River.

A nuisance bloom of *Anabaena flos aquae* (Bonn, 2008) algae did occur in the lower Tualatin River in July of 2008, at sufficient density to cause the Department of Human Services to issue a health advisory to avoid contact with the bloom. This bloom, the first in many years, is thought to be related to management changes at Wapato Lake in the upper watershed. This is a wetland area that was modified with a dike and pump house to de-water the lake for summertime farming. Normally the area is dewatered by March, but a dike breach in December 2007 flooded the lake with volume much greater than usual, and prevented pumping the lake dry until nearby river waters receded below the elevation of the dike breach in July. Water discharged from the lake in July was rich in nutrients, algae, and zooplankton. The particular mix of species evolved as water travelled downstream, causing a bloom dominated by the cyanophyte *Anabaena flos aquae* in the lower river.

3.5 Applicable Water Quality Standards

This element identifies the beneficial uses in the basin and relevant water quality standards, including specific basin standards. The beneficial use that is most sensitive to impairment by the pollutant is specified.

Salmonid use, supporting aquatic life, and recreational use are the most sensitive beneficial uses affected by excessive algal populations in the Tualatin Basin. Recreational use may be impaired by decreased aesthetic quality from dense algae, as well as by skin irritation attributed directly to contact with algae. As noted above, dense algae blooms can result in excessive pH at levels that are harmful to fish and other aquatic life. Swimmers may also experience eye irritation from swimming in waters that have high pH levels. Fish and other aquatic life may be impaired by reduced dissolved oxygen levels that result from excessive algal blooms.

The water quality standards targeted by this TMDL are described thoroughly in the 2001 TMDL (DEQ 2001). **Table 3-4** summarizes the targets applicable to the Tualatin Basin, as well as providing citations to the rule language.

Table 3-4. Summary of Beneficial Uses and Water Quality Criteria in the Tualatin Basin Targeted by the TMDL for Total Phosphorus.

Standard:	***Quick Summary:***	***Citation:***
Beneficial Uses:	Salmonid Fish Spawning (Trout) Salmonid Fish Rearing (Trout) Resident Fish and Aquatic Life Anadromous Fish Passage Water Contact Recreation Aesthetic Quality	***Oregon Administrative Rule (OAR) 340-041-442, Table 6***
Chlorophyll a:	Action level of 0.015 mg/L Chlorophyll *a*: may trigger a study to determine the impacts to beneficial uses, the probable cause of those impacts, and a strategy to attain compliance	***OAR 340-041-0019***
pH	Values may not fall outside the range of 6.5 to 8.5	***OAR 340-041-0021***

Aesthetic Condition	Conditions offensive to the human senses of sight, taste, smell or touch may not be allowed	***OAR 340-041-007(15)***

Note that the limit for chlorophyll *a* is expressed as an action limit. Oregon water quality standards recognize that natural conditions may preclude meeting a specific criterion or action limit, and provide the following guidance regarding natural conditions for chlorophyll *a*: when it is determined that natural conditions are responsible for the exceedance of the chlorophyll a action level, the pertinent water quality standard states that the action level may be modified to an appropriate level:

> *Where natural conditions are responsible for exceedance of the values in section (1) of this rule or beneficial uses are not impaired, the values in section (1) of this rule may be modified to an appropriate value for the water body;* (from OAR 340-041-0150[2][a])

Thus, when naturally occurring phosphorus concentrations are high enough to cause elevated chlorophyll *a,* the chlorophyll *a* action limit may be increased accordingly. As noted in the 2001 TMDL, because background levels of total phosphorus exceed those necessary to meet the 0.015 mg/L chlorophyll *a* level, the chlorophyll a concentration that results when background levels of total phosphorus are achieved, will become the applicable threshold for support of the beneficial uses related to the Chlorophyll a action level.

3.6 Analytical Methods Overview

This Section summarizes the data collected and modeling that was completed to identify the loading capacity of surface water, and the affects of phosphorus loads on water quality in the system.

This TMDL amendment will add two additional sources of total phosphorus on the mainstem Tualatin River, located in the upper Tualatin River at Forest Grove and Hillsboro (river miles 53.8 and 43.3 respectively). Load and waste load allocations for existing sources from the 2001 TMDL will remain unchanged. Both the 1988 and 2001 TMDLs for Total Phosphorus targeted water quality impairment that occurred in the lower Tualatin River, mainly below river mile 9. In this TMDL amendment, the total phosphorus targets for the Tualatin River downstream of the Rock Creek Advanced Waste Water Treatment Plant at river mile 37.7 will remain unchanged.

The TMDL target for the Tualatin River downstream of the Rock Creek Advanced Waste Water Treatment Plant at river mile 37.7 will remain at 0.10 mg total P/L, and at 0.11 mg total P/L downstream of Elsner Road at river mile 16.2. Recent water quality monitoring data show that these phosphorus targets have been met since 1995 (**Figure 3-3 in Section 3.4** and in **Section 3.8,Table 3-7**). Chlorophyll *a* values have also decreased compared to historic levels, but are often higher than the 0.015 mg/L Chlorophyll action level set out in Oregon's water quality standard. Despite this level of algal growth, no pH violations have been observed, and dissolved oxygen concentrations have also improved. Empirical data show that these TMDL targets for total phosphorus are appropriate for meeting water quality standards and protecting the beneficial uses in the lower Tualatin River.

Two new sources will receive waste load allocations that may cause the phosphorus concentrations in the mid-Tualatin River, between river miles 53.8 and 37.7 to increase slightly. These new waste load allocations will be developed in such a way that the established TMDL targets downstream of Farmington Road at river mile 33.3 will still be met, so the water quality improvements attained by the 1988 and 2001 TMDLs will be maintained. The Tualatin River is a steeper, faster moving river upstream of river mile 37.7, which has historically not supported algal blooms and thus has not suffered the related water quality problems of high pH and chlorophyll concentrations. The upper Tualatin River has historically

experienced high phosphorus concentrations; the reason for the lack of algae-related water quality issues in this reach has been attributed to its physical features, presumed to discourage the formation of algal blooms. The question posed by this TMDL modification is whether there is indeed evidence that increased loads of total phosphorus might contribute to water quality impairment between river miles 53.8 and 33.3.

Clean Water Services developed a modeling approach to identify how much total phosphorus could be added to the Tualatin River and still meet the TMDL concentration targets of 0.10 mg total P/L immediately downstream of the Rock Creek Advanced Waste Water Treatment Plant at river mile 37.7. This simple mass-balance approach assumed that all other phosphorus sources in the basin achieved their TMDL targets, and indicated that a total load of 66.1 pounds per day of phosphorus could be discharged in total from the Forest Grove, Hillsboro and Rock Creek Waste Water Treatment Plant discharges, and still meet the TMDL target. This water quality scenario was then modeled using the CE-QUAL-W2 model that has been developed for the upper river by the United States Geological Survey (Appendix A-D to Appendix A-1 of this document, Rounds et al 1999 and Rounds & Wood, 2001). The model results confirm the assumption that slightly increased P concentrations between river miles 53.8 and 37.7 do not cause measurable changes to water quality. The model scenarios confirm that TMDL targets downstream of Rock Creek are met, and that no measureable decreases in dissolved oxygen or increases in total chlorophyll *a* would be observed. The details for this modeling effort are presented in detail in Appendix 3A, Tualatin River Total maximum Daily Loads: Total Phosphorus and Dissolved Oxygen Analyses for the Upper River.

Clean Water Services is also requesting that the time period during with the TMDL applies be shortened from the May 1-October 31 TMDL season that currently applies to May 1 through August 31 with this amendment. Clean Water Services uses two methods for removing phosphorus from waste water; biological removal and alum addition. During the TMDL period, biological removal is not sufficient to meet the TMDL allocation, so alum addition is also used. Shortening the TMDL season would result in the use of less alum to treat wastewater. Clean Water Services has presented an extensive analysis in support of this request that includes the interpretation of existing data, and water quality modeling results for the Lower River. This analysis described the effects on the lower Tualatin River, examining the historic conditions during algal blooms, as well as using the water quality model to predict future bloom events under current flow management scenarios. This analysis is presented in Appendix 3B, Tualatin River TMDL for Total Phosphorus (4/20/2009). This request was considered, but the actual dates adopted in this TMDL revision were modified. The time periods during which this revised TMDL apply are presented in Section 3.9.

3.7 Loading Capacity

This element specifies the amount of a pollutant or pollutants that a water body can receive and still meet water quality standards. The TMDL will set allocations at a level that ensures the loading capacity is not exceeded.

Tualatin River and Tributaries:

Water quality models were used for the 1988 TMDL to quantify the loading capacity of phosphorus by identifying levels of total phosphorus that would limit chlorophyll *a* levels and thus limit excessive algal growth. Subsequent to the 1988 TMDL, water quality studies indicated that natural phosphorus loads from groundwater may constitute a significant portion of low flow (non-runoff period) tributary loads (Kelly *et al*, 1999 and Wilson *et al*, 1999), and that these levels, deemed to be from natural sources, exceeded the 1988 TMDL targets that were identified to meet the 0.015 mg/L action limit for chlorophyll *a.*

Data from monitoring sites in the lower Tualatin River demonstrate that these background phosphorus levels have been met in since the late 1990's. Under these conditions, pH and dissolved oxygen violations are rare to non-existent. Chlorophyll *a* action levels are not consistently attained, but the

nuisance character of blooms has declined. Water quality modeling has shown that chlorophyll *a* levels would exceed the 0.015 mg/L threshold value when the Tualatin River and its tributaries are at the natural background phosphorus concentrations, so the water quality target of 0.015 mg/L for chlorophyll *a* in the Tualatin Basin would not be met at the natural background level of phosphorus, and can be exceeded without violation. It should be noted that at these higher chlorophyll *a* concentrations, the pH criteria is met, and the standard allows for higher chlorophyll *a* levels under these conditions.

The 2001 TMDL for total phosphorus identified dry-season summer medians of total phosphorus as the background conditions for streams in the Tualatin Basin. No changes to the area loading capacities are made by this TMDL. The loading capacities identified of Tualatin streams were identified in the 2001 TMDL, and are repeated here for convenience in **Table 3-5**.

Table 3-5. Tualatin River Subbasin Total Phosphorus Loading Capacities

Stream Segment	Total Phosphorus Concentrations (Summer Median - mg/L)
Mainstem Tualatin River @ Stafford Rd. (RM 5.5)	0.10
Mainstem Tualatin River @ Hwy 99W (RM 11.6)	0.11
Mainstem Tualatin River @ Elsner (RM 16.2)	0.11
Mainstem Tualatin River @ Farmington (RM 33.3)	0.10
Mainstem Tualatin River @ Rood Rd. (RM 38.4)	.09
All Tributaries to the Mainstem Tualatin above Dairy Creek (Unless otherwise specified below)	.04
All Tributaries to the Mainstem Tualatin below Dairy Creek (Unless otherwise specified below)	0.14
Mainstem Tualatin River @ Golf Course Rd. (RM 51.5)	.04
Bronson Creek @ Mouth (205th)	0.13
Burris Cr./ Baker Cr./ McFee Cr./Christensen Cr.(all @ Mouth)	0.12
Cedar Cr./Chicken Cr./Rock Cr. (South)/ Nyberg Cr./Hedges Cr./Saum Cr.(all @ Mouth)	0.14
Dairy Creek @ Mouth	0.09
Fanno Creek @ Mouth	0.13
Gales Creek @ Mouth	0.04
Rock Creek @ Mouth	0.19

Oswego Lake Watershed:

The 2001 TMDL determined that phosphorus loads that would achieve an “acceptable” trophic state are lower than the phosphorus background loading to the lake. Thus in the Oswego Lake watershed, phosphorus loading capacity of the lake was set at the estimated background of external loading, and not at a lower level that may result in more desirable chlorophyll levels but cannot be achieved. As detailed in the 2001 TMDL, meeting the 2001 TMDL targets would reduce phosphorus loads and were expected to have beneficial impacts for the lake. A quantitative analysis of those benefits was beyond the scope of that TMDL as well as this amendment. Load capacities from the 2001 Phosphorus TMDL for the surface-water inputs to Oswego Lake are repeated here. Phosphorus loads are presented in pounds delivered to the lake over a time period. Similar to the Tualatin River tributaries, they are based on background concentrations of total phosphorus in the watershed. Loads, not concentrations, are used for this subbasin because pollutant levels in the lake may remain for a long time period, contributing to water quality problems on a different time scale than that observed in the riverine environment.

Background concentrations of phosphorus for the tributary streams during summer in the Oswego Lake watershed (**Table 3-6**) were determined using the same methodology as was used for the Tualatin River Subbasin streams; dry season median concentrations. Because a substantial data set was only available for Springbrook Creek, these values were used to represent groundwater inputs for all tributaries to Oswego Lake. Springbrook is the largest tributary to Oswego Lake, and most of the streams in the

watershed share similar geology and soils, so the dry-season phosphorus concentrations should represent groundwater background concentrations for all Oswego Lake basin tributaries.

Phosphorus loading to Oswego Lake occurs year round, and unlike river and stream environments where winter loads will be carried downstream and out of the watershed, winter loading to the lake will remain in the lake and affect summer bloom conditions. Springbrook Creek is in a highly urbanized system, where background levels are difficult to estimate. Therefore, background conditions for winter time loading were estimated from nearby Balch Creek. This system has a similar watershed, climate and geology, however, the land use in the watershed is considerably less impacted by urbanization, making it easier to estimate natural background conditions. Balch Creek watershed is primarily open space with some roads, parks and residential use. Based on these factors, Balch Creek was selected as a good reference site for estimating background wet weather concentrations of phosphorus for Springbrook Creek and the other Oswego Lake tributaries.

Table 3-6. Total Phosphorus Tributary Background Loads for Oswego Lake

May 1 through October 31 (summer)		
Storm Loads		169 lb. (77 Kg.) Total Phosphorus
Base Flow Loads	0.11 mg/L Total Phosphorus	242 lb. (110 Kg.) Total Phosphorus
November 1 through April 30 (Winter)		
Storm Loads	0.19 mg/L Total Phosphorus	1087 lb. (494 Kg.) Total Phosphorus
Base Flow Loads	0.08 mg/L Total Phosphorus	757 lb. (344 Kg.) Total Phosphorus

3.8 Excess Loads

This element evaluates the difference between current pollutant load in a waterbody and the loading capacity of the waterbody.

Tualatin River

The 1988 and 2001 TMDLs for total P have been very successful in the mainstem Tualatin River. TMDL targets have largely been met in the mainstem river since 1995 (**Table 3-7**). Excessive algal growth in the lower Tualatin River has become a rare event, and pH violations no longer occur. However, during July, 2008, a bloom of cyanobacteria also known as blue green algae, dominated by *Aphanezomenon sp.* formed in the Lower Tualatin River. Cell counts were sufficiently high to cause the Oregon Health Division to issue an advisory against water contact for this reach, based on the potential for the bloom to produce cyanotoxins; toxins formed by bluegreen algae. Further upstream that same summer, the Joint Water Commission water providers experienced a prolonged taste and odor event. During this time period the Tualatin River drinking water source required additional treatment by filtration with activated carbon to remove an objectionable taste and odor caused by geosmin. Geosmin is a naturally occurring chemical that has a distinctive odor and can cause an undesirable taste in drinking water. Geosmin is found in soils, decaying organic matter, and can be produced by both green and bluegreen algae. As a result of these events, additional water quality data were collected in the basin by the Joint Water Commission and the USGS to identify the possible cause of these unusual conditions. High levels of organic carbon, total P, and dense zooplankton populations were found flowing from the Wapato Lake area near Gaston in the upper watershed. These factors contributed to the bluegreen bloom formation in the Lower Tualatin River. The large volume of water originating from the Wapato was uncommon, and due to a dike breach at that site in December of 2007. This event has drawn attention to the Wapato Lake area as a potential nutrient source, and resulted in the completion of a management plan for the lakebed to ensure that this source complies with the 2001 Phosphorus TMDL. In summary, the efforts set out to address the 1988 and 2001 TMDLs for total phosphorus in the Tualatin mainstem have been largely successful, but as demonstrated by the events of 2008, ongoing management is necessary to continue to meet the TMDL targets.

Table 3-7. TMDL Loading Capacity/Target concentrations and instream summer median concentrations at various Tualatin River sites in the Basin. Data were collected by Clean Water Services, and reported in the 2008 Annual Report of the Tualatin River Flow Management Technical Committee (Bonn, 2008).

Location	River Mile	2001 TMDL Target (mg/L as P)	Total Phosphorus (mg/L as P)						
			1990	1995	2000	2005	2006	2007	2008
Cherry Grove	71.5	0.04	--	0.01	0.01	0.01	0.01	0.01	0.01
Spring Hill	61.2	0.04	0.04	0.03	0.03	0.01	0.01	0.01	0.03
Golf Course Road	52.8	0.04	0.05	0.04	0.03	0.03	0.03	0.03	0.05
Highway 219	44.4	--	--	0.07	0.05	0.06	0.06	0.06	0.07
Rood Bridge Road	39.1	0.09	0.10	0.08	0.06	0.07	0.07	0.07	0.07
Farmington Road	33.3	0.10	0.43	0.08	0.09	--	0.08	0.08	0.09
Scholls	27.1	0.10	0.15	0.09	0.08	0.09	0.09	0.09	0.09
Elsner	16.5	0.11	0.14	0.09	0.08	0.09	0.09	0.09	0.09
Boones Ferry Road	8.7	0.11	0.23	0.09	0.08	0.09	0.09	0.10	0.09
Stafford Road	5.4	0.10	0.23	0.09	0.08	0.09	0.09	0.10	0.09
Weiss Bridge	0.2	0.10	0.22	0.09	0.08	0.09	0.08	0.08	0.08

Tualatin River Tributaries

Summertime phosphorus levels on the Tualatin River are heavily influenced by discharges from the Rock Creek and Durham Advanced Waste Water Treatment Plants, as well as flow augmentation from Hagg Lake and Barney Reservoir. Flow augmentation from the reservoirs provides “dilution water” at lower P levels, as well as by increasing flow rates in the lower river which in turn decreases residence time in the slower moving reaches. Phosphorus control in the tributaries is not as easily accomplished. Instead, management practices that decrease erosion and runoff must be implemented and maintained widely across the basin. Stream bank erosion is another source of instream phosphorus that originates from both natural and human-accelerated activities. In part because the control of non-point sources is difficult to accomplish, improvements on tributary streams take longer, and happen in smaller increments. The TMDL target concentrations and summer median stream concentrations are presented in **Table 3-8**. As in **Table 3-7**, these data were collected by Clean Water Services, and reported in the 2008 Annual Report of the Tualatin River Flow Management Technical Committee (Bonn, 2008).

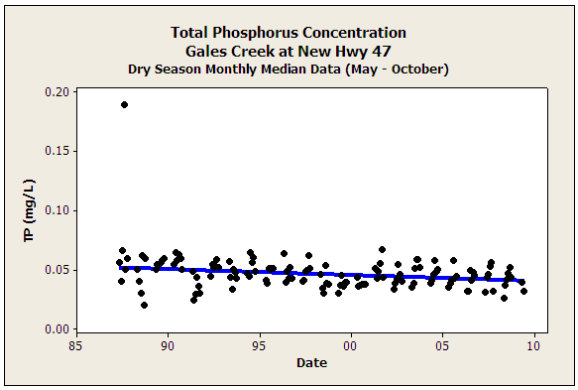
Table 3-8. TMDL Loading Capacity/Target concentrations and instream summer median concentrations at various Tributary sites to the Tualatin River. Data were collected by Clean Water Services, and reported in the 2008 Annual Report of the Tualatin River Flow Management Technical Committee (Bonn, 2008).

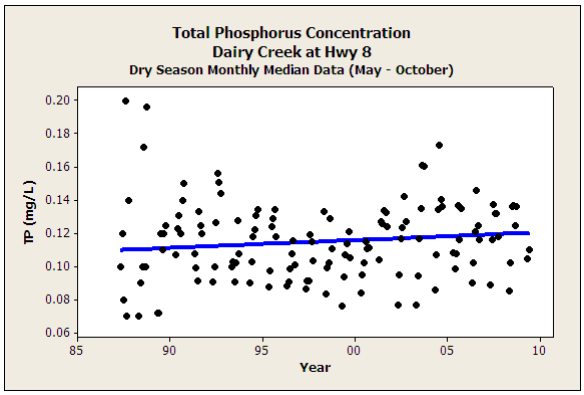
Location	2001 TMDL Target (mg/L as P)	Total Phosphorus (mg/L as P)						
		1990	1995	2000	2005	2006	2007	2008
Scoggins Creek @ Highway 47	0.04	--	0.03	0.01	0.01	0.01	0.01	0.01
Gales Creek @ New Highway 47	0.04	0.06	0.05	0.04	0.04	0.04	0.04	0.04
Dairy Creek @ Highway 8	0.09	0.13	0.11	0.11	0.12	0.12	0.13	0.13

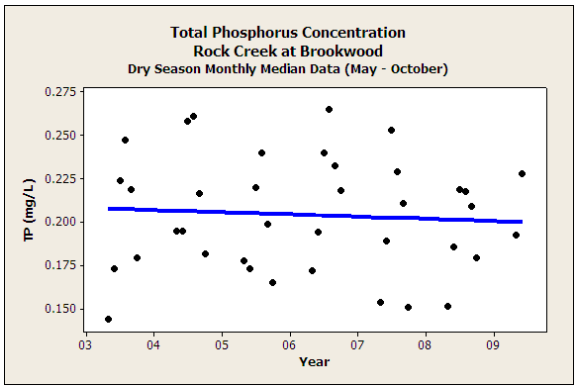
Rock Creek @ Brookwood	0.19	0.21	0.21	0.18	0.19	0.24	0.20	0.20
Bronson Creek @ 205th	0.13	0.13	0.12	0.12	0.14	0.19	0.15	0.16
Chicken Creek @ Scholls-Sherwood	0.14	0.23	0.12	0.11	0.11	0.11	0.11	0.12
Nyberg @ Brown	0.14	--	--	0.17	0.20	0.19	0.20	0.18
Fanno @ Durham Rd.	0.13	0.15	0.15	0.15	0.15	0.16	0.14	0.15

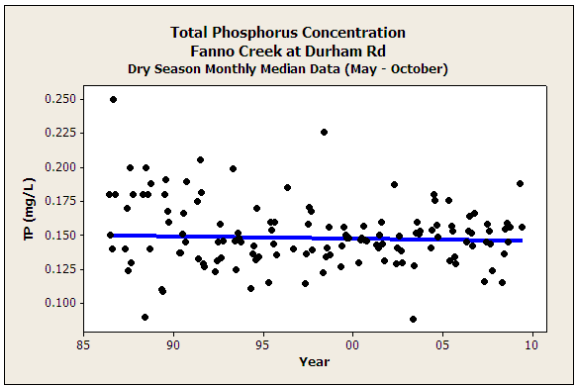
These data show that Scoggins Creek, Gales Creek and Chicken Creek generally meet the 2001 TMDL target, but that other creeks in the basin have summer median concentrations in excess of the 2001 TMDL targets. A simple trend analysis using summer monthly median values shows decreasing trends at Gales Creek (**Figure 3-4**), with relatively low variation in P values from month to month. Similar information for Dairy Creek shows a significant increase in P since 1990, but these data show a much larger variation among monthly values. Data at Rock and Fanno Creeks also show a large variation in values, and do not show significant changes over time. These data were collected and analyzed by Clean Water Services (Steve Anderson, personal communication).

Figure 3-4. Monthly median concentrations of total Phosphorus are plotted over time at four different tributary locations in the Tualatin River Basin. The decrease in Gales Creek and increase in Dairy Creek are significant at the 95% confidence level, using the Seasonal Kendal Tau trend test. No significant trends are present at the Rock Creek and Fanno Creek sites.







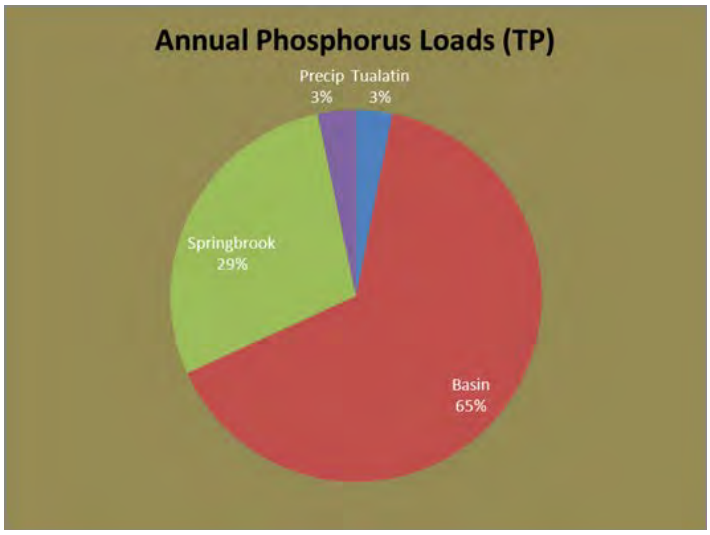


These data suggest that additional work could be done in tributary basins in order to achieve the TMDL targets.

Oswego Lake

At the time the 2001 TMDL was written, Oswego Canal, through its contributions from the Tualatin River, was estimated to contribute 58% of the total phosphorus loading to Oswego Lake that originated from external sources. In a phosphorus budget for 2009 (**Figure 3-5**), Tualatin River contributions are much smaller, and estimated at 3%. This is largely due to changes in both the volume and the dates that Tualatin River water is diverted into Oswego Lake. In 2004, a series of nuisance cyanophyte blooms triggered a study to look more closely at phosphorus sources to the Lake (Gibbons and Welch, 2004). This study identified significant loading sources from four sources: the Tualatin River, stormwater runoff, and phosphorus release from both deep and shallow sediments. As a result, the quantity and dates of diversions from the Tualatin River were greatly reduced. The Gibbons and Welch (2004) study also recommended more intensive monitoring of stormwater inputs to the lake. Lake Oswego Corporation continues to work with the City of Lake Oswego to improve the quality of runoff to the Lake. Since 2005, Lake Oswego Corporation has treated the Oswego Canal and shallow bays of the Lake with alum, to chemically bind the phosphorus to sediments, and decrease the release of phosphorus to the Lake. Despite these efforts, nuisance algae blooms still form in the Lake, indicating that additional work must be accomplished in this system.

Figure 3-5. Relative source contributions of the annual phosphorus loads to Oswego Lake, which totaled 1116 kg during the 2008-2009 water year. (personal communication, Mark Rosenkranz, Lake Oswego Corporation).



3.9 Seasonal Variation and Critical Conditions

This element accounts for seasonal variation and critical conditions in stream flow, sensitive beneficial uses, pollutant loading and water quality parameters so that water quality standards will be attained and maintained during all seasons of the year.

The TMDL for phosphorus is intended to control high chlorophyll *a* concentrations, and violations of the pH criteria. Historically, nuisance algal blooms have occurred seasonally during June, July and August. Nuisance blooms have also been limited geographically to the lower 33 miles, most commonly in the lower 9 miles of the Tualatin River, and in Oswego Lake. For the Tualatin basin proper, the 2001 TMDL allocations applied from May 1 through October 31. However, because of the increased sensitivity of Oswego Lake to phosphorus concentrations, phosphorus allocations apply year round in the Oswego Lake watershed, with different TMDL targets during the summer and winter time periods. One reason that Oswego Lake is more likely to exhibit nuisance blooms relates to the much longer retention time of water in the Lake than in the Lower Tualatin River. Thus water, and therefore phosphorus, diverted to Oswego Lake may influence algal growth over a longer season than phosphorus impacts the Lower Tualatin River. In addition to the dissolved phosphorus carried to the lake, phosphorus-laden sediment is likely to settle out in the slow moving lake water, and may release phosphorus to the water column at a later time.

Clean Water Services has requested that the time period during which the TMDL applies be shortened to May 1 through August 31. A detailed analysis of the water quality impacts resulting from such a change is included in Appendix 3B. Water quality model results show that while algal blooms are influenced by phosphorus, other conditions such as sunlight, temperature and flow-governed residence time are also important factors in bloom formation. Years of monitoring data using a continuous monitor with hourly recording have shown no pH violations in the lower Tualatin River during October, despite high phosphorus levels in the river during some of the early TMDL years (see box plots in Appendix3B). The limited number of pH violations observed in September were all correlated with low river flows; levels that were much lower than occur under the current flow augmentation program. Indeed algal blooms in the lower river are less likely, and are much less sensitive to phosphorus concentrations in September and October than they are in mid-summer. Dry season flow augmentation has been implemented in the basin since Hagg Lake was constructed in the late 1970's. However summer release strategies have changed over time. Starting in 1987, CWS (then United Sewerage Authority) targeted monthly average flows of 150 cfs at the Farmington gage. When the Watershed Permit was issued in 2005, CWS altered the flow augmentation program to release 35 cfs during July and August, and to target a flow of 180 cfs at the Farmington gage. Lake Oswego Corporation has a right to divert water from the Tualatin River. Diversions historically were about 57 cfs year round; in about 2005 these were reduced to less than 10 cfs during the summer months, leaving more flow in the lowest river reach in recent years.

In contrast, Oswego Lake has been shown to support nuisance algal blooms as late as November. In response to the extended series of blue-green algae blooms in Lake Oswego in 2004, Oswego Lake Corporation conducted a study to identify factors that contributed to the nuisance blooms, and subsequently changed their water diversion practices from the Tualatin River. Oswego Lake Corporation holds a water right that allows diversion of 57 cfs of Tualatin River water year-round for hydro-electric generation. Starting as early as 2003, Oswego Lake Corporation greatly decreased the volume of water diverted, as well as limiting those diversions to the summer time period. Roughly 5 cfs of water are now diverted from early July through August and into September, depending on the water year and the lake level. Diversions may continue until mid- October if the lake is particularly low. In addition to decreasing the phosphorus load to the lake by greatly limiting diversion from Tualatin River water, Oswego Corporation has been adding alum to decrease the phosphorus concentration in water coming through the Oswego Canal from the Tualatin River, as well as in other shallow locations of the Lake. Alum is a commonly occurring mineral that when added to water will cause suspended particles to flocculate and

precipitate. Phosphorus can be associated with suspended particles, and is also attracted to the flocculent. Thus alum treatment can be used to remove phosphorus from water. This treatment is used during summer at the Clean Water Services Rock Creek and Durham Plants, and is used in natural waterbodies where phosphorus levels are too high and contribute to nuisance algal blooms.

Sunlight and river flow do play an important role controlling the formation of nuisance algal blooms in the Lower Tualatin River. If this were the only consideration for changing the season in which the phosphorus TMDL applies, it would appear reasonable to shorten the Phosphorus TMDL season to mid-September. Blooms in the Tualatin River have historically not occurred later than this time; light availability is lower, and with increased flow augmentation, river flow is likely to be sufficiently high to disrupt bloom formation. However nuisance blooms still occur Oswego Lake, and have been attributed to high concentrations of phosphorus. Therefore, phosphorus concentrations should not be allowed to increase in the Tualatin River while river water is still being diverted into Oswego Lake.

When the Total Phosphorus TMDL applies, Clean Water Services discharge concentrations of phosphorus are limited to 0.1 mg total P/L. This is the background concentration of the lower river, although summertime river concentrations are slightly lower due to dilution from augmentation flow releases from the upper watershed (Hagg Lake or Barney Reservoir). Clean Water Services utilizes several treatment techniques to decrease phosphorus levels in their discharge, but summertime treatment with alum has been necessary in order to meet the low TMDL discharge limits. During late summer and early autumn, Tualatin River flow levels are sufficiently low that the phosphorus discharges from Clean Water Services Advanced Waste Water Treatment Plants at Rock Creek and Durham have a significant impact on phosphorus concentration levels in the Tualatin River. When Clean Water Services stops treating their discharge with alum at the end of October, phosphorus levels in the River rise quickly to as high as 0.4 mg P/L. These levels create a significant phosphorus source in water diverted to Oswego Lake. Therefore the TMDL should remain in place while water is diverted to Oswego Lake.

However, with an interest to lower the environmental impact of mining, transporting and adding alum to treat waste water, the dates for which the total phosphorus TMDL apply might still be modified. Clean Water Services two largest discharges are the two discharge points closest to the Oswego Lake diversion. The Rock Creek Advanced Waste Water Treatment Plant is has the largest discharge to the Tualatin of 60 cfs at river mile 37.7. The Durham Advanced Waste Water Treatment Plant discharges 35 cfs at river mile 9.2. September travel times to the Oswego Lake Diversion, located at river mile 6.8 are approximately 12 days from Rock Creek, and less than 1 day from the Durham Plant. Therefore, in years when Oswego Lake diversions continue into October, discharges released from Rock Creek on October 1 will not arrive at the diversion point until October 12. Discharges from the Durham Plant have a much shorter travel time to the diversion point, so P levels in discharge from that plant should not be increased until diversions to Oswego Lake have ceased.

River flow in the lower river may also affect bloom formation in the lower Tualatin. **Figure 3-6** shows daily maximum pH values in September versus Tualatin River Flow. The data are plotted to show pH values during the TMDL transition phase of 1991-1993 when phosphorus values were higher, and 1994-2010, when waste water discharges met the TMDL allocation of 0.10 mg/L as total phopshorus (0.11 at Durham). September flows were generally about 100 cfs at the West Linn gauge from 1991-1993, and increased from about 115-150 cfs over the 1994-2010 time period. This figure shows that even with the higher phosphorus levels of 1991-1993, higher river flow is expected to decrease bloom formation and control pH levels in the lower river. The data here suggest that during September, with shorter days and lower temperatures, blooms are less likely to occur when river flows exceed 125 cfs at Farmington. Therefore, between September 15 and 30, if Oswego Lake Corporation has ceased diverting Tualatin River water, and the 7 day average flow is greater than 130 cfs at the Farmington gauge on the Tualatin River, the TMDL period for CWS four treatment plants may end. The TMDL season will be modified as shown in **Table 3-9.**

Figure 3-6. Daily maximum pH values in September at the Oswego Dam, collected between 1991 and 2010, versus daily average flow at the Farmington gage.

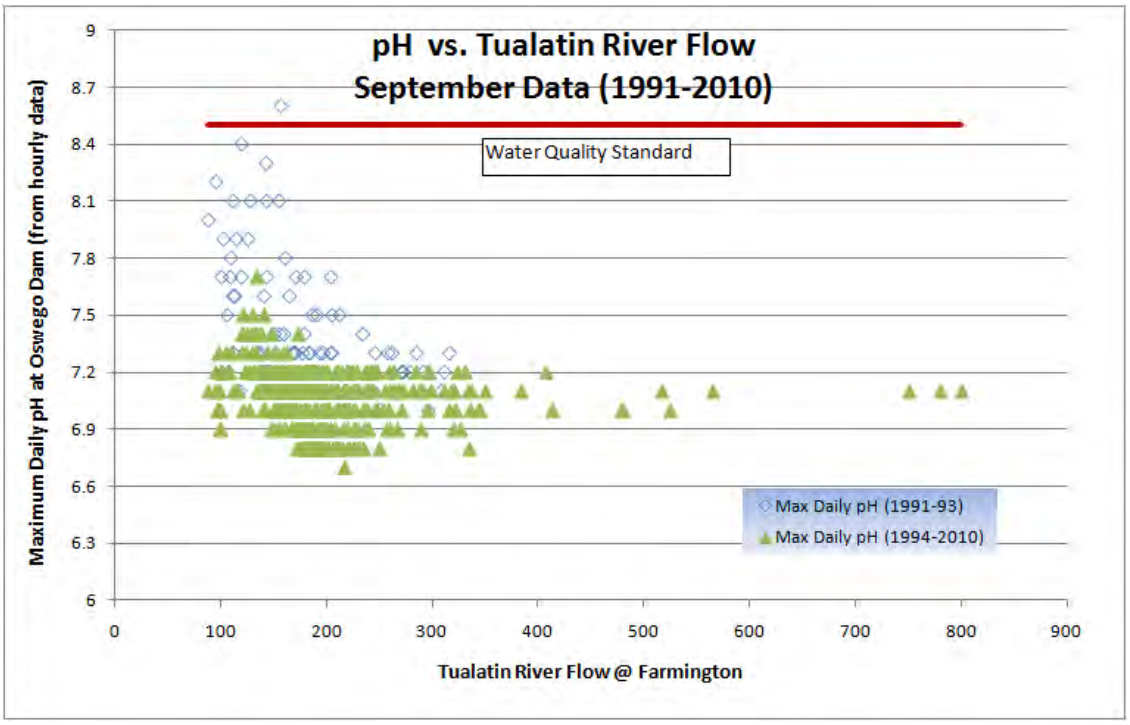


Table 3-9. Dates when the TMDL for Total Phosphorus applies to different sources in the Tualatin Basin.

Source	Dates TMDL Applies	Comments
Non-point Sources to Tualatin Basin	May 1-October 31	No change from 2001 TMDL
Clean Water Services Forest Grove and Hillsboro WWTP	May 1-September 30	Same seasonal and flow restrictions as Rock Creek Treatment Plant
Clean Water Services Rock Creek AWWTP	May 1-September 30	Alum treatment may cease anytime after September 15 if diversions to Oswego Lake have stopped for the year and the 7 day average river flow at the Farmington Gauge is 130 cfs or greater
Clean Water Services Durham AWWTP	May 1-October 15	Alum treatment may cease anytime after September 15 if diversions to Oswego Lake have stopped for the year and the 7 day average river flow at the Farmington Gauge is 130 cfs or greater
Runoff in Oswego Lake Watershed	Year-round	No change from 2001 TMDL

The TMDL dates are only modified for the Clean Water Services Discharges, and in no case will these be lifted earlier than September 16, to ensure that total P will not contribute to nuisance algal bloom formation in the lower Tualatin River in late summer.

The TMDL restrictions for watershed sources to Oswego Lake must remain in place year round in order to limit phosphorus loading to the lake, as annual phosphorus loadings influence the trophic state of lakes (SRI 1987). The dates for which the TMDL applies for load allocations governing non-point sources to the

Tualatin River remain May 1 through October 31. These dates are not modified because management practices, not treatment processes are used to meet these targets. As such, they are not easy to change on short notice, and can easily remain in place throughout the season.

3.10 Existing Phosphorus Sources

This Section describes the pollutant sources within the basin.

Background Sources

The 2001 TMDL for pH and chlorophyll *a* provides a detailed description demonstrating that the main water quality parameter contributing to algal blooms and causing violations of the pH criterion and chlorophyll *a* action level was elevated levels of total phosphorus. Ambient light and travel time play a role as well; dense algal growth occurs in conditions of sufficient light, and is more likely to occur in low current, when populations are less physically dispersed and have greater contact time with favorable nutrient conditions.

Based on research in the local area (Kelly et al 1999 & Wilson et all 1999), the 2001 TMDL documented that background sources of phosphorus in the basin were elevated. Samples collected from tributaries at low summer flow were assumed to represent mainly groundwater inputs. These were analyzed for phosphorus concentrations and reported in the 2001 TMDL for pH and Chlorophyll *a*. The groundwater background concentrations were reported in the 2001 TMDL, and will not be repeated here. However, the median summer 'dry weather' levels formed the basis of the load allocations for tributaries, which are included here in Section 3.7 (Loading Capacity, see **Tables 3-5 and 3-6**). Dry weather surface water samples were selected to minimize the influence of surface water chemistry on the sample analyses; dry weather summer samples are assumed to be heavily dominated by, if not entirely composed of groundwater seepage. Background phosphorus concentrations were generally lower in the upper watershed (0.04 mg Total P/L), and higher toward the western portion of the basin (0.1 mg/L in the mainstem, with some tributaries as high as 0.19 mg total P/L).

Summer season inputs are more important to algal bloom formation in the riverine tributaries and Tualatin River itself than are winter contributions. However, year-round inputs to Oswego Lake are important because of the long retention time of water and sediment with the lake. Therefore wet-season sources to Oswego Lake are also described in this document. More detail about lake dynamics and sediment loading can be found in the original 2001 TMDL, which this chapter amends, but does not replace.

Point Sources

Wastewater Treatment Plants
Clean Water Services operates four wastewater treatment plants in the subbasin. Two of these plants Durham (RM 9.3) and Rock Creek (RM 38.1) currently discharge during the summer season. These plants discharge at concentrations below the allocations provided in the 2001 TMDL. The flow volumes from these two plants are expected to increase as the population of Washington County increases. In addition, to increase treatment volume, Clean Water Services proposes to modify summer treatment at the Forest Grove and Hillsboro Treatment Plants, and begin discharging during the summer at those sites. Before the discharge permit can be issued to allow those discharges, waste load allocations must be developed and a new TMDL order issued. Methods used to derive the new allocations are presented in Section 3.6 of this document, and the allocations themselves are included in Section 3.11

Other Permitted Point Sources

Permit conditions for individual and general industrial activity permits were reviewed to determine whether these discharges may be a source of phosphorus to Tualatin Basin waters. No permits included restrictions on phosphorus in their discharges, and no processes were deemed likely to discharge phosphorus, so these permitted sites are not considered to be sources of phosphorus.

Stormwater discharge is a source of phosphorus, and there are many sources of stormwater runoff in the Tualatin basin that hold NPDES permits. The character of these discharges is described below as runoff.

Runoff Sources
In addition to the groundwater sources of phosphorus, surface runoff is known to contribute total phosphorus loadings to both the mainstem Tualatin River and to the tributary streams. The amount of runoff and the concentration of phosphorus in the runoff will vary with precipitation and land use. What follows is a broad characterization of the contribution of runoff to total phosphorus loadings in the Tualatin River Subbasin. A more detailed discussion of the total phosphorus concentrations and loadings in runoff is included in Appendices C-6 and C-7 to the 2001 TMDL, (DEQ, 2001).

Urban Runoff
Urbanized land areas, with their high percentages of impervious surfaces and extensive drainage systems, have surface runoff even during relatively small rainfall events. The 2001 TMDL characterized phosphorus concentrations in urban runoff. The TMDL showed that concentrations in urban runoff commonly exceed background concentrations, so the TMDL provided load allocations for urban runoff sources.

Runoff from Rural, Agricultural and Forested Lands
While runoff from rural, agricultural and forested lands differs from runoff from urban areas; the main difference between the two broad source categories is that the volume of runoff for a given area from non-urbanized watersheds is generally lower, especially during the summer season. Data on total phosphorus concentrations for agricultural and forested land runoff in the subbasin is lacking, but general values for these concentrations indicate that non-urban runoff concentrations also exceed the background concentrations. Therefore the 2001 TMDL provided load allocations for non-urban runoff as well. (2001 TMDL, Appendix C-7 for a more detailed discussion of rural, agricultural and forested runoff in the subbasin, DEQ, 2001)

Other Sources

While the significant amounts of phosphorus loading to the Tualatin River and its tributaries comes from the wastewater treatment plants and urban and rural runoff including stormwater, there are other potential sources of phosphorus in the basin.

Unregulated (Unpermitted) Upland Sources
Potential upland sources aside from runoff and other permitted discharges include faulty septic and sewer systems, and illegal or illicit discharges. While these sources are not easily quantified, the phosphorus loads are expected to be relatively small due to the aggressive control programs that were established previously. It is important that these programs continue to be implemented and are updated based on new monitoring or other information.

Instream and Riparian Sources
The primary instream source of phosphorus is considered to be groundwater (Kelly *et al*, 1999). Another probable source is the release of phosphorus in sediment due to anoxic conditions. While these releases are estimated to be relatively small in the mainstem (Kelly *et al*, 1999), they may have a larger impact in areas with very low oxygen levels such as tributary ponds.

The contribution of riparian bank erosion to water column and sediment phosphorus levels is also difficult to quantify. While the smaller instream flows during the summer season (when algal blooms are an issue) most likely result in only a small portion of the total bank erosion taking place, this remains a potential source of total phosphorus. Sediment deposited instream during winter-time erosion may still provide a significant source of phosphorus during summer months when in-stream dissolved oxygen levels are low.

Tile Drains

Tile drains, installed primarily in agricultural areas to drain shallow groundwater, are briefly examined in a USGS report on phosphorus sources in the Tualatin River Subbasin (Kelly *et al*, 1999). This report concluded that "(t)he data suggest that agricultural practices in the Tualatin River Subbasin did not significantly increase concentrations of phosphorus in water entering streams during the low-flow [non-runoff] period of this study". This is primarily referring to agricultural impacts on shallow groundwater and tile drains. While this study indicates that this source may be small, Department of Agriculture rules (OAR-603-095-0140(5)) require that irrigation occur at agronomic rates, and do not allow tile drain runoff to occur between May and October unless an approved monitoring plan for discharge water quality is in place.

Wapato Lake/Wapato Improvement District

Wapato Lake is located in Gaston, Oregon, in southwestern portion of the Tualatin River watershed. The Wapato Improvement District (WID) drained the lake in the 1930's to create farmland. This drainage project includes an elongated U-shaped dike, roughly 3,000 feet in length that protects the lakebed from winter flooding by the surrounding creeks. Irrigation canals were constructed both inside and outside the dike to deliver water to cropland.

During the rainy season the lakebed floods with a foot or two of water from rain and creeks that flow into the lake area. The flood water is pumped out of the lake in late winter or early spring, allowing the soil time to dry for spring and summer planting. Pipe turnouts penetrate the dike and allow for the controlled diversion of water from Wapato Creek into the lakebed canals to supply irrigation water during the summer. The turnouts discharge into drainage ditches inside the dike. Farmers pump this irrigation water out of the drainage ditches and apply it to their crops with either big gun travelling sprinklers, wheel-line sprinklers or hand-line sprinklers. Thus, the Wapato Lake drainage ditches provide two functions; drainage of the lakebed in the spring and transport of irrigation water in the summer.

Normally the lakebed is emptied and dried during the non-TMDL season between November and April. However, in recent years, both dike breaches and pump failures have resulted in the release of nutrient-rich water to Wapato Creek and the Tualatin River during the TMDL season. In 2008, this release led to a bloom of harmful algae in the lower Tualatin River, mentioned above in Section3.4 and in greater detail in Bonn (2008).

Oswego Lake Sources

Oswego Lake receives water both by diversion from the lower Tualatin River as well as its natural watershed. Gibbons and Welch, (2004) identified diverted Tualatin River water, stormwater runoff, and both shallow and deep lake sediment as significant sources of phosphorus to Lake Oswego. Additional sources include tributary flow, groundwater and precipitation. Phosphorus associates with soil particles more easily than it remains dissolved in the water column. Sediment tends to accumulate in lake-bottoms, as flow velocities decline in the slower or non-moving lake water. Water at depth has lower oxygen levels than surface water, and creates conditions where phosphorus associated with sediment particles is released to the water column. Lake Oswego Corporation, whose management activities for the lake include water quality, currently add alum to sediments in the lake and the diversion canal to control phosphorus levels and thus decrease algal bloom activity in the Lake. In addition, diversions of Tualatin River water are now limited in volume and season, further reducing phosphorus inputs to the Lake. The current annual phosphorus budget (**Figure 3-5**) identifies Springbrook Creek as contributing 30% of the annual budget, with 65% generated in the lake basin itself. These numbers include both natural background as well as stormwater loading, and reflect the low volume of water currently diverted from the Tualatin River.

3.11 Waste Load Allocations

This element determines the portions of the receiving water's loading capacity that are allocated to existing point sources of pollution, including all point source discharges regulated under the federal Water Pollution Control Act Section 402 (33 USC Section 1342).This amendment to the 2001 TMDL provides new allocations for the Forest Grove and Hillsboro Clean Water Services discharge locations, and provides daily load equivalents for the monthly targets set out in the 2001 TMDL. Comments will only be accepted for the amended values.

Allocations

Total Maximum Daily Loads are described by a simple equation that defines the loading capacity of a system, and quantifies pollutant sources in the form of natural background sources, point sources from permitted discharges, and non-point sources. The TMDL is a legal document that places limits on point and non-point pollutant sources. The limits placed on point sources are referred to as Waste Load Allocations, and those placed on Non-Point Sources are referred to as Load Allocations. In the Tualatin Basin there are basically two types of point sources that contribute phosphorus; the waste water treatment plants, and the runoff originating from densely populated urban areas that require National Pollution Discharge Elimination Permits for Municipal Separate Storm Sewer Systems (MS4). Runoff from rural areas, and smaller urban areas that are not addressed by an MS4 permit are still subject to TMDL restrictions, but are provided with Load Allocations (see section 3.12), not Waste Load Allocations.

The main purpose for this Total Phosphorus TMDL amendment is to provide Waste Load Allocations for two of the Clean Water Services municipal waste water treatment plants. These two facilities were online at the time of the 2001 TMDL, but they have not been discharging during the summer months. Instead, during the summer, effluent from these treatments plants are piped down to the Rock Creek Advanced Waste Water Treatment Facility. As population in the Tualatin Basin increases, Clean Water Services proposes to increase their waste water treatment capacity by maintaining the current capacity at its' two downstream facilities, the Rock Creek and Durham plants, and by commencing summertime discharges at its' two upstream facilities at Forest Grove and Hillsboro. The two downstream plants at Rock Creek and Hillsboro will increase capacity as needed once Forest Grove and Hillsboro are operating at full capacity during the summer.

Waste Load Allocations for Point Sources Other than Waste Water Treatment Plants

Waste Load Allocations for point sources other than the waste water treatment plants in the Tualatin Basin remain unchanged from the 2001 TMDL and are presented in **Table 3-10**. These sources are mainly those addressed in various Municipal Separate Stormwater Sewer System (MS4) National Pollution Discharge Elimination System Permits (NPDES). The summer median values are included in this document for convenience, so that the reader need not search out the 2001 TMDL for these values. These values are not part of the amendment to the 2001 TMDL, and therefore are not open for comment during this public comment period.

Table 3-10. Tualatin River Subbasin Total Phosphorus Wasteload Allocations for Point Sources (other than WWTPs). Summer median values are from the 2001 approved TMDL and are not included in the amendment.

Designated Management Agency/Source	Source Discharging to: (Subbasin)	Total Phosphorus Concentrations (Summer Median - mg/L)
City of Lake Oswego, City of Portland, City of West Linn, Clackamas Co., Oregon Dept. of Transportation, Multnomah Co., Clean Water Services, and Washington Co. (And other point sources other than WWTPs)	All Sources to the Mainstem Tualatin below Dairy Creek (Unless otherwise specified below)	0.14
	All Sources to the Mainstem Tualatin above Dairy Creek (Unless otherwise specified below)	.04
	Bronson Creek @ Mouth (205th)	0.13
	Burris Cr./ Baker Cr./ McFee Cr./Christensen Cr.(all @ Mouth)	0.12
	Cedar Cr./Chicken Cr./Rock Cr. (South)/ Nyberg Cr./Hedges Cr./Saum Cr. (all @ Mouth)	0.14
	Dairy Creek @ Mouth	0.09
	Fanno Creek @ Mouth	0.13
	Gales Creek @ Mouth	0.04
	Rock Creek @ Mouth	0.19

Discharge concentrations are the applicable units for the waste load allocations presented in **Table 3-10** above. Equivalent allocations in the form of loads may be utilized instead as needed or desired. Loads are presented in units of weight per time period, such as pounds per day, or pounds per season. Allocations in the form of loads are calculated by multiplying the concentration in the discharge by the estimated discharge volume for the source. For point sources such as waste water treatment plants, discharge concentrations and volume are readily measured. Waste Load Allocations expresses as concentrations in **Table 3-10** above apply mainly to stormwater runoff, for which discharge volume is difficult to measure. Allocations in the form of loads for the sources in **Table 3-11** below have been calculated based on the mean seasonal precipitation. Discharge values were estimated for each source using a GIS analysis that included city and county boundaries, land use information, and boundaries for Clean Water Services' district, Oregon Department of Transportation Roads, and urban growth. The methods were outlined in detail in Appendix C-6 through C-8 of the 2001 TMDL (DEQ 2001).

The loading capacities identified in Section 3.7 were developed to address water quality issues specific to the lower mainstem Tualatin River. As such, the aggregate loading from all sources to the lower mainstem is the critical factor. Therefore, the allocations given to each DMA in **Table 3-11** may be met by addressing the aggregate of the 5th-field subbasin loadings for the DMA.

Allocations in the form of load for specific precipitation events, and/or using different runoff estimation techniques, may be calculated by the designated management agencies with DEQ approval. The equation used for the conversion of concentration-based allocations to load-based allocations is:

Equation 3-1.

Allocation (lb. of Total Phosphorus/season) = Allocation (mg/L Total Phosphorus) x Seasonal Discharge Volume (ft^3/season) x 6.24×10^{-5} (lb.–L/ft^3-mg)

The resulting allocations are in the form of loads per unit time. The wasteload allocations (assigned to point sources) are given in units of pounds per season (May 1 – October 31). The concentrations listed in **Table 3-10** can be used to assist in the assessment of monitoring data and to provide targets for runoff quality. Loads **(Table 3-11)** can be used to guide management strategies that are designed to reduce the

quantity and/or quality of runoff. DEQ encourages management strategies that optimize reduction of runoff quantity and improvement of quality.

The allocations in the form of loads for sources other than WWTPs are given below in **Table 3-11**. It should be noted that these values are designed to both meet the loading capacities of the receiving waters and to allocate loadings that allow for some human influence.

For each of the subbasins listed in **Tables 3-10** and **3-11**, one or more DMAs have jurisdiction over land and activities. Each DMA's implementation plan and responsibilities will address only the lands and activities within each identified stream segment to the extent of the DMA's authority.

Table 3-11. Waste Load Allocations for Runoff Expressed as Load in units of Pounds per Season (May 1- October 31). These allocations were established in the 2001 TMDL and are included here for reference only.

5th-Field Subbasin[1]	DMA (or Municipality – see note)[2]	Wasteload Allocation (Pounds per TMDL Season)	CWS Wasteload Allocations Subdivided by Municipality (Pounds per TMDL Season)[3]
Dairy	ODOT	3.7	
	CWS	213	
	Banks		0.1
	Cornelius		16.7
	Forest Grove		25.4
	Hillsboro		143.2
	North Plains		0.1
	Other		27.5
	Washington Co.	42.2	
Rock	ODOT	49.3	
	CWS	2974.5	
	Beaverton		629.7
	Hillsboro		796.2
	Other		1548.6
	Multnomah Co.	61.4	
	Washington Co.	14.9	
	Portland	100.8	
Lower Tualatin/Fanno Creek	ODOT	230.1	
	CWS	1271.6	
	Beaverton		217.5
	Rivergrove		3.4
	Sherwood		132.5
	Tigard		371.5
	Tualatin		279.1
	Durham		4.8
	King City		8.1
	Other		254.8
	Clackamas Co.	37.4	
	Multnomah Co.	1.5	
	Washington Co.	33.1	
	West Linn	26.4	
	Lake Oswego	73.0	
	Portland	134.9	
Upper Tualatin	ODA	0	

	ODF	0	
	CWS	0.2	
	Gaston		0.2
	Washington Co.	0	
Middle Tualatin	ODOT	4.9	
	CWS	203.1	
	Cornelius		15.9
	Forest Grove		19.4
	Hillsboro		58.2
	Beaverton		3.5
	Other		106.0
	Washington Co.	26.9	
Gales	ODOT	1.3	
	Forestry	0	
	CWS	25.9	
	Forest Grove		25.4
	Other		0.5
	Washington Co.	0	

Notes:
[1]As explained in Section 3.11, the allocations given to each DMA may be met by addressing the aggregate 5th-field subbasin loadings for the DMA.
[2]The municipalities listed directly under CWS are not Designated Management Agencies; they are listed here with allocations corresponding to their jurisdictions for reference only. CWS is the designated management agency for these areas. "Other" under this heading refers to loads from areas outside of cities.
[3]The seasonal loads may be divided by 184 to give the average daily loading.

Oswego Lake Waste Load Allocations

The Load and Wasteload allocations combined for Oswego Lake were set equal to the background loadings as estimated in the 2001 TMDL. The wasteload allocations are for discharges from the City of Lake Oswego's Municipal Separate Storm Sewer system (MS4). All other discharges and instream contributions (instream erosion, etc.) are included in the Load Allocation in Section 3.12. These allocations were developed in the 2001 TMDL, and are not changed by this TMDL amendment. The 2001 TMDL includes a detailed discussion regarding the development of these allocations (DEQ, 2001).

The summer stormwater background concentration (point source) is assigned a value of 0.09 mg/L total phosphorus (TP), with the corresponding load leading to an increase to 0.11 mg/L assigned to instream (non-point) sources. The winter stormwater target concentration (point source) is assigned a value of 0.15 mg/L TP, with the corresponding load leading to an increase to 0.19 mg/L assigned to instream (nonpoint) sources. Based on these values, the total phosphorus allocations for the City of Lake Oswego are given in **Table 3-12,** below. These values were established in the 2001 TMDL and are not being amended by this TMDL amendment.

Table 3-12. Total Phosphorus Allocations for the City of Lake Oswego, unchanged from the approved 2001 TMDL.

May 1 through October 31 (Summer)	
Wasteload Allocations (Stormwater Discharges)	139 lb. (63 Kg.) Total Phosphorus
November 1 through April 30 (Winter)	
Wasteload Allocations (Stormwater Discharges)	858 lb. (390 Kg.) Total Phosphorus

Waste Load Allocations for Clean Water Services Municipal Wastewater Treatment Plants

The main objective of the 2001 Phosphorus TMDL was to control the concentration of total phosphorus in the lower Tualatin River (Section 3.2) to reduce the incidence of nuisance algal blooms that led to increased pH and decreased dissolved oxygen concentrations. This objective remains unchanged in this TMDL amendment; waste load allocations for Clean Water Services Rock Creek and Durham Treatment Plants will remain the same as the 2001 TMDL (**Table 3-13**). These allocations provide each treatment plant with a maximum discharge concentration of total phosphorus, based on a monthly median values. Due to the influence of these two discharges, combined with the flow augmentation program in CWS Watershed-Based NPDES Permit, the load allocations have been met in the Lower River for several years (**Figure 3-3**).

In November of 2006, EPA began to require that when TMDLs are presented for time periods other than daily loads, as was the case for the 2001 TMDL for pH and Chlorophyll *a* (total phosphorus TMDL), that a daily value also be included. The daily values have been added to Table 3-13, 3-15, 3-16, and 3-17. Daily values were computed according to a June 2007 draft EPA document (EPA, 2007). The seasonal median values have been adjusted using multipliers from Table 18 in Appendix B of the EPA guidance. The multiplier utilizes an estimate of the variability of daily concentrations to calculate daily maximum concentrations that could occur and are still likely to meet a median monthly value. Little data are available to calculate the coefficient of variation for these TMDL concentration targets, so DEQ assumed a coefficient of variation of 0.6, as recommended in the Technical Support Document for Water Quality Based Toxics Control (EPA, 1991). Wasteload allocations in Table 3-13 are based on monthly median values, so the daily load is computed by multiplying the monthly target by 2.39 (30 day time period with a coefficient of variance of 0.6). For Tables 3-15, 3-16 and 3-17, the 2001 TMDL targets are based on meeting the target over a 6 month period. The multiplier for computing the daily load for these is 3.51 (180 days with a coefficient of variance of 0.6). Daily targets have been added as an additional column to the affected tables.

The purpose for this TMDL amendment is to provide waste load allocations for Clean Water Services' Forest Grove and Hillsboro Waste Water Treatment Plants, to enable future summer discharges from these locations to accommodate population growth. Secondary treatment is currently utilized at both the Forest Grove and Hillsboro Waste Water Treatment Plants. Prior to summer discharge, Clean Water Services proposes to modify treatment at the Hillsboro facility to include Advanced Secondary treatment including nitrification, followed by nutrient polishing in a Natural (wetland) Treatment System (NTS). Future plans for Forest Grove include either a similar upgrade as Hillsboro (advanced secondary treatment with NTS), or advanced tertiary treatment to the levels currently provided at the Rock Creek Advanced Waste Water Treatment Plant, such that all NPDES requirements will be met.

In order to provide flexibility for future treatment systems, this TMDL provides a bubble allocation as a daily load for the three upstream discharge sites; Forest Grove, Hillsboro, and Rock Creek discharges combined must not exceed 66.1 pounds per day as a monlthy median value (the daily target is 158 pounds per day). (**Table 3-13**). The discharge concentration limit of 0.10 mg total P/ L must concurrently be met at the Rock Creek Advanced Waste Water Treatment Plant.

Table 3-13. Wasteload Allocations for Clean Water Services Municipal Sewerage Treatment Plants.

Bubble Allocation for CWS Forest Grove, Hillsboro and Rock Creek Wastewater Treatment Plant[1]		
Sum of the Total P loads from Forrest Grove, Hillsboro and Rock Creek WWTP ≤ 66.1 pounds per day as a monthly median (158 pounds per day as a daily maximum load)[1]	Dates TMDL applies	May 1- September 30[2]
CWS Rock Creek Wastewater Treatment Plant		
Wasteload Allocation Monthly Median Effluent Concentration 0.10 mg/L Daily maximum effluent concentration 0.24 mg/L	Dates TMDL applies	May 1- September 30[2]
CWS Durham Wastewater Treatment Plant		
Wasteload Allocation Monthly Median Effluent Concentration 0.11 mg/LDaily maximum effluent concentration 0.26 mg/L	Dates TMDL applies	May 1- October 15[2]

[1] The monthly median load will be calculated as follows: (8.35 conversion factor)×[((Median monthly Forest Grove discharge concentration of total P mg/L)×(Actual median Forest Grove effluent volume MGD))+((Median monthly Hillsboro concentration of total P mg/L)×(Actual median Hillsboro effluent volume MGD))+ ((Median monthly Rock Creek discharge concentration of total P mg/L)×(Actual median Rock Creek effluent volume MGD))]

[2]TMDL Phosphorus restrictions may be relaxed as early as September 15 in years that Lake Oswego Corporation ceases Tualatin River withdrawals on or before September 15, and the weekly average flow at the Farmington gauge is at least 130 cfs. (see Section 3.9 for more detail)

Allocations for the new discharge locations are provided as a bubble allocation in an expansion of the pollutant trading program already established in the Tualatin Basin. The bubble allocation will provide Clean Water Services with the flexibility to adopt innovative treatment at one or both of the upstream treatment plants, knowing that minor variations in phosphorus treatment at the upstream plants can be offset by proven advance treatment technology already in place at the Rock Creek Plant. This type of trading, also called intramunicipal trading, is encouraged by EPA, and described in detail in EPA's Water Quality Trading Toolkit for Permit Writers (EPA 2007, pg 23). Intramunicipal trading allows the district to manage its multiple discharges as a system, apportioning a total load among multiple facilities. In this case, DEQ has already issued a watershed permit that includes all four discharges under a single permit order. Describing the total phosphorus allocation as a bubble load in this TMDL will enable the permit writer to incorporate intramunicipal trading in subsequent watershed permits for Clean Water Services. One requirement for this type of trade is a demonstration that localized impacts are not expected at any of the discharge locations. The modeling information in Appendix 3-A and the discussion below provide this demonstration.

The bubble wasteload allocation will allow a slight increase in river concentrations of total phosphorus between river mile 53.8 at the Forest Grove discharge and river mile 37.7 downstream of the Rock Creek Treatment Plant. However, the bubble allocation will restrict the concentration of the river to 0.10 mg/L downstream of Rood Road Bridge at river mile 39, maintaining the 2001 TMDL target.

Details that describe the modeling results and potential impacts for this change are located in Appendix A-1. **Figure 3-7** shows that concentrations of total P will be maintained in the lower river, and increases only slightly between Forest Grove and Rock Creek. **Figure 3-8** shows the model prediction for chlorophyll *a* levels in that same river reach. Chlorophyll *a* levels are slightly lower with waste water treatment plants discharging, likely to due faster travel times, than when plants are not discharging.

Figure 3-7. Primary TP Mass Balance Results (Median TP Concentration, May through October, 2002-2007) Assumes TP Mass Load ≤ 66.1 lb/day, current flow augmentation levels, and tributaries meeting water quality standards.(See Appendix B-1, Exhibit 2-10). Baseline Total P concentration (◊ light blue diamond) reflects current river concentrations, while the Concentration (◊, dark blue diamond) and load (Δ green triangle) are projected future conditions based on a future 66.1 lb./day load.

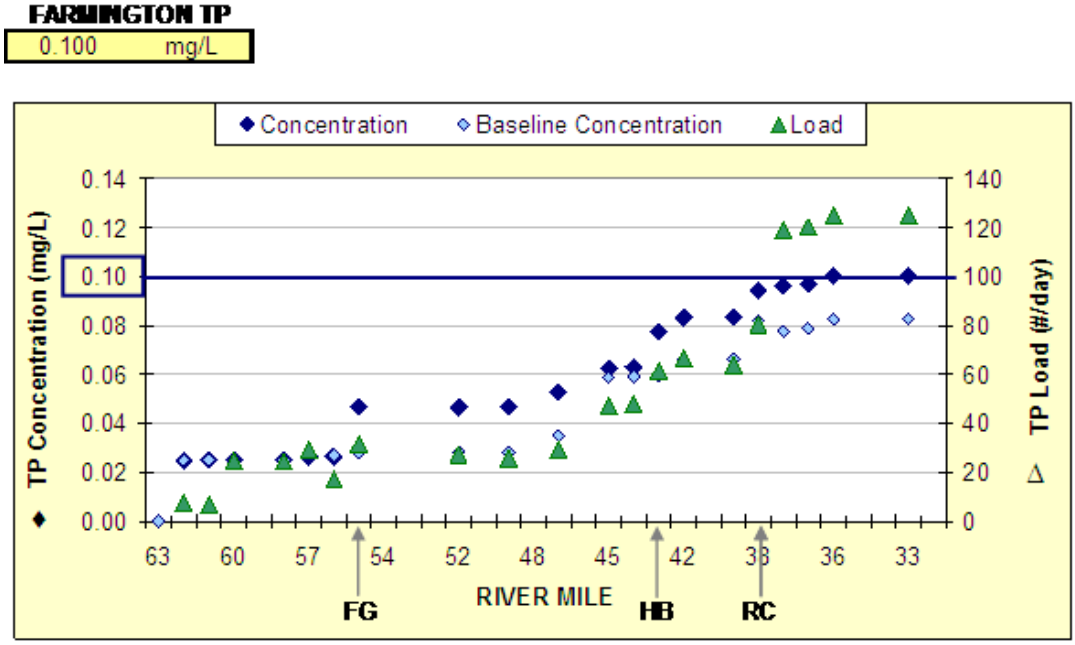
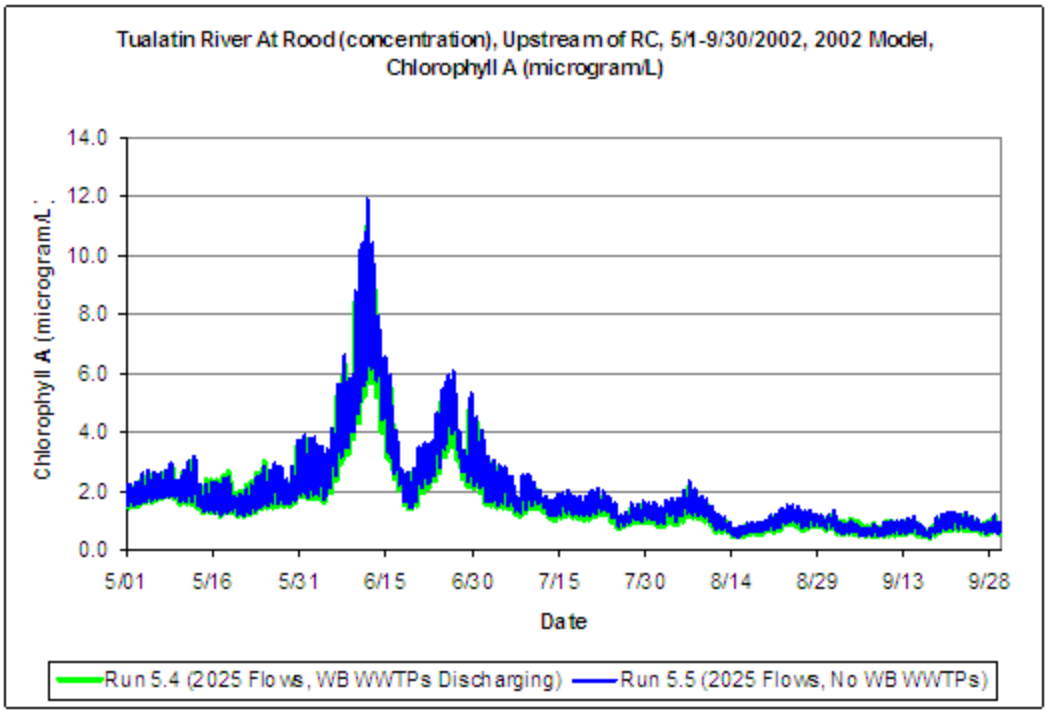


Figure 3-8. Chlorophyll *a* at Rood Road, presented in Total Phosphorus Modeling Report in Appendix A-1.



Other Permitted Sources
Permitted sources other than the wastewater treatment plants and municipal separate storm sewer systems have been given allocations in the form of target concentrations. These target concentrations were assigned in the 2001 TMDL and are presented here in **Table 3-11 and 3-12** (above). These have been and will be incorporated into the sources' NPDES permits either directly as concentrations, or as loads based on these concentrations. If current discharge levels are below the WLA concentrations, the WLA to be given within the permit will be equivalent to "current performance".

Riparian Bank Erosion

Phosphorus loads from riparian bank erosion are estimated to be relatively small during the TMDL season, but they are still a potential source of pollutants. Due to limitations in the available data, it is not possible to develop a quantitative estimate of phosphorus from riparian bank erosion. Therefore, the load allocation for this source is narrative: No excessive riparian bank erosion may occur in the Tualatin River Subbasin during the TMDL season, or to the Oswego Lake Subbasin year-round. This issue is best addressed through the Tualatin River Subbasin (this document) and the Willamette Basin Temperature (DEQ, 2006) TMDLs, which will require system potential shading in the Tualatin and Oswego Lake Basins, respectively. It is reasonable to assume that the best management practices resulting in system potential shading will also result in bank stabilization and the elimination of excessive riparian bank erosion, especially during the TMDL season.

3.12 Load Allocations

This element determines the portion of the receiving water's loading capacity that is allocated to existing nonpoint sources of pollution or to background sources. Load allocations are best estimates of loading, and may range from reasonably accurate estimates to gross allotments depending on the availability of data and appropriate techniques for predicting loading. Whenever reasonably feasible, natural background and anthropogenic nonpoint source loads will be distinguished from each other. The Load Allocations here were adopted in the 2001 TMDL and are repeated for the reader's convenience.

Load allocations for tributaries and runoff in the Tualatin Basin remain unchanged from the 2001 TMDL. The allocations are repeated here, however the original 2001 TMDL includes more detail and discussion regarding these loads. These load allocations were presented as a combination of concentrations and loads based on meeting those median seasonal concentrations. Offering alternative units for the load allocations is considered appropriate since it both addresses the water quality standard and lends itself to the design of control measures.

Both mainstem and tributary background (groundwater) sources of total phosphorus are assigned load allocations in the form of concentrations in **Table 3-14**.

Table 3-14. Tualatin River Subbasin Total Phosphorus Load Allocations for Background (Groundwater) Sources.

Stream Segment	Total Phosphorus Concentrations (Summer Median - mg/L)
All Tributaries to the Mainstem Tualatin below Dairy Creek (Unless otherwise specified below)	0.14
All Tributaries to the Mainstem Tualatin above Dairy Creek (Unless otherwise specified below)	.04
Bronson Creek @ Mouth (205th)	0.13
Burris Cr./ Baker Cr./ McFee Cr./Christensen Cr.(all @ Mouth)	0.12
Cedar Cr./Chicken Cr./Rock Cr. (South)/ Nyberg Cr./Hedges Cr./Saum Cr. (all @ Mouth)	0.14

Dairy Creek @ Mouth	0.09
Fanno Creek @ Mouth	0.13
Gales Creek @ Mouth	0.04
Rock Creek @ Mouth	0.19

Load allocations for runoff are provided in **Table 3-15** below. These loads are presented as median summer concentrations, and because they are based on maintaining background levels of total phosphorus, have the same values as the background concentrations in **Table 3-14** above. These values are repeated from the 2001 Tualatin TMDL. However, as now required by EPA, daily load equivalents for the monthly values included in the 2001 TMDL have been added to the tables below. These were computed in the same way as the waste load allocations and are described in Section 3.11.

Table 3-15. Tualatin River Subbasin Total Load Allocations for Nonpoint Sources

Designated Management Agency/Source	Source Discharging to: (Subbasin)	Total Phosphorus Concentrations (Summer Median - mg/L)	Total Phosphorus Concentrations (Daily Maximum - mg/L)
Clackamas Co., Oregon Dept. of Agriculture, Oregon Dept. of Forestry, Multnomah Co. and Washington Co., Wapato Improvement District (or future Wapato Lake Manager)	All Sources to the Mainstem Tualatin below Dairy Creek (Unless otherwise specified below)	0.14	0.49
	All Sources to the Mainstem Tualatin above Dairy Creek (Unless otherwise specified below)	.04	0.14
	Bronson Creek @ Mouth (205th)	0.13	0.46
	Burris Cr./ Baker Cr./ McFee Cr./Christensen Cr.(all @ Mouth)	0.12	0.42
	Cedar Cr./Chicken Cr./Rock Cr. (South)/ Nyberg Cr./Hedges Cr./Saum Cr. (all @ Mouth)	0.14	0.44
	Dairy Creek @ Mouth	0.09	0.32
	Fanno Creek @ Mouth	0.13	0.46
	Gales Creek @ Mouth	0.04	0.14
	Rock Creek @ Mouth	0.19	0.67

Wapato Creek, the outlet from Wapato Lake, discharges to the Tualatin River just upstream of Scoggins Creek near Tualatin River mile 60. Wapato Creek drains a mostly low-lying area, which includes the Wapato Lake area, an old wetland area characterized by unique organic, peaty soils. It is not clear whether background phosphorus concentrations here differ from the surrounding watersheds. Because there is not sufficient data to identify a different background contribution or load allocation for this system, the load allocation that applies to the upper watershed applies to Wapato Creek: 0.04 mg/L of total P, during the TMDL season.

Loads can be calculated using the same approach as described in Section 3.11 above for Waste Load Allocations using **Equation 3-1**. These are presented by source for average seasonal runoff in **Table 3-16** below.

Table 3-16. Tualatin River Subbasin Total Phosphorus Allocations for Runoff Sources

5th-Field Subbasin[1]	DMA	Load Allocation (Pounds per TMDL Season)[2]	Load Allocation (daily maximum load in pounds
May 1 through October 31 (Summer)			
Dairy	ODOT	0	0
	CWS	0	0
	Washington Co.	1.1	3.86
Rock	ODOT	0	0
	CWS	0	0
	Multnomah Co.	0	0
	Washington Co.	0	0
	Portland	0	0
Lower Tualatin/Fanno Creek	ODOT	0	0
	CWS	0	0
	Clackamas Co.	0.8	2.8
	Multnomah Co.	0	0
	Washington Co.	0.2	.70
	West Linn	0	0
	Lake Oswego	0	0
	Portland	0	0
Upper Tualatin	ODA	26.4	92.7
	ODF	17.1	60.0
	CWS	0	0
	Washington Co.	8.6	30.2
Middle Tualatin	ODOT	0	0
	CWS	0	0
	Washington Co.	1.60	5.6
Gales	ODOT	0	0
	Forestry	0.1	.35
	CWS	0	0
	Washington Co.	0.1	.35

[1]As explained in Section 3.11, the allocations given to each DMA may be met by addressing the aggregate 5th-field subbasin loadings for the DMA.
[2]The seasonal loads may be divided by 184 to give the average daily loading.

Load Allocations for Lake Oswego

The Load Allocations and Wasteload Allocations combined were set equal to the background concentrations in the 2001 TMDL. These have been separated into load allocations for non-point sources and wasteload allocations for point sources. The wasteload allocations, presented in Section 3.12, are for discharges from the City of Lake Oswego's municipal separate storm sewer system (MS4). The Load Allocations in **Table 3.17** apply to all other discharges and for instream contributions (instream erosion, etc.) combined.

Table 3-17. Total Phosphorus Allocations for the City of Lake Oswego

	May 1 through October 31 (Summer)	Daily Maximum Load during Summer
Load Allocation (Base Flow and Instream Contributions)	272 lb. (124 Kg.) Total Phosphorus	955 lb. (435 kg) Total Phosphorus
	November 1 through April 30 (Winter)	Daily Maximum Load during Winter
Load Allocation (Base Flow and Instream Contributions)	986 lb. (448 Kg.)Total Phosphorus	3461 lb (1572 kg) Total Phosphorus

The reduction of phosphorus loads is expected to have beneficial impacts for the lake (though a quantitative analysis is beyond the scope of this TMDL). Since the contribution of phosphorus from sediment releases is considered a function of the external loads to the lake, this source is not included in the loading capacity. By reducing external loads to the lake, the releases from sediment may be reduced also – both through the reduction of available phosphorus in the sediment and through decreased hypolimnetic oxygen depletion rates.

It can be seen that the estimated background loadings to the lake in the 2001 TMDL are higher than the allocations given in the original 1988 TMDL (which included total allocations of 1500 lb. of total phosphorus per year). These background loadings are also significantly lower than the estimated current loadings to the lake. In order to quantitatively estimate what water quality impacts would result from reducing the phosphorus loads from their current levels to background levels, a new diagnostic analysis for the lake would have to be undertaken. Qualitatively, however, as reported in the SRI report (SRI, 1987) a reduction in the annual phosphorus loading is predicted to result in decreased mean summer chlorophyll *a* values, increased mean summer secchi depths, and decreased hypolimnetic oxygen depletion rates. Estimating the significance of these reductions would be part of a full lake diagnostic analysis and would have to take into account other restoration efforts (e.g., artificial aeration, alum treatments, etc.).

In addition to the benefits gained by reducing the annual phosphorus loads to the lake, the large influx of phosphorus immediately following storms may often result in short-term algal blooms that present water quality problems. The reduction of phosphorus concentrations in storm water to background levels, especially during the summer, will most likely result in noticeable reductions of these blooms.

3.13 Reserve Capacity

This element is an allocation for increases in pollutant loads for future growth and new and expanded sources. The TMDL may allocate no reserve capacity and explain that decision.

Reserve Capacity is a portion of the Loading Capacity that is set in reserve for future growth, so that new or expanded sources can be accommodated. In the Tualatin River Basin, the loading capacity, waste load and load allocations are based on concentrations. As such, new sources may be added to the Tualatin Basin as long as they are able to meet the concentration-based allocations.

The Loading Capacity for the Oswego Lake subbasin is defined as a load, due to the lentic nature of lakes, and the relationship between annual loads of phosphorus to lake trophic level. No reserve Capacity has been set aside for phosphorus sources to Oswego Lake.

3.14 Margins of Safety

This element accounts for uncertainty related to the TMDL and, where feasible, quantifies uncertainties associated with estimating pollutant loads, modeling water quality and monitoring water quality.

Implicit Margins Of Safety (MOS) were included in the Phosphorus TMDL for the Tualatin Subbasin. Conservative estimates of the background concentrations of phosphorus were used to identify the loading capacity for the Tualatin River and its tributaries. Since these background concentrations are the basis for the allocations, the allocations are also conservative. The details describing these estimations are presented in the 2001 TMDL (see Section 4.4.9 and Appendix C-8, DEQ, 2001). The climate changes predicted under global warming scenarios for the Tualatin Basin include a larger number of significant summertime storms, with increased summer time rainfall. The fact that groundwater, not storm inputs, are the main contributor of summertime phosphorus concentrations also provides a margin of safety that

should protect Tualatin streams from high phosphorus levels in the future. High summer phosphorus from groundwater should be diluted under more frequent rainwater inputs. In addition, the establishment of system potential shade in riparian corridors will also act to filter phosphorus from runoff, reducing future storm-related phosphorus inputs.

New wasteload allocations are provided for new summertime discharges in this TMDL that were not included in the 2001 TMDL effort. Because these allocations are based on the 2001TMDL targets for the lower Tualatin River, the margins of safety from the 2001 TMDL are also partially applicable to these allocations. The new allocations are based on limiting a total phosphorus load to the lower river, in order to maintain the concentration based 2001 TMDL target downstream of Rock Creek and the Rock Creek Advanced Waste Water Treatment Plant on the Tualatin River. As a daily load, calculation of this bubble allocation was based on both discharge and phosphorus concentration. Flow data collected from 2002-2007 were used to estimate river and tributary flows; the bubble load was based on several years of variable flow regimes. The impact of the resulting phosphorus loads along the mid-reach of the Tualatin River was then determined using the CE-QUAL-2E model, calibrated for the 2001-2002 low water years. Thus while the bubble load was estimated based on average flow, the potential impacts of the bubble load were modeled using low flow years, when the bubble allocation may have a larger impact.

The waste load allocation approach is also conservative in the assumptions made about treatment facilities, and because the allocation includes both a bubble allocation that provides some flexibility among three treatment plants, combined with a concentration-based effluent limit at the largest treatment plant. The model inputs used for Forest Grove and Hillsboro treatment plants are conservative because they assume no infiltration or evapotranspiration will occur, and that no phosphorus removal will occur in the wetland Natural Treatment Systems at Forest Grove and Hillsboro. The conservative mass balance model used to calculate the total phosphorus load assumed that there would be no uptake of phosphorus as water travels down the Tualatin River. There is likely to be some uptake of phosphorus from the water column as the Tualatin River flows downstream, so the mass balance approach will somewhat overestimate the phosphorus reaching the lower river. These assumptions collectively over-estimate the contribution of phosphorus from the two upstream treatment plants. Discharge at the downstream Rock Creek Plant will be limited by the existing 2001 concentration based TMDL limit, so when the two upstream sources discharge at a rate lower than anticipated by the TMDL bubble allocation, the total phosphorus discharged to the Tualatin will remain low. Despite some flexibility for trading among plants, the phosphorus “savings” at the two upstream treatment plants cannot be transferred downstream to the Rock Creek Plant. Finally, the mass balance model computed that a bubble load of 66.1 pounds of total P per day as a seasonal median value would meet the TMDL targets set as concentration levels in the downstream Tualatin River reaches . However the 66.1 pounds per day of total phosphorus was assigned in the TMDL as a monthly median value, not a seasonal value. The allocation as a monthly, not seasonal value is more conservative, because for a dataset with the same coefficient of variance, one could expect to see a higher median value in any given month, while still meeting the seasonal target. Here the monthly bubble allocation is set at the lower seasonal median, offering additional assurance that the bubble allocation will in not exceed the lower river concentration targets.

Oswego Lake Allocation Margins of Safety

The margins of safety for Oswego Lake TMDL were implicit in the selection of the concentrations that represent background levels of phosphorus. The winter background concentration was derived from a representative watershed that had soils that were better draining than the Oswego tributary watershed soils. This most likely led to a concentration that is slightly lower than actual background concentrations in the Oswego Lake watershed. The summer background concentrations were set to levels that do not consider any increased loading during summer storm events. While this is most likely accurate for most summer storm events, a few larger summer storms would naturally have increased loadings due to the high gradient of the Oswego Lake watershed and its highly erodible soils. Therefore the concentration selected to represent summer background conditions is most likely conservative and provides an adequate margin of safety.

3.15 References

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Appendices

Appendix 3A: Tualatin River Total Maximum Daily Loads: Total Phosphorus and Dissolved Oxygen Analyses for the Upper River Final Report

This Appendix describes the water quality models used to predict the impacts of summertime discharges from the Forest Grove and Hillsboro Waste Water Treatment Facilities (WWTF). The overall approach restricted all of the Clean Water Services WWTF discharges so that the existing allocations for total phosphorus would be maintained in the Lower River.

The document is organized as follows:

1. Executive Summary: Summarizes the modeling approach and major findings.
2. Introduction: Describes the Tualatin Basin in general, provides a relevant history of TMDLs in the Tualatin Basin, describes hydrology and water quality in the Tualatin mainstem river including the impacts and characteristics of the Clean Water Services WWTF discharges, describes the future operation proposal for the Clean Water Services WWTF and the need for additional waste load allocations in the TMDL amendment.
3. Phosphorus Analyses: Describes the critical assumptions and targets for the new allocations, summarizes the modeling approach, and provides key results.
4. Ammonia Analyses: Describes the existing ammonia TMDL, describes additional modeling information regarding ammonia, provides key results.
5. Requested Allocations: Presents Clean Water Services proposals for amendments to the total phosphorus and ammonia TMDL waste load allocations.
6. Appendices to the Analysis Report:
    a. Detailed description of the CE-Qual-W2 model used, and selected results
    b. Charts of model input parameters
    c. Charts of waste water treatment plant input parameters
    d. Model Calibration information
    e. Excel-spreadsheet used to define the mass balance model for total P
    f. Directions on use of the mass balance model
    g. Copy of the oxygen-demand trading language from the 2005 Watershed NPDES permit

Appendix 3B: Tualatin River TMDL for Total Phosphorus (4/20/2009) Phosphorus Control Period

This document presents data analyses regarding the potential for algal blooms to form in the lower Tualatin River during September and October. The data suggest that total P concentration is not a key parameter affecting algal bloom formation in that river reach at that time of year. The document presents evidence that ambient light, water temperature, and flow become increasingly more important in controlling algal blooms after September 1 than are nutrient concentrations.

Based on these analyses, Clean Water Services has requested that the dates for which the 2001 allocations for Total Phosphorus be modified. Clean Water Services uses innovative biological methods to remove total P during its waste water treatment. However, this approach is not sufficiently effective to remove total P to the level required by the Waste Load Allocations set out in the 2001 TMDL. Alum is added during the Phosphorus TMDL season to precipitate and remove phosphorus from the treated waste. If the TMDL season was shortened, Clean Water Services could cease alum additions in September and October. Alum is a mineral that must be mined and transported; using less alum would decrease environmental impacts of mining and shipping, as well as lowering the cost of waste treatment.

As noted above, this document considered the impacts of total phosphorus concentrations on algal blooms in the lower Tualatin River. The Tualatin River water is diverted to Oswego Lake, a site where algal blooms are also problematic. Blooms have been documented there as late as November. In addition, due to the lentic nature and high residence times of lakes, phosphorus loading any time of year can contribute to summer and fall bloom events. This issue is not considered in this Appendix, but is an important consideration in setting the autumn dates during which the TMDL applies. The impacts to Oswego Lake, and TMDL seasonal dates are included in Section 3.9.