Attachment 1

The Rock Creek AWWTF Variance Application

Variance Application Form

State of Oregon Department of Environmental Quality
Water Quality Division Variance Application Form

Note: Applicants should review DEQ's Internal Management Directive entitled "Implementing Water Quality Standards Variances for NPDES Permit Holders" before completing this application. Applicants can attach supplemental pages for further descriptions of specific sections on form.

A. Applicant Information

1. Permittee Name: Clean Water Services

2. Contact Person: William Gaffi

3. NPDES Permit No.: 101144; **EPA No.:** OR-002977-7; the variance is for a watershed permit that includes four treatment facilities; the permit number specified here is for one of the treatment facilities

4, 6, 7, 8. Mailing Address for Contact Person: 2550 SW Hillsboro Hwy., Hillsboro, Oregon 97123

5. Facility Name: Rock Creek Advanced Wastewater Treatment Facility (AWWTF)

9, 12, 13. Street Address of Facility: 3235 River Road, Hillsboro, Oregon

10. Telephone Number: 503.681.4424

11. Fax Number: 503.681.3603

14. Email Address: gaffib@cleanwaterservices.org

15. Receiving Water & River Mile: Tualatin River RM 37.7

16. Sources of Influent (municipal; river mile; groundwater; process): municipal

17. Is this a first-time application for a variance or is this a renewal? First-time application

B. Effluent Characterization

18. Pollutant for which variance requested:
Total Mercury. The water quality criterion for which Clean Water Services requests a variance is the 0.040 milligram per kilogram (mg/kg) methylmercury fish tissue criterion for the protection of human health. OAR 340-041-8033(3), Table 40. This criterion is implemented, however, through discharge limits on total mercury.

No variance is sought for the total mercury water quality criteria for the protection of aquatic life (2.4 micrograms per liter (µg/L) acute; 0.012 µg/L chronic). OAR 340-041-8033(3), Table 30. The water quality evaluation conducted for the permit renewal did not show reasonable potential to exceed aquatic life-based water quality criteria.

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19. Average discharge flow rate:
The average dry weather design flow and the average wet weather design flow as specified in Clean Water Services' watershed-based NPDES permit are presented in the table below. The annual average flow represents the arithmetic average of the dry and wet season design flows.

Table 1: Annual Average Flow (MGD)

Facility	Average Dry Weather Design Flow	Average Wet Weather Design Flow	Annual Average Flow
Rock Creek AWWTF	46.4	68.4	57.4

20. Number of effluent samples analyzed and dates samples taken:
In 2005, Clean Water Services began testing for mercury using EPA method 1631 (purge and trap), which has a nominal reporting level of 0.5 ng/L. Mercury monitoring has typically been conducted as part of Clean Water Services' industrial pretreatment program, which requires the collection of 24-hour composite samples for three consecutive days once every quarter. A total of 174 samples were collected from 2005 to 2017.

21. Concentration and mass loads (annual, monthly if possible) pollutant in effluent (attach documentation):
The attached spreadsheet presents the mercury data for the Rock Creek AWWTF. The following table presents summary statistics for the concentration and mass loads of mercury.

Table 2: Rock Creek Effluent Mercury Summary Statistics

Statistic	Value
Number of Samples	174
Geometric Mean (ng/L)	1.6
Arithmetic Mean (ng/L)	1.8
Maximum (ng/L)	5.1
Standard Deviation	0.93
Coefficient of Variation	0.51
Annual Average Flow (MGD)	57.4
Mass Load (lbs/year)	0.28

22. Sources of pollutant in effluent and how pollutant is entering effluent (attach Pollutant Source Investigation Report):
Anthropogenic sources of mercury in wastewater can come from the residential, commercial or industrial sectors. In a 2002 study, the Association of Metropolitan Sewerage Agencies (AMSA now known as National Association of Clean Water Agencies (NACWA)) listed the most common sources of mercury in wastewater (AMSA, 2002).

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Table 3: Common Sources of Mercury in Wastewater (AMSA, 2002)

Commercial	Residential	Industrial
• Dental offices • Hospitals • Laboratories • Universities/schools • Medical clinics • Vehicle service facilities • Industrial activities	• Human waste (amalgam) • Human waste (dietary) • Laundry graywater • Household products • Improper disposal of mercury thermometers	• Chlorine production • Portland cement • Mining – i.e. gold mining • Caustic soda • Sulfuric acid

The AMSA study found that several common household products contributed mercury at relatively high concentration but at a relatively low mass load. The study found that the common household items accounted for about 15 percent of the influent load. The study found that human waste from dental amalgam accounted for over 80 percent of the mercury load from domestic sources to municipal treatment facilities.

Additionally, a 2008 EPA report estimated that 50 percent of the nation's mercury in wastewater comes from the dental sector (USEPA, 2008). Supporting documentation for the EPA's Proposed Effluent Limitation Guidelines and Standards for the Dental Category (released October, 2014) estimated that roughly 110,000 dental offices placed and/or removed dental amalgam in the United States. The EPA estimated that 4.4 tons of mercury waste from these dental offices is discharged to wastewater treatment facilities (WWTFs) annually (USEPA, 2014).

Mercury is also present in a variety of consumer and commercial products including batteries, compact fluorescent lights, jewelry, skin creams, paint, thermometers, switches/relays, etc. While some of these products have a low probability of reaching the sanitary sewer system in large quantities, their removal from the environment is nonetheless beneficial.

As found in national studies, the sources of mercury in wastewater in Clean Water Services' service area are expected to be primarily from commercial and residential sources specified in Table 3. There are no industrial users within Clean Water Services' service area that utilize the industrial processes specified in Table 3.

C. Technology-Based Pollutant Controls

23. If applicable, EPA's effluent limit guidelines for pollutant:
Not Applicable. (EPA issued its final Effluent Limitations Guidelines and Standards for the Dental Category on June 14, 2017, effective July 14, 2017. 82 Fed. Reg. 27,154 (June 14, 2017) (to be codified at 40 C.F.R. part 441). These guidelines and standards apply to dental facilities that may discharge into the Rock Creek AWWTF, but they do not apply to Clean Water Services or to discharges from the Rock Creek AWWTF.)

24. If applicable, type of treatment technology required by EPA's effluent guidelines for the pollutant:
Not Applicable

25. Have you installed the treatment technology referred to in No. 24?
Not Applicable

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D. Controls on Nonpoint Pollutant Sources

26. Do you have control or authority over any nonpoint sources of the pollutant that discharge to the receiving water? Yes.
Stormwater runoff from properties: Clean Water Services has a Field Operations facility, a Field Operations Storage facility and an Administrative Building Complex in the Tualatin River watershed. Additionally, Clean Water Services owns properties in the rural areas of the Tualatin River watershed.

27. If you have control or authority over nonpoint sources of pollutant, what actions have you taken to reduce the levels of the pollutant in your effluent and from the receiving water body from these nonpoint sources?
Clean Water Services has employed a number of best management practices to improve stormwater quality and reduce the pollutant load from its nonpoint source facilities. At its Field Operations facility, Clean Water Services installed low impact development approaches such as a green roof and pervious pavement, and green infrastructure such as bioswales. The Field Operations Storage Facility currently under construction includes a series of planter boxes to capture, treat and infiltrate runoff from impervious areas and bioswales that can be used to evaluate BMP design in addition to the water quality facilities required by the current design and construction standards. At its Administrative Building Complex, Clean Water Services harvests rainwater and installed infiltration ponds and bioswales.

Clean Water Services has restored riparian vegetation and instituted other management practices to prevent/reduce runoff and soil erosion at its properties in agricultural areas of the Tualatin River watershed.

Additionally, Clean Water Services has taken actions to reduce pollution from other nonpoint sources in the Tualatin River watershed. Clean Water Services has conducted riparian planting and stream restoration activities in urban and agricultural areas of the Tualatin River watershed as part of its water quality trading program. Clean Water Services partners with cities, Washington County, Metro, Tualatin Hills Parks and Recreation District and other entities to conduct large-scale restoration activities on public lands. In agricultural areas, Clean Water Services partners with the Tualatin Soil and Water Conservation District (SWCD) in coordination with Natural Resources Conservation Service (NRCS) and Farm Service Agency (FSA) for Washington County to provide incentive programs that enroll agricultural lands in its water quality trading program. From 2004 to 2016, Clean Water Services implemented 122 riparian shade projects which resulted in the restoration of over 57 stream miles of riparian vegetation in urban and rural areas of the Tualatin River watershed. The riparian planting and stream restoration activities provide a number of benefits including improved stream functions (e.g., floodplain roughness, bank stabilization, reduced erosion, peak flow attenuation, habitat creation), filtering of stormwater runoff and improved water quality. These actions are effective in reducing some of the most significant nonpoint sources of mercury noted in the TMDL – agricultural deposition runoff and soil erosion in agricultural and urban areas.

Clean Water Services also collaborates with the Tualatin SWCD, NRCS, FSA, Oregon Watershed Enhancement Board and other partners to provide complementary programs that maximize water quality and ecological benefits. Examples of such programs include:

- The Agricultural Water Enhancement Program (AWEP) is administered by NRCS and provides incentives for farmers in the Gales Creek and Upper Tualatin River watersheds to implement practices that reduce nonpoint source pollution (nutrients, sediment and pesticides) to surface water; increase stream flows by improving irrigation efficiency; or reduce stream temperatures by providing riparian shade. NRCS provides cost-sharing incentives via AWEP for practices such as nutrient management, drip irrigation, filter strips, no-till farming practices and tree/shrub establishment.

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- The Environmental Quality Incentive Program is administered by NRCS and provides assistance to growers and landowners who want to install measures to protect the soil, water, air and other natural resources on their working land. Conservation practices include tree planting, drip irrigation, soil moisture sensors, fish screens, pest consultants and erosion control.

- Stream flow enhancement is also achieved through Clean Water Services' Landowner Incentive Program. Landowners have the option to lease water rights to the State of Oregon for in-stream use.

28. Are there cost-effective and reasonable best management practices (BMPs) available to reduce pollutants from the permittee or from nonpoint sources under your control or authority (e.g., controlling stormwater)? Yes.
Refer to the discussion above for Clean Water Services' management practices to reduce pollutants from nonpoint sources. These management practices are effective at reducing pollutant loads from many of the source categories identified in the 2006 TMDL including air deposition runoff and soil erosion in agricultural areas.

Clean Water Services implements a Mercury Minimization Plan (MMP) to reduce mercury levels in wastewater. The MMP was approved by the Oregon Department of Environmental Quality and incorporated into Clean Water Services' watershed-based NPDES permit. The MMP includes a source control program focused on dental offices. Dental offices are required to install and maintain amalgam separators and Clean Water Services conducts annual surveys of dental offices to verify compliance. Clean Water Services also inspects all new dental offices to ensure that they meet requirements. Other key elements of the MMP include an audit of Clean Water Services' facilities; targeted outreach to schools, health care facilities and laboratories; and outreach to businesses and general public.

Clean Water Services also implements an industrial pretreatment program to control all significant industrial users that discharge to its treatment facilities. Clean Water Services estimated that the overall mercury contribution from industrial users is minimal (less than a 1 percent reduction by limiting industrial discharges to domestic levels). This estimate, however, is based on older mercury data that did not use low-level analytical methods. As part of the MMP, Clean Water Services is conducting additional monitoring of its industrial users using low-level analytical methods to better characterize mercury levels. Initial results indicate that the mercury levels from industrial users are significantly below earlier estimates. Once the monitoring program is complete, Clean Water Services will evaluate results and determine whether additional controls are necessary.

The table below summarizes Clean Water Services' strategies for controlling mercury in wastewater.

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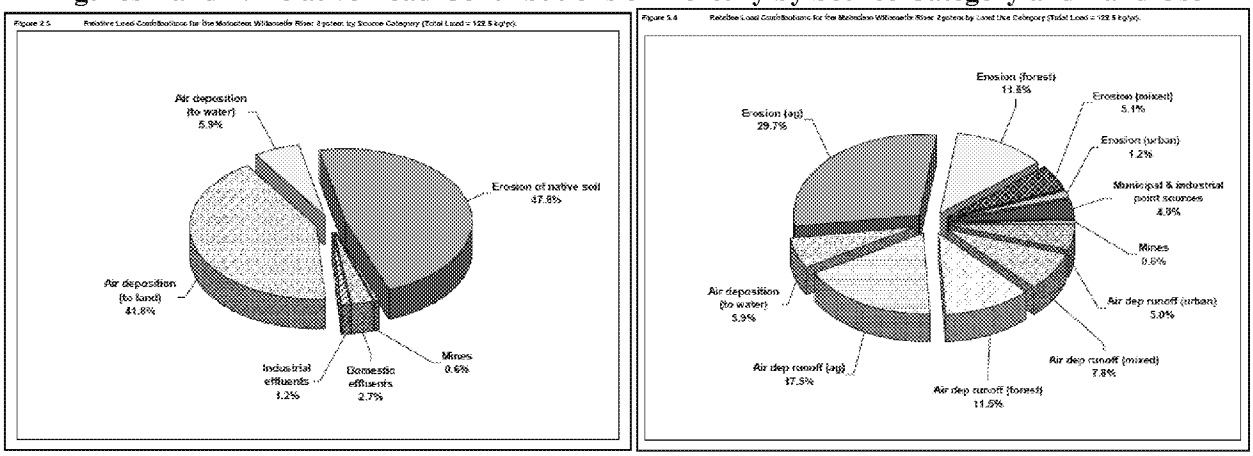
Table 4: Strategies for Controlling Mercury in Wastewater

Sector	Activity	Timeline
Industry	Pretreatment Program (identify, permit, monitor, and inspect SIUs, develop local limits)	On-going
	Conduct one-time monitoring of all current SIUs (low-level mercury)	Year 1 and 2 of Next Permit Cycle (Est. 2016 - 2018)
Dental	Survey all dental facilities (existing and new facilities)	On-going
	Identify and inspect all new dental facilities	On-going
CWS Facilities	Recycle mercury-containing equipment	On-going
	Conduct inventory of CWS facilities, replacing mercury-containing equipment and chemicals	Next Permit Cycle (Est. 2016 - 2021)
	Review and identify opportunities for mercury reduction	Next Permit Cycle (Est. 2016 - 2021)
Schools	Implement targeted outreach program	Next Permit Cycle (Est. 2016 - 2021)
Healthcare	Implement targeted outreach program	Next Permit Cycle (Est. 2016 - 2021)
	Partner with nonprofit healthcare groups	Next Permit Cycle (Est. 2016 - 2021)
Laboratories	Implement targeted outreach program	Next Permit Cycle (Est. 2016 - 2021)
Commercial and Residential	Promote auto switch recycling through the EcoBiz Program	On-going
	Distribute educational mercury brochures	On-going
	CWS website, mercury information, links	On-going
	Promote household hazardous waste collection events	Next Permit Cycle (Est. 2016 - 2021)
	Promote certification and product stewardship programs	Next Permit Cycle (Est. 2016 - 2021)

The effectiveness of these actions in reducing mercury levels to Clean Water Services' treatment facilities is discussed in the response to question 40.

29. What improvements in water quality could be achieved by implementing these BMPs? (May find information in TMDL or TMDL implementation plan; or in MS-4 permit.)
The 2006 TMDL identified the relative load contributions of mercury by source category. The 2006 TMDL estimated that more than 95 percent of the mercury contributions in the Willamette River Basin are from air deposition and soil erosion; the TMDL estimated that 2.7 percent of the mercury load is from municipal treatment facilities.

Figures 1 and 2: Relative Load Contributions of Mercury by Source Category and Land Use



The 2006 TMDL also estimated the relative contribution of mercury by land use category. The TMDL estimated that air deposition runoff and erosion in agricultural areas account for 47.2 percent of the mercury load; air deposition runoff and erosion in urban areas account for 6.2 percent of the mercury load. Thus, controlling nonpoint source contributions is essential to reducing mercury loading in the Willamette River Basin. As described above, Clean Water Services implements a broad set of management practices to reduce mercury loading into its treatment facilities and from nonpoint sources in the Tualatin Basin. These actions specifically target many of the source categories identified in the 2006 TMDL including air deposition runoff and soil erosion in agricultural areas. These management practices reduce mercury loading from point and nonpoint sources and result in a proportional reduction in mercury loading. However, the water quality improvements from these actions have not been quantified.

E. Potential Impact of Variance on Threatened or Endangered Species

30. If an aquatic life criterion is at issue, are you aware if the receiving water provides habitat or feeds into a water body identified as critical habitat for any threatened or endangered species?
Not Applicable

F. Potential Risk to Human Health from Variance

31. Degree to which level of pollutant in effluent exceeds criterion:
The 2006 TMDL utilized a fish tissue methylmercury concentration of 0.3 mg/kg to establish an ambient total mercury water column guidance value; the 0.3 mg/kg fish tissue concentration was based on fish consumption advisories issued by the Oregon Department of Human Services. The 2006 TMDL discussed the uncertainties and limitations for developing a target ambient water column concentration and noted "the limitations have the potential to influence the estimates of the loading of mercury in the Willamette system, the sector-specific source contributions, the water column guidance values, as well as the estimated reductions necessary to restore the beneficial use of fish consumption." For this reason, DEQ developed *interim* water column guidance values and sector-specific allocations based on the information available at that time. The 2006 TMDL also stated that the "preliminary sector-specific allocations will not be translated into numeric water quality based effluent limits for individual point sources at this time. The interim targets and allocations will be used to define the extent of the problem and to identify the level of effort needed to address the bioaccumulation of mercury in fish."

DEQ has since updated its water quality criteria for mercury; the current water quality criteria is 0.04 mg/kg and is expressed as a fish tissue concentration of methyl mercury. The ambient total mercury concentration needed to achieve the methyl mercury fish tissue criteria has not been determined; this step is necessary to establish a water quality criteria for use in NPDES permits.

The 2006 TMDL applied an extensive process-based probabilistic model to estimate distributions of fish tissue concentrations for various trophic levels and fish species at differing ambient concentrations. DEQ has not determined a bioconcentration factor to estimate the dissolved methyl mercury concentration consistent with achieving the new fish tissue criteria. DEQ has not determined a translator that would convert the estimated dissolved methyl mercury to total mercury under conditions that are anticipated to be consistent with the new standard needed to determine a total mercury target for the new fish tissue criteria for the Willamette River Basin. It is therefore currently infeasible to derive a water quality-based effluent limit based on the new fish tissue criteria.

Nonetheless, the 2006 TMDL provides information that may be used to provide an approximation of the potential range of target total mercury water column concentrations consistent with the methyl mercury fish tissue criterion. The 2006 TMDL presented the resulting ambient water column target levels as central tendencies using median concentrations assuming a constant translator (Ω) as the ratio of the dissolved methyl mercury and total mercury. The 2006 TMDL includes an equation for deriving the target ambient water column concentration of total mercury.

{TMDL Equation 12: $TL_n = \left[\frac{TC}{BMF_{MEn}\ \Omega}\right] CF$}

Where:

TL_n is the total mercury target level for the nth fish species (ng/L)
TC is the fish tissue criterion for methyl mercury (0.30 mg/kg)
BMF_{MEn} methyl mercury biomagnification factor for the nth fish species (L/kg)
Ω is ratio of dissolved methyl mercury and total mercury in surface waters (unitless)
CF is the Conversion factor (1×10^6 ng/mg)

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This equation can be used to calculate the bioconcentration factor (BMF_{MEn}). The TMDL provides information that can be used to calculate a BMF_{MEn} at current conditions and the modeled TMDL condition. The current condition would be the observed ambient (e.g. 1.25 ng/L total Hg) and fish tissue concentrations. The TMDL conditions are the target ambient water column concentration of total mercury (0.92 ng/L) that would be protective of the 0.3 mg/kg fish tissue concentration. The TMDL provides different BCF_{MEn} for the current and TMDL conditions.

The most straightforward estimate of a target total mercury water column concentration using equation 12 is to vary only the new criteria (TC) and hold all other factors constant. Using the derived biomagnification factor from the 2006 TMDL and assuming a constant Ω value results in an estimated ambient water column target of 0.12 ng/L of total mercury that would be consistent with the 0.04 mg/kg methyl mercury fish tissue criterion. However, as noted above, the TMDL Equation 12 derives different BMF_{MEn} as estimated ambient conditions and associated fish tissue concentrations change. It is not feasible to reasonably estimate the BMF_{MEn} with the current data, which makes any estimate of an ambient total mercury target consistent with the 0.04 mg/kg methyl mercury fish tissue criterion uncertain. The modeling to support the TMDL update may substantially change the estimated ambient water column target of total mercury. The TMDL may also review and update assumptions used in the model or allocation process. However, it is likely that any targeted level of total mercury will be below the current 0.92 ng/L target expressed in the 2006 TMDL, which is below what is achievable by existing treatment technology at Clean Water Services' treatment facilities. The geometric mean effluent total mercury concentration at Clean Water Services' Rock Creek facility is 1.6 ng/L. DEQ is proposing to update the biomagnification modelling and estimates for Ω as part of the commitment to updating the TMDL over the next two years. It is infeasible to update the model prior to the DEQ effort.

32. Describe (quantitatively, if possible) facility's relative contribution to the pollution load of water body:
The 2006 TMDL estimated that municipal point sources contributed 2.7 percent of the mercury load; the relative contribution of mercury from Clean Water Services' four treatment facilities combined was estimated to be about 1 percent of the total annual load in the 2006 TMDL. This estimate was based on an assumed effluent mercury concentration of 10 ng/L. The 2006 TMDL noted the need for better data to estimate mercury loadings.

The effluent concentration of mercury at the Rock Creek AWWTF is 1.6 ng/L as a geometric mean (Table 2) – much lower than the 10 ng/L effluent concentration used in the 2006 TMDL. The effluent mercury concentrations at the other three Clean Water Services' facilities are also much lower than the concentration used in the 2006 TMDL. Based on the actual effluent quality, an updated estimate of the mercury load from Clean Water Services' four wastewater treatment facilities is less than 0.2 percent of the load identified in the 2006 TMDL.

33. Proximity of drinking water intakes to point of discharge:
No drinking water intakes are near or downstream of the discharge from the Rock Creek AWWTF. Moreover, the criterion for which a variance is sought is a fish tissue criterion, not a criterion intended to protect human health from consuming water.

34. List any tributaries or streams between point of discharge and drinking water intakes:
Not Applicable

35. Are there sites known to be used for fishing near the point of discharge? If so, where?
There are no sites known to be used for fishing near the point of discharge from the Rock Creek AWWTF. Additionally, the Rock Creek AWWTF effluent mercury concentrations are similar to levels in

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the Tualatin River above the Rock Creek AWWTF. Thus, the discharge from the Rock Creek AWWTF does not result in elevated mercury concentrations near the discharge location. Attachment A, Figure 6 illustrates this point as the mercury concentrations in the Tualatin River above and below the Rock Creek AWWTF are nearly identical.

Oregon Department of Fish and Wildlife (ODFW) published its latest fishing guide for the Willamette River Basin in 2015. This guide provides general information on fishing locations and species in the Basin. The District Fish Biologist for ODFW reports that the primary fisheries of concern in the Willamette River below the falls and downstream to the Columbia are spring chinook, coho, sturgeon, shad and summer and winter steelhead. ODFW also notes that there is a popular warm-water fishery for smallmouth and largemouth bass in the Willamette, but no formal monitoring study has been used to assess the fishery. Several Native American tribes also harvest lamprey annually in late June and July at the falls, but the harvest numbers are not accurately reflected. There are some seasonal warm-water fisheries and limited native cutthroat trout fishing in the Tualatin River and its tributaries.

According to ODFW, the Tualatin River and its tributaries provide excellent angling opportunity for native cutthroat trout, both in the mainstem and many of its larger tributary streams including Dairy, Gales and Scoggins Creeks. Trout angling is open all year with harvest of two trout, greater than 8 inches, allowed from May 23 through October 31. These areas are located upstream of the discharge from Clean Water Services' facilities. Warm-water fish, including smallmouth and largemouth bass and bluegill provide good fishing opportunity in late spring and summer in mainstem reaches. Access points exist at major bridge crossings and some riverside parks.

G. Potential Impacts on Existing Uses

36. If the variance is being sought for an aquatic life pollutant, please indicate to the best of your knowledge whether the following use has occurred within the waterbody. If it has occurred, please describe the type of information you are relying upon to draw these conclusions (anecdotal, field study, personal observation, other). Cite data source.
☐ Fish and aquatic life
Not applicable. The criterion for which a variance is sought is a human health criterion.

37. If the variance is being sought for a human health pollutant, please indicate to the best of your knowledge whether any of the following uses have occurred within the waterbody. If so, please describe the type of information you are relying upon to draw these conclusions (anecdotal, public records, survey, personal observation, other). Cite data source.
☐ Private or public domestic water supply ☐ Fishing ☐ Water contact recreation.
The Tualatin River downstream of the Rock Creek AWWTF is not used as a private or public domestic supply. Moreover, the criterion for which a variance is sought is a fish tissue criterion, not a criterion intended to protect human health from consuming water.

See discussion above regarding fisheries in the Tualatin River Basin.

Water-contact recreation such as kayaking and canoeing is a popular activity in the lower Tualatin River. The following figure from the Tualatin Riverkeepers website shows the access areas, hazards and support facilities in the lower Tualatin River. Again, however, the criterion for which a variance is sought is a fish tissue criterion; it is not intended to protect water contact recreation.

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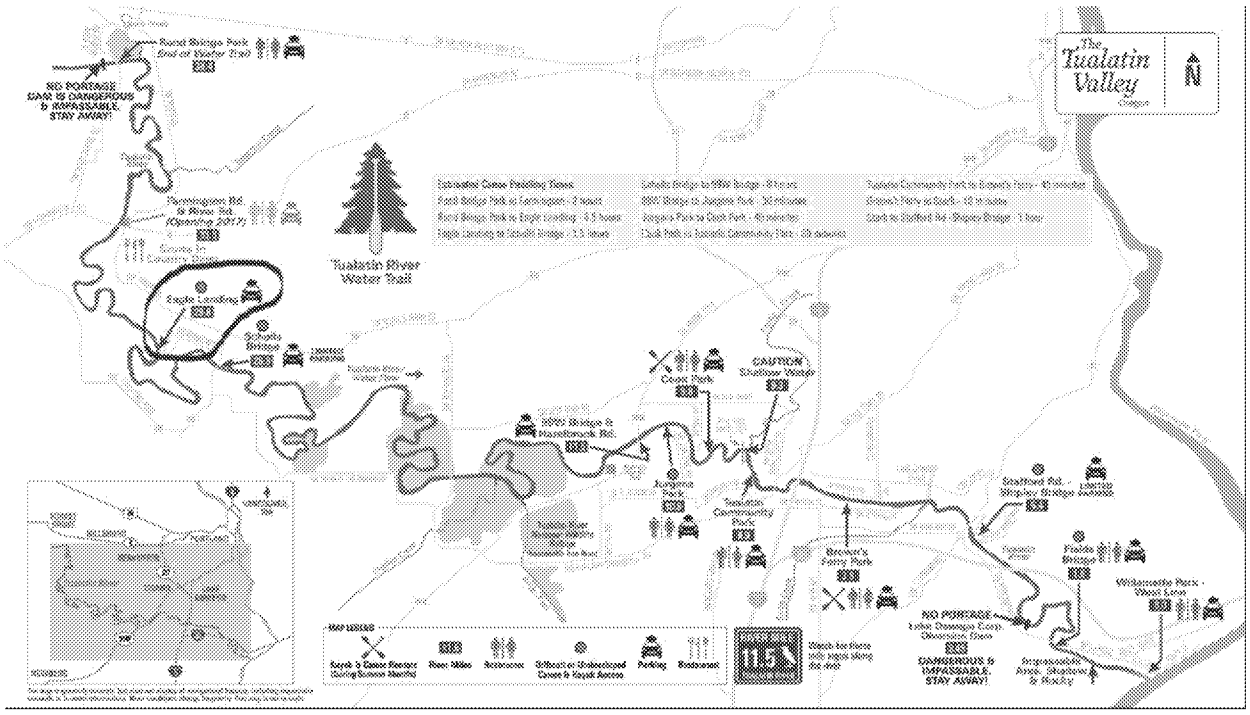
Figure 3: Kayaking and Canoeing in Tualatin River (from Tualatin Riverkeepers)



H. Reason for Variance

38. Please indicate which of the factors below makes a variance for this pollutant necessary (more than one may apply). For each factor indicated, please fill out the applicable attachment.

x A. Naturally occurring pollutant concentrations prevent attainment of the criterion. (See Attachment A)

__ B. Flow conditions or water levels prevent attainment of the criterion. (See Attachment B)

x C. Human-caused conditions or pollutions sources prevent attainment of the criterion and cannot be remedied. (See Attachment C)

__ D. Hydrologic modifications prevent attainment of the criterion. (See Attachment D)

__ E. Natural features of the water body preclude attainment of aquatic life protection uses. (See Attachment E)

__ F. Controls more stringent than technology-based controls will result in substantial and widespread economic and social impact. (See Attachment F)

The basis for the requested variance are factors A (naturally occurring pollutant concentrations) and C (human-caused conditions or pollution sources).

I. Evaluation of Alternatives Considered to Meet Calculated Water Quality-Based Effluent Limit

39. List alternatives considered to meet WQBEL (e.g. substituting process materials; pollutant offsets or trading; various treatment options; addressing inflow/infiltration issues, BMPs):
The following alternatives were considered to meet a water quality-based effluent limit for mercury: Source Control, Alternative Treatment Technologies, Internal Controls and Water Quality Trading. Each of these alternatives is discussed below.

Source Control: As discussed in the response to 28 above, Clean Water Services implements a MMP that includes a source control program focused on dental offices. Dental offices are required to install and maintain amalgam separators. Clean Water Services conducts annual surveys of dental offices to verify compliance and Clean Water Services also inspects all new dental offices to ensure that they meet requirements. Other key elements of the MMP include an audit of Clean Water Services' facilities; targeted outreach to schools, health care facilities and laboratories; and outreach to businesses and general public.

Clean Water Services' industrial pretreatment program regulates all significant industrial users, which include categorical industrial users that are subject to technology-based pretreatment standards as defined in 40 CFR 403. The industrial pretreatment program consists of identifying, permitting and monitoring significant industrial users that discharge to the sanitary sewer system. Clean Water Services has developed local limits to protect worker health and safety, ensure industrial discharges do not interfere with the biological processes at its WWTFs, allow for beneficial use of biosolids and protect water quality in the Tualatin River. Local limits have been developed for several pollutants, including mercury.

Clean Water Services implements technology-based pretreatment standards as well as local limits through pretreatment permits that are issued to all significant industrial users in the service area. The pretreatment permits require industrial users to periodically monitor their wastewater and report results. Clean Water Services also implements its own, independent monitoring program to characterize industrial discharges. This independent monitoring has included mercury. Based on this monitoring, Clean Water Services estimated the overall mercury contribution from significant industrial users is minimal (about 1 percent of the total mercury load to the WWTFs). As part of the MMP, Clean Water Services is conducting additional monitoring of its industrial users using low-level analytical methods to better characterize mercury levels. Data from this effort will be used to determine whether additional controls are necessary.

DEQ's methyl mercury criteria implementation document specifies the following industrial processes use or generate mercury:

- Chlorine production (Chlor-alkali)
- Portland cement
- Mining – i.e., gold mining
- Caustic soda production
- Sulfuric acid production
- Emissions treatment (wet-pack scrubbers)
- Municipal waste combustors
- Hospital, medical and infectious waste incinerators

There are no industrial users within Clean Water Services' service area that utilize the industrial processes noted above.

Alternative Treatment Technologies: Clean Water Services reviewed the treatment technology effectiveness evaluation conducted by Ohio and Michigan. Clean Water Services also evaluated the following treatment technologies to determine their feasibility in meeting a water quality-based effluent limit for mercury: precipitation, adsorption (granular activated carbon (GAC) and thiol-based), and membrane filtration (microfiltration, ultrafiltration and reverse osmosis (RO)).

Internal Controls: Clean Water Services conducts internal audits of its facilities as part of the MMP. The audit focuses on replacing equipment and chemicals that contain mercury and identifying additional

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opportunities for reducing mercury. As part of the MMP, Clean Water Services has completed an audit of its facilities and will be documenting the results of the audit.

Water Quality Trading: As described above, Clean Water Services implements a broad set of management practices to reduce mercury loading from nonpoint sources. These actions address many of the source categories identified in the 2006 TMDL including air deposition runoff and soil erosion in agricultural areas. Clean Water Services is not proposing a water quality trading program because DEQ rules prohibit the use of water quality trading for toxic pollutants (OAR 340-039-0015). DEQ's rules allow for a water quality trading program as part of a variance. However, the development of a water quality trading program requires a basin-scale assessment of sources of mercury and strategies to control them. Clean Water Services will evaluate whether water quality trading is a viable option for mercury once DEQ updates the mercury TMDL for the Willamette Basin and establishes a framework for water quality trading.

40. For each alternative considered, explain why it is not technically, financially or otherwise feasible to implement that alternative to meet a WQBEL:

Source Control

Source control has been an effective strategy in reducing mercury levels to Clean Water Services' treatment facilities. Influent mercury concentrations at Clean Water Services' treatment facilities have decreased significantly; Figure 4 displays mercury data from 1993 to 2017; the dashed lines represent values below the reporting level. The reduction in mercury levels to the treatment facilities is more evident in the mercury concentrations in biosolids, which show a significant decline during this time period (Figure 5).

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Figure 4: Influent Mercury Concentration at the Rock Creek AWWTF

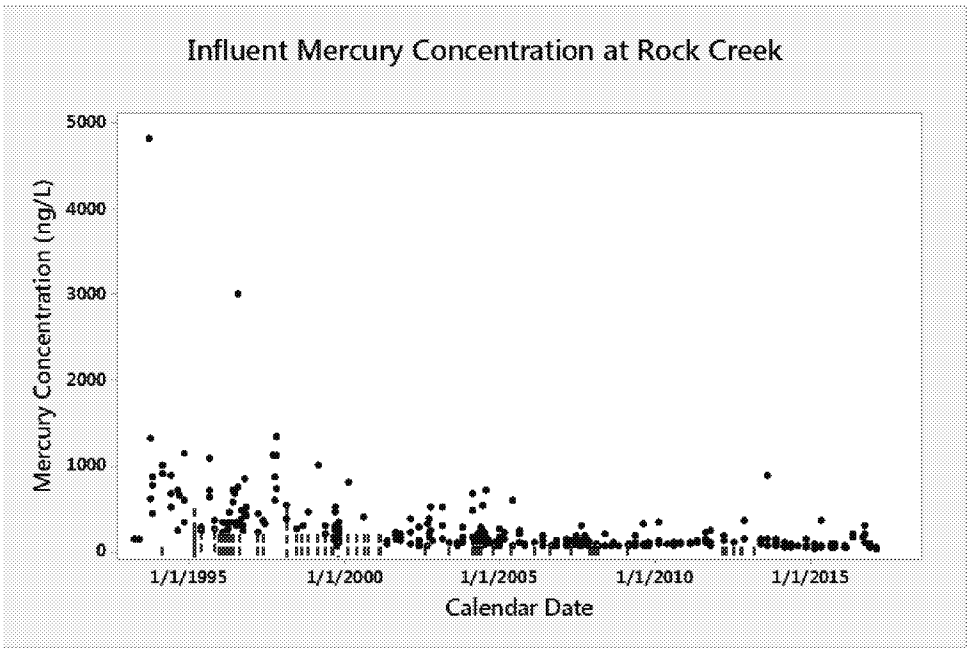
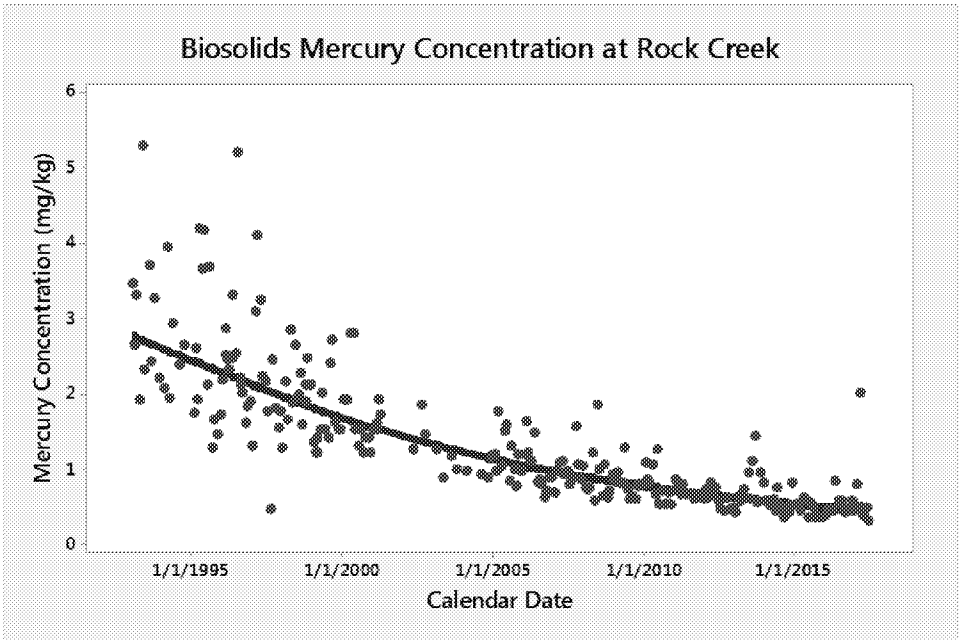


Figure 5: Biosolids Mercury Concentration at the Rock Creek AWWTF



The MMP specifies the actions that Clean Water Services will continue to take to reduce mercury levels. However, additional substantive reductions in mercury levels are unlikely due to the significant reductions already achieved and the remaining sources of mercury being diffuse. Note also that the treatment facilities are not as effective in removing mercury at lower influent concentrations. Even though influent mercury concentrations have continued to decline over the last several years, effluent trends have been much more subtle. As such, additional source control activities are unlikely to substantively reduce effluent mercury levels to meet a water quality-based effluent limit.

Alternative Treatment Technologies

The Ohio EPA published a review of treatment technology effectiveness and costs for mercury treatment as part of an assessment of economic impact (Assessing the Economic Impacts of the Proposed Ohio EPA Water Rules on the Ohio Economy, April 24, 1997)[1]. Several states, including Michigan, have relied on this assessment. Michigan notes in its variance procedures that its review of available information regarding end-of-pipe treatment for mercury, including the effectiveness of the treatment and associated costs, focused on information contained in Ohio's 1997 assessment. Michigan noted that the Ohio analysis is applicable to other states since the analysis is treatment-specific, not state-specific, when concluding that end-of-pipe controls to meet the mercury water quality standard of 1.3 ng/L would cause substantial and widespread economic impact without guaranteeing removal sufficient to achieve the mercury standard.

Ohio evaluated biological processes, including activated sludge and chemical precipitation, and found that these methods would not guarantee achievement of the end-of-the-pipe mercury targets of 1.3 ng/L. Ohio also reviewed ion exchange, which chemically captures the mercury in the water on the surface of a specially-engineered resin as the water flows across it, and reverse osmosis, a form of membrane filtration where the mercury is concentrated in a brine waste stream using pressure and concentration gradients and a system of permeable membranes. Ohio noted in the 1997 assessment that the ability of these systems to achieve the 1.3 ng/L total mercury target was not known. The estimated annual cost of each system in 1997 dollars was between $10 million and $100 million per pound of mercury removed[1].

Clean Water Services completed an updated literature review to evaluate the performance of various treatment strategies to achieve target mercury levels. The table below summarizes the performance, application scale (pilot or full scale) and cost of the treatment technologies.

Table 5: Performance, Scale and Costs of Treatment Technologies

Technology	**Influent Hg (ng/L)**	**Effluent Hg (ng/L)**	**Scale**	**$/gpd (5 MGD facility/ 25 MGD facility)**
Precipitation				
Chelator[2]	9,600,000	35	full	
Adsorption				23-50/17-35[4]
GAC[2,3]	44,000	300	full	(microfiltration/ GAC)
	767 ± 571	~60-340	pilot	
Thiol-based[3]	767 ± 571	~20-100	pilot	
Rock Creek AWWTF Activated sludge w/nutrient removal + filtration	78.4 (long term geometric mean)	1.6 (long term geometric mean)	full	existing treatment technology; no additional incremental cost

Clean Water Services' literature review did not identify pilot or full-scale systems that would be able to achieve the current TMDL target of 0.92 ng/L or the potential levels needed to achieve limits in the range of 0.012 ng/l. Overall, the lack of full-scale installations consistently producing effluent mercury concentrations in the low ng/L range makes it difficult to predict whether it is physically possible to achieve mercury concentrations below 1 ng/L on a long-term, large-scale basis.

Bench-scale testing suggests that membrane filtration technologies could potentially achieve target effluent mercury levels in the range of the current TMDL target of 0.92 ng/L[5]. The incremental costs ($10-22 per gallon) of implementing these technologies are significant[4]. There is no indication that the implementation of these technologies would achieve a total mercury target consistent with the new fish tissue criteria of 0.04 mg/kg.

In addition to the significant incremental costs, implementation of membrane filtration technologies have a substantial carbon footprint. According to a life cycle assessment performed for the Berlin-Ruhleben secondary wastewater treatment plant (63 MGD), the operational energy use of polymer ultrafiltration or ceramic microfiltration membranes would be 0.33 Watt * hour/gal. The global warming potential of operating these membranes was estimated to be about 3.0 kg CO_2-eq/capita-year. This would represent approximately a 9 percent increase in that plant's existing global warming potential and does not include the additional global warming potential that would be contributed by infrastructure, chemicals for maintenance and any necessary coagulants[6]. Of the different types of membrane filtration, reverse osmosis also has the large disadvantage of necessitating disposal of the concentrate stream, which can amount to approximately 5 to 20 percent of the influent.

It is also important to note that the current treatment technology at the Clean Water Services Rock Creek AWWTF, which consists of an activated sludge biological treatment system with filtration, is very effective at removing mercury. The average mercury removal efficiency at the Rock Creek AWWTF is approximately 98 percent and the geometric mean effluent concentration is 1.6 ng/L.

Thus, Clean Water Services believes it is not feasible to install alternative treatment technologies for the following reasons:

- There is little or no evidence that adding alternative treatment systems to the existing treatment system would provide substantial further reduction in effluent concentrations, much less meet the likely discharge limit needed to meet the 0.040 mg/kg fish tissue criterion;
- The existing treatment system provides results comparable to or better than the alternative full-scale or pilot-scale treatment technologies, particularly given the low influent concentrations that have resulted from CWS's source control efforts;
- Any resulting reduction in the facility's mercury discharges would have no significant effect on the mercury concentration in the river; and
- Adding alternative treatment systems to the existing advanced treatment system would be prohibitively expensive and have substantial adverse environmental effects through increasing the facility's air emissions (including greenhouse gases), solid waste generation and energy use.

Internal Controls

Clean Water Services is completing an internal audit of its treatment facilities and its laboratory to identify opportunities to reduce mercury. Clean Water Services believes the audit will be effective in preventing unintentional releases of mercury but is not expected to affect overall effluent quality.

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41. If permittee is a POTW, describe legal authority to control potential sources of the pollutant that discharge into wastewater treatment facility:
Ordinance 27 prescribes the Rules and Regulations governing the use and operation of the Sanitary Sewerage System and the Storm and Surface Water Management System ([HYPERLINK "http://www.cleanwaterservices.org/for-business-industry/pretreatment/ordinance-27/"]). This ordinance regulates the discharge of water, wastewater and pollutants to Clean Water Services' treatment facilities and requires permits for use of these systems. This ordinance provides Clean Water Services the necessary authority to control potential sources of pollutants to its treatment facilities. As described above, Clean Water Services has effectively used this authority to reduce mercury influent concentrations to its treatment facilities.

J. Pollutant Reduction Plan

42. Identify actions you propose to take that will result in reasonable progress toward meeting the underlying water quality, including milestones and schedule. Please refer to Section 3.5 Pollutant Reduction Plan of DEQ's Internal Management Directive entitled "Implementing Water Quality Standards Variances for NPDES Permittees" for minimum required elements and other important information. Attach the Plan to this application.
Clean Water Services' MMP specifies the actions that will be taken to reduce mercury loading. The MMP was approved by DEQ and incorporated into Clean Water Services' watershed-based NPDES permit. A summary of the actions and the timeframe for implementation are presented in Table 4 above.

K. For renewals only: Actions taken under Pollution Reduction Plans

43. Describe actions taken under Pollutant Reduction Plan submitted with original variance application. Attach annual progress reports if not already provided to DEQ. If applicable, explain why any annual milestones were not met or why any required actions were not taken.
Not Applicable

44. Describe impact(s) of actions with respect to achieving underlying water quality standard. Provide documentation where possible.
Not Applicable

L. Additional Information or Comments

None

M. Signature

William Gaffi General Manager	Title

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VARIANCE APPLICATION ATTACHMENT A – REASON FOR VARIANCE NATURALLY OCCURING POLLUTANTS

If you indicated in Section H of the Variance Application that you are requesting a variance because naturally occurring pollutant concentrations prevent attainment of the criterion (Reason A), please fill in the information requested below. This variance condition exists where natural background concentrations of a pollutant, such as a naturally occurring earth metal, already exceeds or contributes to exceedance of a water quality criterion.

1. For what pollutant is the variance requested?
Mercury. The water quality criterion for which Clean Water Services requests a variance is the 0.040 milligram per kilogram (mg/kg) methylmercury fish tissue criterion for the protection of human health. OAR 340-041-8033(3), Table 40. This criterion is implemented, however, through discharge limits on total mercury. No variance is sought for the total mercury water quality criteria for the protection of aquatic life (2.4 micrograms per liter (µg/L) acute; 0.012 µg/L chronic). OAR 340-041-8033(3), Table 30.

2. Please describe upstream ambient data sufficient to adequately characterize pollutant concentrations:
Clean Water Services conducts a comprehensive, watershed-based monitoring program that includes in-stream water quality monitoring using discrete samples and continuous recording devices, stream flow monitoring, macroinvertebrate monitoring and physical conditions monitoring. The ambient water quality monitoring program consists of monitoring for field parameters (temperature, dissolved oxygen, pH, turbidity and specific conductance), major ions, nutrients, total organic carbon, solids and metals. Clean Water Services currently monitors more than 25 locations in the Tualatin River and its tributaries.

Figure 6 presents mercury data from 2005 to 2017 at several locations on the Tualatin River above and below Clean Water Services' treatment facilities. The location of Clean Water Services' treatment facilities is also noted in the chart (RC represents the Rock Creek AWWTF).

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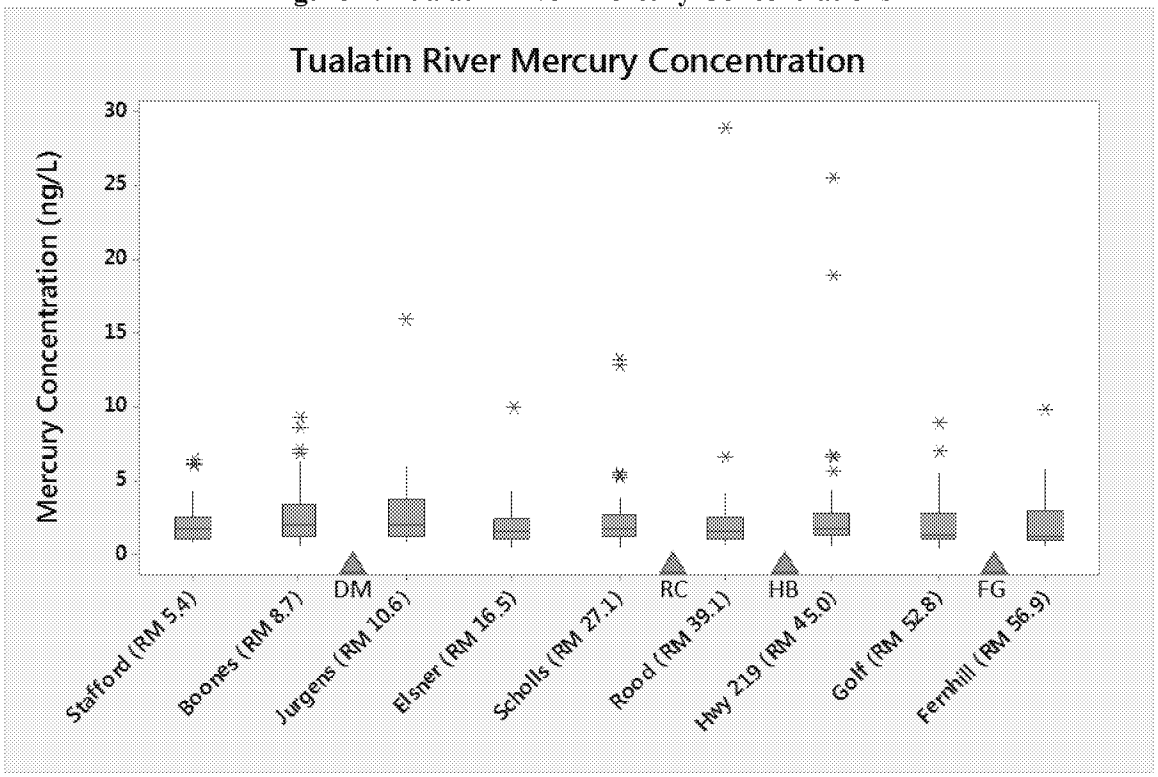
Figure 6: Tualatin River Mercury Concentrations



For each of the monitoring locations in the chart above, the following table presents the site description, number of samples and summary statistics.

Table 6: Tualatin River Mercury Concentrations (ng/L)

Site Name	Site Description	N	Mean	Geometric Mean	Standard Deviation	Median	Maximum
Stafford (RM 5.4)	Tualatin River at Stafford Rd	44	2.11	1.77	1.42	1.75	6.42
Boones (RM 8.7)	Tualatin River at Boones Ferry Rd	54	2.64	2.05	2.05	1.98	9.20
Jurgens (RM 10.6)	Tualatin River at Jurgens Park	18	3.06	2.12	3.52	1.96	15.80
Elsner (RM 16.5)	Tualatin River at Elsner Rd Bridge	32	1.97	1.58	1.72	1.60	9.90
Scholls (RM 27.1)	Tualatin River at Hwy 210 Bridge (Scholls)	53	2.39	1.83	2.40	1.69	13.10
Rood (RM 39.1)	Tualatin River at Rood Bridge Rd	47	2.41	1.73	4.08	1.60	28.90
Hwy 219 (RM 45.0)	Tualatin River at Hwy 219 Bridge	60	2.78	1.96	3.89	1.72	25.40
Golf (RM 52.8)	Tualatin River at Golf Course Rd	43	2.17	1.67	1.80	1.33	8.85
Fernhill (RM 56.9)*	Tualatin River at Fernhill Rd	25	2.09	1.54	2.04	1.09	9.69

*The Fernhill site includes data collected from an alternate sample location: Tualatin River at the Joint Water Commission Water Plant

The ambient mercury concentrations are essentially unchanged above and below treatment facilities. The ambient mercury concentration above the Rock Creek AWWTF is 1.73 ng/L as a geometric mean at the Tualatin River at Rood Bridge Road monitoring location; below the Rock Creek AWWTF, the ambient mercury concentration is 1.83 ng/L as a geometric mean at Tualatin River at Hwy 210 Bridge (Scholls). The ambient mercury levels are also very similar at the ambient monitoring location farthest upstream above the Forest Grove WWTF (Tualatin River at Fernhill Road) and the location farthest downstream below Durham AWTF (Tualatin River at Stafford). The geometric mean of ambient mercury levels at the Tualatin River at Fernhill Road monitoring location is 1.54 ng/L compared to 1.77 ng/L at Tualatin River at Stafford.

The 2006 TMDL focused substantial effort on characterizing mercury concentrations in the mainstem Willamette River. The Tualatin River enters the Willamette River at River Mile 28 just upstream of Willamette Falls. Appendix B, Table 2 of the 2006 TMDL presents the observed total mercury concentrations and estimated flow by mainstem river mile. Table 7 presents the geometric mean values for the adjusted observed total mercury concentrations in the lower Willamette River; these values are similar to the total mercury concentrations observed in the Tualatin (Table 6).

Table 7: Total Mercury Concentrations in the Willamette River

Willamette River (River Mile)	Total Mercury (adjusted geometric mean), ng/L
6.8	1.85
7.0	1.52
17.9	1.78
38.8	2.11
50.1	1.65

3. Please identify the source or sources of the pollutant within the water body. Also describe the data and basis for the conclusion that naturally occurring pollutant concentrations preclude attainment of the criterion. Such information may include, but is not limited to: soil composition data, groundwater data, USGS analyses/reports, comparison to data collected from headwater streams, and analyses done by other states with an explanation of why they are relevant in this case. If possible, there should be some analysis of how much of the pollutant in the stream occurs naturally and how much is a result of NPDES-permitted sources.
See discussion above regarding ambient mercury concentrations in the Tualatin River.

The 2006 TMDL identified the relative load contributions of mercury by source category (See Figures 1 and 2 above). Erosion of native soil accounts for 47.8 percent of the mercury load and air deposition runoff accounts for 47.7 percent of the mercury load to the Willamette River Basin. The 2006 TMDL also noted that the majority (82.9 percent) of air-deposited mercury is estimated to come from global sources.

The 2006 TMDL acknowledged the difficulty in separating out the relative contributions of natural and human-caused contributions to the mercury mass balance. The TMDL attempted to differentiate between non-anthropogenic (natural, background) and anthropogenic sources of mercury, to the extent possible. The TMDL noted that each of the categories considered in the mercury source characterization analysis may include mercury originating from natural sources, although the precise quantification of this background component can be constrained by a paucity of literature values and site-specific information from the Willamette Basin. Mercury loading attributable to the erosion of native soils from agricultural and forested land is based entirely on the concentration of mercury naturally present in native soils. However, erosion of native soil from undisturbed areas (attributed to natural sedimentation or the sloughing of stream banks) was not quantified as available data suggest it represents only a small percentage of total native soil erosion in the Basin.

With regard to atmospheric deposition, an attempt was made to differentiate between contributions from local (largely anthropogenic point, area and mobile) sources within the Basin and those from global sources (a mix of natural and anthropogenic mercury emissions) from beyond the Basin. The analysis does not account for the volatilization (or recycling) of the mercury present in native soil or that which is deposited from the atmosphere.

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The 2006 TMDL estimated that more than 95 percent of the mercury contributions in the Willamette River Basin are from nonpoint sources (air deposition runoff and erosion of native soil); the TMDL estimated that 2.7 percent of the mercury load is from municipal treatment facilities. The 2.7 percent estimate for municipal treatment facilities is likely high because it was based on an assumed effluent mercury concentration of 10 ng/L. As noted above, the effluent mercury concentrations at Clean Water Services' treatment facilities are significantly lower; this may be true at other municipal treatment facilities as well. Thus, the mercury loading from point sources is relatively minor compared to nonpoint source loads from air deposition runoff and erosion of native soil.

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VARIANCE APPLICATION ATTACHMENT C – REASON FOR VARIANCE HUMAN-CAUSED POLLUTANTS CANNOT BE REMEDIED

If you indicated in Section H of the Variance Application that you are requesting a variance because human-caused pollutant concentrations prevent attainment of the criterion (Reason C), please fill in the information requested below. This variance condition exists where human-caused concentrations of a pollutant, such as mercury, PCBs, DDT and phthalates, exceeds a criterion or contributes to an exceedance of a water quality criterion; and the human-caused condition or source cannot be remedied or it would cause more environmental damage to correct than to leave in place.

1. For what pollutant is the variance requested?
Total Mercury. The water quality criterion for which Clean Water Services requests a variance is the 0.040 milligram per kilogram (mg/kg) methylmercury fish tissue criterion for the protection of human health. OAR 340-041-8033(3), Table 40. This criterion is implemented, however, through discharge limits on total mercury. No variance is sought for the total mercury water quality criteria for the protection of aquatic life (2.4 micrograms per liter (µg/L) acute; 0.012 µg/L chronic). OAR 340-041-8033(3), Table 30.

2. Please describe upstream ambient data sufficient to adequately characterize pollutant concentrations:
See discussion in Attachment A.

3. Please identify the source or sources of the pollutant within the water body. Also describe the data and basis for the conclusion that human-caused pollutant concentrations preclude attainment of the criterion. Such information may include, but is not limited to: soil composition data, groundwater data, USGS analyses/reports, comparison to data collected from headwater streams, and analyses done by other states with an explanation of why they are relevant in this case. If possible, there should be some analysis of how much of the pollutant in the stream occurs as a result of legacy pollutants and how much is a result of NPDES-permitted sources.
See discussion in Attachment A.

4. Is the receiving water body water quality-limited for the pollutant?
Yes

5. Do the facility's processes contribute any of this pollutant to the effluent?
Clean Water Services' processes do not contribute mercury to the effluent.

6. If applicable, please describe the environmental damage that would be caused by reducing or treating the pollutant to criteria levels, and whether that damage would outweigh the damage caused by leaving the pollutant in place. (For example, if multiple passes of non-contact cooling water concentrates the pollutant and other cooling methods such as cooling towers are not feasible, may show that benefits to stream temperature and flow resulting from multiple passes outweigh harm caused by reducing number of passes. In some cases, additional treatment may result in potential disposal issues with waste generated from various treatment technologies such as brines or spent resin. Or, additional treatment may require greatly increased energy usage.)
As discussed above, there are no full-scale or pilot-scale treatment technologies that would be able to meet target effluent mercury levels in the current TMDL. Membrane filtration technologies could potentially achieve target effluent mercury levels expressed in the TMDL; however, only bench-scale test

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results are available for these technologies. Additionally, these technologies require significant energy use and thus, would have a large carbon footprint and substantial adverse environmental effects. Furthermore, there is no indication that membrane filtration technologies would be capable of achieving target mercury levels based on the 0.04 mg/kg fish tissue criterion.

It is also important to note that the TMDL observes that the predominant source of mercury is from nonpoint sources associated with atmospheric deposition and erosion of native soil. The TMDL notes that complete removal of point sources will have negligible influence on ambient mercury concentrations and would not attain the target levels specified in the TMDL or an updated target based on the current fish tissue methyl mercury criteria (see excerpt below from the 2006 TMDL).

> *"The estimated load of total mercury from all known and currently quantified point sources (5 kg/yr) represents approximately 4% of the total load of mercury in the mainstem Willamette River system. Due to the fact that the impairment of the Willamette River is due primarily to nonpoint sources associated with either atmospheric deposition or the erosion of mercury containing soils, the complete elimination or significant reduction of mercury from water point source discharges would not be enough to attain the interim water column target. In other words, even if this TMDL were to allocate none of the calculated allowable load to NPDES point sources (i.e. a wasteload allocation of zero), the applicable water column targets for mercury would not be attained because of the very high mercury loadings from nonpoint sources. At the same time, however, ODEQ recognizes that mercury is an environmentally persistent bioaccumulative toxic substance that should be eliminated from discharges to the extent practicable. In this initial phase of the TMDL, ODEQ expects that point source loadings of mercury would be reduced primarily through mercury minimization programs developed and implemented by industrial and municipal point sources. Eliminating the point source discharges of mercury (through a wasteload allocation of zero) would have little overall effect on water quality and would cause much economic hardship. Furthermore, reducing point source loadings beyond the levels contemplated by the cumulative wasteload allocation would not be necessary to achieve the interim water column targets. The analysis presented in this document suggests that no one source category is entirely responsible for the mercury contamination in the Willamette Basin. Collaborative efforts extending across all source categories (both point and nonpoint) will be necessary to achieve reductions in mercury loading and, ultimately, the restoration of the beneficial use of fish consumption. A description of the various implementation activities designed to achieve cross-sector reductions in the load of total mercury are presented in detail in the Water Quality Management Plan (see Chapter 14 of the TMDL)."*

The District has implemented a number of strategies to reduce mercury levels to the treatment facilities, which has resulted in high effluent quality. The District has and continues to implement a MMP which includes an effective source control program focused on dental offices that exceeds EPA's recently published Dental Amalgam Rule. The MMP was approved by the Oregon Department of Environmental Quality (DEQ) and incorporated into Clean Water Services' watershed-based NPDES permit.

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Attachments

Rock Creek AWWTF Effluent Mercury Data

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