FACT SHEET FOR THE DRAFT NPDES AND STATE WASTE DISCHARGE GENERAL PERMIT FOR WATER TREATMENT PLANTS

A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM AND STATE WASTE DISCHARGE GENERAL PERMIT

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DEPARTMENT OF ECOLOGY
State of Washington

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PURPOSE OF THIS FACT SHEET

This ***fact sheet*** is a companion document to the National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Water Treatment Plants (WTP). A fact sheet is prepared and released with every draft permit. It explains the reasoning behind the Conditions of the permit and documents the decisions the Washington State Department of Ecology (Ecology) made in drafting the permit and the regulatory and technical bases for those decisions, describes how the public may comment, and it fulfills the requirements of Washington Administrative Code (WAC) 173-226-110.

Ecology prepared and has made available a draft permit for water treatment plants and this accompanying fact sheet for public evaluation during a 45-day review period before issuing the final general permit. Copies of the draft NPDES general permit and this fact sheet are available at Ecology regional offices and via the internet for public review and comment from March 20, 2024, through May 03, 2024. Details about how to prepare and submit comments are in Appendix D (Public Involvement Information).

After the public comment period, Ecology may make changes to the draft general permit in response to comments, summarize any substantive comments, and provide responses to them in Appendix E (Responses to Comments). Ecology will maintain the fact sheet, responses to comments, and permit in the permit file as part of the legal history.

SUMMARY

The proposed general permit provides coverage for discharges of treated wastewater from water treatment filtration processes (filter backwash, sedimentation/pre-sedimentation wash-down, sedimentation/clarification, or filter-to-waste) to surface waters of the State, if water treatment is the primary function of the facility. The general permit does not provide coverage for WTPs with an average monthly production rate of less than 35,000 gallons per day, nor for wastewater resulting from ion exchange, reverse osmosis, or slow sand filtration processes. Descriptions of these processes are in Appendix G (Industrial Process Descriptions).

The proposed general permit includes technology-based limits for pH and settleable solids, and a water quality-based limit for total residual chlorine. This fact sheet reviews the monitoring data reported during the first 4 years of the current permit cycle (September 1, 2019, through October 31, 2023). Those data showed that any threat from WTP discharges to surface waters was negligible, so the proposed permit applies water quality based effluent limitations if the receiving water is impaired for pH; either with an applicable EPA-approved TMDL with WLAs for pH, or an applicable Category 5 303(d) impairment for pH.

Ten substantive differences exist between the current WTP general permit and the proposed general permit:

1. Combination NPDES and State Waste Discharge General Permit – This draft permit is now a combination NPDES and State Waste Discharge. This change will ensure that all Waters of the State are protected by the permit even when they do not fall under the federal definition of Waters of the United States.
2. Reorganization and additions of S-1:
    a. New Significant Contributors of pollutants section – Ecology may require permit coverage for facilities that produce less than 35,000 gallons a day to obtain coverage.
    b. Clarified that facilities covered under this permit do receive authorization to discharge backwash wastewater to the ground and stormwater to waters of the state.
    c. Facility Excluded from Coverage – clarified that the permit does not cover federal facilities, native American facilities, or facilities with Reverse Osmosis (RO), Ion Exchange (IX), or slow sand filtration.
3. Impaired waters section – This proposed draft permit includes an updated section for discharges into 303(d) listed (Category 5) impaired waterbodies. As of the writing of this permit, only one facility is permitted to discharge into a water body that is impaired for (or due to) a pollutant likely to be discharged from Water Treatment Plants covered by this permit. This draft permit includes more restrictive limits for facilities that discharge to pH impaired waters.
4. Solid Waste Control Plan Review – In order to ensure that solid wastes generated onsite are being handled in a way that does not pose a risk of polluting waters of the State, Ecology proposes to require permittees to submit a copy of their Solid Waste Control Plan (SWCP) by October 1, 2024. Solid Waste Control Plans must meet the minimum requirements found in Chapter 173-350 WAC. Ecology has prepared a focus sheet[2] to assist permittees in creating or updating their Solid Waste Control Plan. The requirement to create and maintain a SWCP existed in the previous permit. However, the requirement to submit it to Ecology for review is new to this draft permit.
5. Updated Stormwater Pollution Prevention Plan (SWPPP) Requirements – The proposed permit includes updated requirements for site SWPPPs. Facilities are required to prepare and maintain a SWPPP when a facility discharges stormwater from areas with industrial activities. These requirements were updated for consistency with other industrial stormwater permits and 40 CFR 122.26(c).
6. Reduced monitoring frequency due to Consistent Attainment of Limits – This draft permit proposed to allow permittees to request a reduction in sampling frequency

[2] https://apps.ecology.wa.gov/publications/SummaryPages/0710024.html

after meeting permit limits or benchmarks for two years' worth of required sampling. Group 1 facilities may request to reduce sampling to quarterly and Group 2 facilities may request to reduce sampling to monthly.

7. Major turbidity benchmark exceedances must now be reported within 24 hours. This proposed draft includes a requirement that major turbidity benchmark exceedances (greater than 250 NTU's) be reported to the Ecology Environmental Report Tracking System (ERTS) and regional permit administrator within 24 hours of noticing the exceedance. This is an existing requirement, but the 24-hour reporting requirement is new.
8. Addition to S-6.2.4 Notification of a Change in Covered Activities to include PFAS treatment.
9. Addition to reasons to "Reporting a Cause for Modification or Revocation" Condition G-4.6. A significant change to the permitted activity includes a change made to address PFAS in the source water, finished water, or wastewater at the facility.
10. This draft removes the temporary data collection efforts including the additional quarterly monitoring for selected facilities in 2021, "Appendix C. Questionnaire: Excerpts from Operations, Maintenance, And Planning Documents", and "Appendix D. Survey Questions for Selected Water Treatment Plants".

INTRODUCTION

The Federal **Clean Water Act** (CWA, 1972, and later amendments in 1977, 1981, and 1987) established **water quality** goals for the navigable (surface) **waters of the United States**. One mechanism for achieving the goals of the Clean Water Act is the **National Pollutant Discharge Elimination System** (NPDES), administered by the U.S. Environmental Protection Agency (EPA). The U.S. EPA authorized the State of Washington to manage the NPDES **permit** program in Washington State. The Washington State Legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to the Washington State Department of Ecology (Ecology). The Legislature defined Ecology's authority and obligations for the wastewater **discharge** permit program in Chapter 90.48 of the Revised Code of Washington (RCW).

The Washington Administrative Code (WAC) requires that water **treatment** plants (WTPs) obtain coverage under an NPDES **general permit** before discharging wastewater to the **waters of the State**. The following regulations apply to NPDES general permits:

- Water quality **criteria** for **groundwaters**, bases for **effluent limits**, and other requirements (Chapter 173-200 WAC)
- Water quality criteria for **surface waters**, bases for effluent limits, and other requirements (Chapter 173-201A WAC)
- **Sediment management** standards, bases for effluent limits, and other requirements (Chapter 173-204 WAC)
- **Whole effluent toxicity testing** and limits (Chapter 173-205 WAC)
- Determination and payment of fees (Chapter 173-224 WAC)
- Procedures Ecology follows for issuing and administering NPDES general permits (Chapter 173-226 WAC)
- Plans and reports for construction of wastewater facilities (Chapter 173-240 WAC)

A general permit is designed to provide environmental protection under conditions typical for the covered industrial group. It may not be appropriate for every situation. When site-specific conditions at a **facility** are not typical of the industrial group or they are beyond the scope of the general permit, an **individual permit** may be required.

The establishment of a general permit for the WTP industry is appropriate because:

- The wastewater characteristics among facilities are similar.
- A standard set of permit requirements can effectively provide environmental protection.
- In complying with permit conditions, facilities will comply with water quality standards.

ACTIVITIES, DISCHARGES, AND FACILITIES THAT REQUIRE THIS PERMIT

The discharge of wastewater from WTPs to surface water requires an NPDES permit. No **pollutants** may be discharged from any commercial or industrial **operation** into waters of the State except as authorized under a wastewater discharge permit. WTPs meet the legal definition of commercial or industrial operation, the process wastewater contains pollutants, and WTPs are **point source dischargers**.

This Permit is a combination NPDES and State Waste Discharge General Permit. This change was made to protect Waters of the State that are not defined as Waters of the United States. This general permit satisfies the legal requirement for an NPDES permit for WTPs that employ filtration processes and discharge wastewater to surface water. Filtration processes include oxidative filters (berm, green sand) as well as conventional, direct, and in-line filtration systems. In addition to facilities that produce potable water, this general permit applies to WTPs that produce industrial grade water through primary treatment (settling and filtration), when the production and distribution of the treated water is the primary product of the industry with no other activities that would require a discharge permit.

The proposed Draft WTP General Permit (anticipated effective October 1, 2024, through September 30, 2029) provides coverage for facilities with an actual production volume of treated product water (finished water) of at least 35,000 gallons per day (gpd) as determined on an average monthly basis. The actual production rate is the amount of finished water that a treatment facility actually produces on any given day. To calculate the value of the actual production rate on an average monthly basis, add the values of each daily production rate during a calendar month, and divide the sum by the total number of days in the month.

Ecology retains the right to determine that any WTP facility (no matter how small) must obtain coverage if Ecology finds a potential threat to water quality.

ACTIVITIES, DICHARGES, AND FACILITIES THAT DO NOT REQUIRE COVERAGE UNDER THIS PERMIT

Facilities that require a wastewater discharge permit for processes that are not associated with the production of drinking water or industrial water are not covered under this general permit. WTPs with actual production rates of less than 35,000 gpd, based on a **monthly average**, are not covered under this general permit. This general permit establishes monitoring and reporting requirements that assume a level of operation and expertise that is not expected from small systems. These very small WTPs have low-volume and infrequent discharges that are most often better addressed with **best management practices** and guidelines for environmental protection.

This general permit does not cover WTP discharges that are significantly different from typical filter backwash. A general permit is an appropriate vehicle for regulating wastewater discharges when the characteristics of the wastewater are similar, and a single set of permit conditions can address the environmental concerns and set treatment and discharge standards for the industry as a whole. WTPs that employ treatment processes (e.g., ion exchange, reverse osmosis) where the general permit conditions do not adequately address the environmental concerns associated with the wastewater discharge are not covered by this general permit.

Ion exchange is a type of water treatment process used by some relatively small WTPs and single domestic water systems in Washington State. This process works by removing ions from the water as they pass over an exchange medium. When the ability of the media to attract these ions has been consumed, the media is washed with a liquid (typically salt brine) that replaces the attached ions, thereby regenerating the medium. The wastewater consists of regeneration liquid, the removed ions, and rinse water. Whereas filtration processes remove suspended solids and clean the filter with water, ion exchange removes dissolved solids and adds a regeneration liquid to the waste stream. Thus, the characteristics of the wastewater resulting from ion exchange are quite different. This general permit does not apply coverage to WTPs that discharge wastewater from ion exchange processes. Guidance on the permitting and best management practices required for the discharge of wastewater from ion exchange processes is included in Appendix G-2 (Ion Exchange and Reverse Osmosis).

Reverse osmosis is another water treatment process used by a few, very small water treatment systems in Washington State. Pressure and semi-**permeable** membranes are used to remove **contaminants** from water. The primary application of this technology in the **State** has been to produce potable water from salt water or brackish water. The quantity of wastewater can be greater than that of the produced potable water, and the resulting wastewater is very high in dissolved salts, quite different from the wastewater associated with filtration processes. This general permit will not apply coverage to WTPs that discharge wastewater from reverse osmosis processes. Guidance on the permitting and best management practices required for the discharge of wastewater from reverse osmosis processes is included in Appendix G-2 (Ion Exchange and Reverse Osmosis).

The treatment and removal of per- and polyfluoroalkyl substances (PFAS) from water is currently done by only a small number of facilities in Washington State but is expected to grow considerably in the future. The treatment technologies and processes used to remove PFAS from water vary and can include Ion exchange and reverse osmosis or others. The wastewater discharges from these treatment processes are significantly different from the wastewater generated from filtration systems. This general permit does not apply coverage to facilities designed to treat water for PFAS. These facilities may need coverage under an individual NPDES or State Waste Discharge Permit.

Additionally, discharges to land, groundwater and to sewage treatment plants (POTWs, **publicly-owned treatment works**) by WTPs that employ filtration are not covered under this general permit. Water treatment filtration processes typically remove dirt, water-borne pathogens, and small amounts of organic material from surface water, or iron and manganese from groundwater. Ecology has determined that **land application** of the type of material removed by filtration in the production of drinking or industrial water will not typically require a state waste discharge permit. For the purposes of this permit, discharges to land are those discharges that will completely infiltrate or evaporate, with no potential, during all weather conditions, of discharging to surface water, per Appendix G-3 (Discharge to Land or POTWs). Ecology has also determined that the discharge of backwash effluent under this permit to groundwater is not likely to violate groundwater quality standards. Data collected to date suggest that typical WTP discharge is not likely to adversely affect POTW operations, introduce **pollutants** that will interfere with or pass through the POTW, or violate any **pretreatment standard** or requirement. Additionally, since the discharge has about the same concentration of suspended solids as **domestic wastewater**, with lower biochemical oxygen demand and fewer pollutants than domestic wastewater, a state-based discharge permit is not required for typical WTP discharges to POTWs, per Appendix G-3 (Discharge to Land or POTWs).

BACKGROUND INFORMATION

FACILITY DESCRIPTION

History

The Washington State Department of Health (DoH) provides most of the regulatory **control** over WTPs, specifically regarding their production of potable and industrial water. The DoH focuses on the equipment, chemicals, and operations WTPs use during production of finished water. Ecology's regulatory interest in WTPs focuses on their generation, treatment, and disposal of wastewaters created during production.

Ecology first issued the WTP wastewater discharge general permit on December 3, 1997. When the permit expired on February 1, 2003, Ecology administratively extended it for those 30 facilities already covered.

In July 2004, Ecology reissued the general permit with several changes. The effluent limits for **chlorine** were decreased, and **Permittees** received a 2-year **compliance schedule** to meet the new limits. The requirements for monitoring and reporting the oxygen content, temperature, trihalomethane concentrations, and the rate and total volume of discharges were deleted. The permit contained an additional requirement for Permittees to prepare and use a **stormwater pollution prevention plan**.

In September 2009, the third version of the general permit took effect, but contained no substantive changes. By the end of the term of this permit, in early 2014, Ecology had issued coverage under the permit to only 31 facilities.

In September 2014, the fourth cycle of the general permit took effect. A requirement for reporting discharge flows took effect in September 2015. The required flow data were the total daily volume of discharge and the total daily number of discharge events. This permit also required monthly monitoring for total and dissolved arsenic in wastewater discharges from September 2016 through August 2017.

In September 2019, the fifth version of the general permit took effect. This permit required Permittees to submit only the information in their basic operations, maintenance, and planning documents relevant to protecting the waters of Washington State. The permit also established a turbidity benchmark of 25 NTU and response actions. To analyze filter backwash discharges to ground, all permittees were required to complete and submit a questionnaire. Additionally, selected permittees were required to complete and submit a survey, supporting documentation, and monitoring for secondary pollutants. Table 1 lists the 31 WTPs currently covered under this general permit, as of October 2023.

Table 1: Facilities Currently Covered Under this Permit (as of October 2023)

Water Treatment Plant	Permit No.	Location	Receiving Water
Aberdeen	WAG641026	Aberdeen	Trib. to Wishkah River
Anacortes	WAG643002	Mount Vernon	Skagit River
Arlington	WAG647003	Arlington	Stillaguamish River
Cathlamet	WAG641009	Cathlamet	Elochoman River
Chehalis	WAG641012	Chehalis	Coal Creek
Chinook Water District	WAG641027	Chinook	Trib. to Chinook River
Clallam County PUD #1	WAG641010	Port Angeles	Morse Creek
Cusick	WAG647000	Cusick	Pend Oreille River
Everett	WAG643009	Everett	Lake Chaplain
Friday Harbor	WAG643005	Friday Harbor	Trib. to Margos Lake
Hoquiam	WAG641000	Hoquiam	W.F. Hoquiam River
Ilwaco (Indian Creek)	WAG641001	Ilwaco	Bear Creek
Judy Reservoir	WAG994401	Sedro Woolley	Judy Reservoir
Kalama	WAG641023	Kalama	Kalama River
Leavenworth	WAG645001	Leavenworth	Icicle Creek
LISECC, Inc.	WAG643004	Lummi Island	No Name Creek
Long Beach	WAG641019	Long Beach	Mountain Spring Reservoir
Lynden	WAG643003	Lynden	Nooksack River
McNeil Island Stewardship, WDoC	WAG643008	McNeil Island	Eden Creek
Morton	WAG641016	Morton	Tilton River
Pasco (Butterfield)	WAG647001	Pasco	Columbia River
Raymond	WAG641007	Raymond	S. F. Willapa River
Richland	WAG645000	Richland	Columbia River
Ryderwood	WAG641011	Ryderwood	Campbell Creek
South Bend	WAG641008	South Bend	Johnson Slough
Stevenson	WAG641020	Stevenson	Rock Creek
Vader	WAG641004	Vader	Olequa Creek
Whatcom County PUD #1 Plant 1	WAG643006	Ferndale	Nooksack River (near Trigg Road)
Whatcom County PUD #1 Plant 2	WAG643007	Ferndale	Nooksack River (near Ferndale Road)
Willapa Valley Water District	WAG641013	Raymond	Stringer Creek
Woodland	WAG641021	Woodland	Lewis River

Industrial Processes

Washington State is home to almost 900 WTPs that use some form of water filtration in the treatment of drinking or industrial water. About 75% of these facilities are very small facilities producing less than 35,000 gallons of water per day. Of the larger facilities, about half discharge to land or to a sewage treatment plant and most of the others discharge to a surface waterbody. Chlorine continues to be the primary disinfectant used by WTPs in the State in the production of water. WTPs typically use chlorine-treated water when backflushing their filters.

Typical WTP filtration processes include pre-sedimentation, oxidation, coagulation, flocculation, **sedimentation**, and filtration. Although any one facility may not utilize all the processes, the waste streams produced by any combination of processes are relatively similar. When the source water (raw water) has significant levels of suspended solids such as sand, an initial settling tank may be the technique employed to remove those solids. The settling tank can be designed to allow for continuous removal of the solids, or the tank may be drained periodically, and the solids removed. Some facilities dispose of these solids separately as a **solid waste** or wash them into the same waste stream as the backwash. A sedimentation basin may also be incorporated to settle solids after the addition of coagulants and flocculants, but before filtration. Like a pre-sedimentation basin, the sedimentation basin may be equipped for continuous cleaning or may be cleaned periodically, and the solids may be disposed separately or washed into the same waste stream as the backwash.

Coagulants are added to the raw water to destabilize the colloidal state of suspended particles through "charge neutralization" allowing the particles to adhere to each other. The most common coagulant in use is aluminum sulfate (alum), $Al_2(SO_4)_3 \bullet 14\ H_2O$, but at least one facility uses ferric chloride, $FeCl_3$, and many other coagulants are available. Other additives may include compounds to adjust **pH** (e.g., soda ash); oxidants (e.g., chlorine, potassium permanganate, and ozone) for disinfection or precipitation of dissolved minerals; and polymers to enhance coagulation, settling (flocculation), and filtration.

A wide variety of polymers are available for use in the production of drinking or industrial water to enhance coagulation, settling, and filtering. Polymers are relatively large molecules made through linkage (chaining) of small lightweight molecules (monomers). They are not necessarily readily soluble and may be cationic, anionic, or nonionic. Those polymers susceptible to ultraviolet radiation and microbes tend to break down readily. Coagulant aids that produce cationic polymers tend to be expensive and are generally used in dilute amounts, in the range of 0.2 to 2 milligrams per liter (mg/L). Settling aids produce anionic polymers that form a heavy floc that settles readily. Large polymer molecules entrap suspended particles as they settle with the polymer. The dose rates are generally in the range of 1 to 5 mg/L. Nonionic polymers are used primarily as filter aids. Filter aids are large, very "sticky" polymers that will not pass through the filter medium but interact with it to increase the ability of the filter medium to remove suspended particles. Since they can easily plug a filter, they must be used in very dilute amounts, 10 to 50 (mg/L).

Additives are generally applied with great care and in precise amounts. Dosage is based on the amount of suspended solids to be removed or the dissolved solids to be precipitated. Many chemical additives used in WTP filtration systems work best at just the right dosage. Too much can produce as poor a result as too little. Also, since the product here is drinking water, the quality of that product cannot be compromised by an excess of additives. Drinking water with a "purple tinge" from the addition of too much potassium permanganate, for example, would not be acceptable.

Source water may be either surface water, ground water under the direct influence of surface water, or groundwater, and the typical processes associated with water treatment vary with the source of the water. Typical surface water treatment applies filtration to remove organic and inorganic matter and to remove pathogenic **organisms**. Coagulation, flocculation, and filtration are key to treating surface water to meet drinking water quality standards. Typical groundwater treatment consists of precipitation of dissolved minerals through oxidation, followed by filtration to remove the minerals. The filtration processes used for raw waters from both sources employ filters that lose their effectiveness as solid residues accumulate, necessitating cleaning to avoid breakthrough and unacceptable pressure loss. Filter cleaning is accomplished by reversing the flow of water and backflushing the filter, which produces wastewater composed of the solid residue and backflush water. The solid residue includes substances removed from the raw water as well as additives applied to enhance their removal, and the backflush water may include additives such as chlorine. This wastewater is known as backwash and constitutes the majority of the wastewater discharge covered under this general permit.

The frequency of discharge is highly variable, from several times per day for large WTPs with several filters to once or twice per week for small WTPs. Likewise, the quantity of the discharge varies somewhat by the size of WTP, from about 3,000 gallons to backflush a small filter to 80,000 gallons for large filters. The duration of backwash discharge, however, is relatively constant, about 10 to 15 minutes per episode. Following a backflush of the filter, WTPs may also discharge filtered water for a period of time while the filter settles and "cures", a procedure known as filter-to-waste.

Wastewater Treatment Processes

Filter backwash is not discharged directly to surface water. Backwash must be treated before discharge. Treatment typically consists of one or more settling ponds. After a period of settling, water from the surface of the pond is drained off either by pump or gravity and discharged. As described in the previous section, the frequency of discharge is highly variable among WTPs.

Discharge Outfall

The typical discharge of wastewater from WTPs is through a pipe at the edge of the receiving waterbody. This side bank discharge is only submerged when the level of the **receiving water** rises above normal levels. Most facilities do not use diffusers or submerged discharge pipes. Table 1 identifies the waterbodies to which the currently permitted WTPs discharge.

Solid Wastes

The result of filter backwashing is generally a wastewater containing **spent** filter media and accumulated **sediment**. Subsequent filtration or settling produces a sludge from which the clearer wastewater is separated or decanted and discharged. The residual water in the remaining sludge may then be allowed to drain into the soil. WTP operators then either pump out the sludge or scoop it into trucks for transport off **site**. Typically, either the **municipality** responsible for the WTP or a contractor disposes of the sludge in a landfill or applies it to the land for a beneficial agronomic or silvicultural use. Local regulatory **jurisdictions** are responsible for overseeing or permitting such land application, disposal in a **landfill**, and intra-county beneficial use. If the owner of the sludge wants the sludge designated for beneficial use statewide, the Ecology solid **waste** program is responsible for oversight, including approving the beneficial use or permitting the disposal operation. Appendix C (Guidance for Regulatory Oversight of Water Treatment Plants: Wastewater and Solid Waste Disposal) contains a summary of the agencies with regulatory oversight authority of WTPs for different waste streams and disposal methods.

Permittees must have and maintain an up-to-date site-specific solid waste **control plan** that describes the details of the characteristics of the solid waste (sludge), its source(s), the rate of generation, and disposal methods. The plan must comply with Chapter 173-350 WAC as well as any applicable requirements of the jurisdictional health department and any local requirements for a solid waste permit. The Permittee must update the plan as necessary to reflect changes in solid waste handling and disposal and keep the plan on site and available for inspection by Ecology. This draft permit also requires permittees to submit their updated Solid Waste plans to Ecology for review by October 1, 2025.

DESCRIPTION OF RECEIVING WATER

The typical receiving water relevant to this general permit is a freshwater surface waterbody. Characteristic uses for this type of waterbody include the following: water supply (domestic, industrial, agricultural); stock watering; fish **migration**; fish rearing, spawning, and harvesting; wildlife habitat; primary contact recreation; sport fishing; boating and aesthetic enjoyment; commerce; and navigation. Water quality of this type must meet or exceed the requirements for all or **substantially** all uses.

Some WTPs, particularly the smaller facilities, discharge wastewater entirely to the ground. Ecology does not cover those facilities and their discharges to the ground under this NPDES general permit due to the relatively small volume of wastewater they discharge and the availability of individual **state waste discharge permits**. Numerous communities and individuals do rely on groundwater as their source of raw water for drinking.

WASTEWATER CHARACTERIZATION

Current Data

WTPs may use either groundwater or surface water as their source water. The required water treatment processes can vary depending on the source water. Treatment of groundwater most frequently consists of removing dissolved iron and manganese and typically includes oxidation (e.g., ozonation or addition of chlorine or potassium permanganate) to precipitate the iron and manganese followed by filtration to remove the iron and manganese oxides.

The most frequent treatment method for surface water has been filtration to remove suspended solids and large diameter pathogens (e.g., Giardia), possibly including passage through pre-sedimentation and sedimentation basins before filtration. Precipitation, coagulation, and flocculation frequently increase the effectiveness of filtration and sedimentation. Aluminum sulfate (alum) is the most common additive used by WTPs to induce coagulation of dissolved materials. Polymers are another common additive that enhance coagulation, flocculation, or filtration. WTPs may add chlorine before filtration as an oxidizing agent to promote precipitation and to remove unwanted taste and color. Chlorine is also frequently added after filtration for disinfection purposes and to produce the "finished water" for distribution as drinking water. Chlorinated finish water is typically used to backflush the filters.

The chlorine used as a disinfectant by WTPs can chemically combine with other organic matter in the water and form trihalomethanes. The U.S. EPA has listed the trihalomethanes as potential **carcinogens** that have a potential to cause a human health concern. Based on available data, Ecology has determined that the wastewaters discharged from WTPs typically contain small amounts of the three trihalomethanes: chlorodibromomethane, dichlorobromomethane, and trichloromethane (chloroform). These chemicals have human health-based criteria based on long-term exposure from eating fish exposed to the toxicants and drinking water containing the toxicants. While the trihalomethane of greatest concern was dichlorobromomethane, with modest dilution its concentration will likely be reduced to an acceptable level. Deriving reasonable potential for WTPs is difficult because they produce discharges intermittently and do not readily fit the long-term exposure assumptions of the criteria as there will typically be longer periods of no discharge than of discharge. The intermittent nature of the discharges combined with the relatively low concentrations of these toxicants in the discharges support Ecology's determination that there is no reasonable potential for these toxicants to violate water quality standards.

Filter backwash from standard coagulation/flocculation processes associated with treating surface water can be characterized as follows:

Settleable Solids	6 to 20 mL/L
Aluminum Hydroxide or Ferric Hydroxide (additive):	25 to 50%
Clay/Silt (source water):	35 to 50%
Organic Matter (source water):	15 to 25%
Total Residual Chlorine:	0.1 to 1 mg/L

WTP Permittees in Washington State have reported the concentrations of pollutants in their discharges via their monthly or weekly discharge monitoring reports. The data summarized in Table 2 represent the quality of the wastewater **effluent** discharged from the permitted WTPs from September 1, 2019, through November 1, 2023.

Table 2: Summary of Monitoring Data (September 1, 2019, through November 1, 2023)

	Total Residual Chlorine (mg/L)	Settleable Solids (mL/L)	Turbidity (NTU)	pH (S.U.)
Total Number of Unique Samples	3908	4616	4793	5148
Total Number of Unique Samples with pH < 6.0	NA	NA	NA	0
Total Number of Unique Samples with pH > 9.0	NA	NA	NA	0
Maximum of Unique Samples	0.22	5	100	8.89
90th Percentile of Monthly Averaged Results	0.05	0.1	7.37	NA[(a)]
Median of Monthly Averaged Results	0.02	0.1	1.27	NA[(a)]
Average	0.02	0.08	2.9	NA[(a)]
Minimum of Unique Samples	Non-detect	Non-detect	Non-detect	6.0

(a) Because pH is logarithmic, calculating averages is not appropriate.

Monitoring of Arsenic

Initial Study

In 2008, an Ecology study ("Investigation of Discharges from Water Treatment Plant Filter Backwash,") included chemical analyses of filter backwash wastewater generated by 15 small WTPs at various locations in Washington State. Although the usefulness of the data was limited, the data for total arsenic provided a starting point for later calculations of **pollution** potential, discussed below. Table 3 summarizes the data for total arsenic.

Factors that limited the utility of the arsenic data included the use of multiple laboratories, their use of multiple analytical methods, and the excessively large reporting limit for some of the results. The results of the arsenic analyses for 11 of the 15 WTPs were "non-detect." However, the reporting limit for those arsenic analyses was 60 ug/L, which is much greater than both the freshwater quality criterion for protection of human health (0.018 ug of inorganic arsenic/L) and the primary drinking water standard **maximum contaminant level** (10 ug of total arsenic/L). The results for three of the remaining WTP discharges ranged from 140 to 190 ug of total arsenic/L. Two of those WTPs with the greater concentrations employed aeration or another method to oxidize arsenic, iron, and manganese, and filtration to remove those contaminants from the treated water. The treatment method used by the third WTP is unknown. These data, limited as they are, suggest a potential that filter backwash wastewaters from at least some types of WTPs may pose a threat to human health via the groundwater pathway.

Table 3: Summary of the Initial Study of Arsenic Concentrations in Filter Backwash Wastewater

Water Treatment Plant	Total Arsenic (ug/L)	Water Treatment Plant	Total Arsenic (ug/L)
Bayview Beach	140	Mountain Road Estates	<60
Boxx Berry Farm	<60	Mutiny View Manor Community	<60
Bummer #2	<60	Naches Water Treatment	<60
Harbor Hills Water System	<60	Outlook	6.9
Ledgewood Beach Water District	150	Ridgeview Estates	<60
Lost Lake	<60	Coupeville	<60
Mariners Cove Beach Club	<60	Westside Water System	190
Mission Ranch Estates	<60		

Note: Multiple laboratories produced these data, using differing analytical methods with different reporting limits

Follow-Up Study

Due to this potential for arsenic contamination in filter backwash wastewater, from September 2016 through August 2017, Ecology required the existing WTP Permittees to collect a **representative** set of treated filter backwash discharges and to analyze them for total and dissolved arsenic. Table 4 summarizes the data reported from that effort. Based on the results of this arsenic assessment (Ecology, April 2018), Ecology found that:

1. WTP backwash wastewater effluent contained quite variable concentrations of arsenic.
2. The reported arsenic data did not correspond with specific water treatment processes, the sources of raw water, or other monitored parameters.

3. The dissolved arsenic data indicated that WTP backwash wastewater effluent did not present a reasonable potential to exceed water quality criteria for protecting aquatic life. Based upon the low concentrations of arsenic and the intermittent nature of effluent discharges, a reasonable potential to exceed the human health criterion was also unlikely.

Since Ecology's follow-up study found no reasonable threat to aquatic life or human health from the arsenic detected in permitted WTP discharges, Ecology did not create a discharge limit or require further monitoring for arsenic by the WTP Permittees. In any case, the Permittees must provide **all known, available, and reasonable methods of prevention, control, and treatment** (AKART) and implement **adaptive management** processes.

Table 4: Summary of the Follow-up Study of Arsenic Concentrations in Filter Backwash Wastewater

Water Treatment Plant	Permit	Total Arsenic (ug/L)	Dissolved Arsenic (ug/L)
Total of All 30 WTPs	na	0.26 (294, 0.65)	0.11 (278, 0.25)
Aberdeen	WAG641026	<0.5 (11, nc)	<0.5 (11, nc)
Anacortes	WAG643002	<0.5 (2, nc)	<0.5 (2, nc)
Arlington	WAG647003	0.71 (12, 0.62)	0.08 (12, 0.03)
Castle Rock	WAG641025	0.25 (10, 0.23)	0.24 (10, 0.20)
Cathlamet	WAG641009	<0.5 (11, nc)	<0.5 (11, nc)
Chehalis	WAG641012	<0.1 (12, nc)	<0.1 (12, nc)
Chinook Water District	WAG641027	<0.5 (12, nc)	<0.5 (12, nc)
Clallam County PUD #1	WAG641010	0.40 (5, 0.20)	0.40 (3, 0.10)
Cusick	WAG647000	1.08 (4, 0.11)	1.16 (4, 0.32)
Everett	WAG643009	0.36 (12, 0.13)	0.32 (12, 0.17)
Friday Harbor	WAG643005	<0.1 (10, nc)	<0.1 (10, nc)
Hoquiam, Outfall 1	WAG641000	<5 (7, nc)	<5 (7, nc)
Hoquiam, Outfall 2	WAG641000	<0.5 (5, nc)	<0.5 (5, nc)
Ilwaco (Indian Creek)	WAG641001	0.23 (12, 0.15)	0.10 (9, 0.01)
Kalama	WAG641023	3.48 (1, nc)	0.65 (1, nc)
Leavenworth	WAG645001	2.10 (10, 1.82)	<1.4 (10, nc)
LISECC, Inc.	WAG643004	<0.01 (12, nc)	<0.01 (12, nc)
Long Beach	WAG641019	0.13 (12, 0.07)	0.12 (12, 0.03)
Lynden	WAG643003	0.46 (12, 0.64)	0.12 (12, 0.23)
McNeil Island	WAG643008	0.63 (10, 0.41)	0.54 (10, 0.14)
Morton	WAG641016	<0.5 (12, nc)	<0.5 (12, nc)
Pasco	WAG647001	0.42 (12, 0.37)	0.24 12, 0.19)
Raymond	WAG641007	<0.1 (12, nc)	<0.1 (12, nc)
Richland	WAG645000	<0.5 (6, nc)	<0.5 (6, nc)
Ryderwood	WAG641011	<1 (11, nc)	<1 (11, nc)
South Bend	WAG641008	<0.1 (12, nc)	NR
Stevenson	WAG641020	1.54 (12, 0.60)	0.72 (12, 0.14)
Vader	WAG641004	<0.1 (11, nc)	<0.1 (11, nc)
Whatcom County PUD #1	WAG643006	<0.1 (2, nc)	<0.1 (3, nc)
Willapa Valley Water	WAG641013	0.11 (12, 0.03)	0.10 (12, 0.02)
Woodland	WAG641021	1.07 (11, 0.52)	0.29 (11, 0.31)

na = Not applicable NR = Not reported
N = Number of samples nc = Not calculated SD = Standard deviation

Discharges to Ground

For prior WTP general permits, Ecology has employed certain facts and assumptions to determine whether discharges of treated backwash wastewater presented a significant potential to pollute waters of the State. Recent data has updated our understanding of the risk that backwash wastewater presents to groundwater.

The **Fact Sheet** has stated, "In Washington State as of December 1997, 20 water treatment plants (WTPs) with more than 100 residential connections were identified as discharging wastewater to land." However, in mid-2014, Ecology identified approximately 97 WTPs with more than 100 residential connections each that probably have been discharging wastewater to land. This five-fold increase merited a closer look at the possible effects of those discharges.

Appendices G-2 and G-3 of this Fact Sheet describe the two simple models that Ecology has used to assess and then dismiss the potential that wastewater discharges to the ground might adversely affect groundwater quality. A preliminary re-evaluation of discharges from WTPs in Washington State (Ecology, May 2018) found that the actual rates of discharge of filter backwash wastewater to the ground exceeded the rates assumed in the Fact Sheet by up to 11-fold.

Follow-up Study

During the 2021 calendar year Ecology required permittees with a potential to discharge backwash water to ground water, to conduct additional sampling of treated and untreated filter backwash wastewater. The "secondary contaminants" monitored were chloride, total dissolved solids, total and dissolved iron, and total and dissolved manganese. Appendix H, Groundwater Discharge Analysis, describes the method used to analyze this data. This evaluation indicated that WTP discharges to groundwater may pose a small risk of impacting groundwater for Iron and Manganese. However, the concentrations of Iron and Manganese in the backwash water from the sampled facilities (Table H-2) are much lower than the previously estimated concentrations. With modest dilution, their concentrations will likely be reduced to an acceptable level. Additionally, iron and manganese are secondary contaminates which means that they are based on Secondary Drinking Water Standards. These standards are guidelines to protect drinking water aesthetics and not to protect human health or the environment. Based to the intermittent nature of the discharges, the relatively low concentrations of these pollutants in the discharges, and Ecology's best professional judgement, the discharges from WTP's covered by this permit are not likely to pose a reasonable threat to aquatic life, human health, or the environment. Therefore, this permit does not include new limits or conditions for discharges to groundwater.

SUMMARY OF COMPLIANCE WITH PREVIOUSLY ISSUED PERMITS

Historical Permit Cycles

For the 6-year period from December 1997 through December 2003, there were a total of 696 permit violations from 29 of the 33 facilities that were permitted under the Washington State NPDES WTP general permit. This represented a total rate of non-compliance of roughly 8%. Non-reporting from 23 facilities constituted 425 of the permit violations. The non-reporting was due to operator error.

During that same period, there were 115 exceedances of the discharge limit for total residual chlorine (TRC) from 11 facilities; five of the facilities were chronic violators. After plant upgrades and technical assistance from Ecology, the violations for TRC went down from 33 violations in 1999 to only five violations in 2003.

There were a total of six violations for pH from four facilities, with only one pH violation in 2002 and no violations for pH since.

From December 1997 through December 2003, there were 151 exceedances of the discharge limit for settleable solids from 15 different facilities, 82 of them from one facility. That facility was in the process of upgrading its plant. The violations were due to several different causes, a few of them being: wrong sampling location, operator error in sampling and sample reading, and needed facility upgrade.

Ecology has provided technical assistance to the majority of the facilities that have multiple violations to help them come into compliance. Ecology sent four Administrative Orders, two Civil Penalties, nine Notices of Correction, and three Notices of Violation to promote compliance. Ecology also sent 253 Warning Letters to 21 of the facilities to notify them of compliance issues.

For 2013, compliance was considerably better than previous years. In 2013, the total rate of non-compliance was roughly 2%. All Permittees submitted the required monitoring reports, though 12 Permittees occasionally submitted them late. Two Permittees erred once each in the frequency at which they sampled, and two others exceeded their discharge limits for TRC (once and twice, respectively).

Between September 2014 and August 2018 the total rate of non-compliance with monitoring and discharge limits was roughly about a third. At one time or another, 25 Permittees failed to submit their discharge monitoring reports (DMRs) or submitted them late. Likewise, 16 Permittees exceeded discharge limits for pH, settleable solids, or total residual chlorine a total of 29 times. On average, Permittees reported only about 50% of the required flow data (number of discharge events per day and total volume discharged each day).Between September 2019 and November 2023, there were a total of 152 violations with at least one from every facility under permit coverage. 105 of these were reporting violations such as failure to submit a report or a late DMR and 47 were monitoring or effluent violations such as failure to conduct a required sampling or failure to meet permit discharge limits. Overall, compliance with current permit continues to increase overtime.

COMPLIANCE WITH STATE EVIRONMENTAL POLICY ACT

State law exempts the issuance, reissuance, or modification of any wastewater discharge permit from the **State Environmental Policy Act** (SEPA) process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383 and WAC 197-11-855). This proposed reissued general permit does not add to the covered area, which is the entire State of Washington; (b) Add to the type of facilities that must be covered; (c) Allow the discharge of additional pollutants; and (d) Contain conditions less stringent that the applicable federal and state rules and regulations.

PERMIT LIMITS

Federal and State regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the U.S. EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3 and Chapter 173-220 WAC).

Water quality-based limits are calculated so that the effluent will comply with the Surface Water Quality Standards (Chapter 173-201A WAC), Groundwater Standards (Chapter 173-200 WAC), Sediment Quality Standards (Chapter 173-204 WAC), and the National Toxics Rule (40 CFR 131.36).

Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit are based in part on the typical effluent characteristics for this group of discharges. The effluent constituents were evaluated on a technology- and water quality-basis. The limits necessary to meet the rules and regulations of the State of Washington were determined and included in this permit. Ecology does not develop effluent limits for all reported pollutants. Some pollutants are not treatable at the concentrations reported, are not controllable at the source, are not listed in regulation, or do not have a reasonable potential to cause a water quality violation.

During the 5-year permit cycle, a WTP's effluent discharge conditions may change from those conditions reported in the application for permit coverage. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. If Ecology determines that a WTP is discharging pollutants that are not typical of the industry or at quantities of environmental concern, Ecology may require an individual permit to address the issue.

TECHNOLOGY-BASED EFFLUENT LIMITS

Ecology must ensure that facilities provide all known, available, and reasonable methods of prevention, control, and treatment (AKART) when it issues a permit.

The U.S. EPA commissioned Science Applications International Corporation (SAIC) to draft a model permit for the water supply industry (1987). Although the draft permit was not implemented, SAIC released its findings in a document entitled "Model Permit Package - Water Supply Industry," January 30, 1987. In this document SAIC reported its analyses of the best practicable control technology currently available (BPT) and best **conventional pollutant** control technology (BCT), which addressed "conventional" pollutants. SAIC did not identify best available technology economically achievable (BAT) requirements, which address **toxic** pollutants, because WTP process effluent contains principally conventional pollutants, and SAIC found insufficient evidence for toxic pollutants in the discharge to justify development of across-the-board limits. SAIC proposed the following limits based on their best **professional judgment** after considering existing permits, WTP monitoring data, and achievable WTP wastewater treatment levels:

Monthly average total suspended solids (TSS):	30 mg/L
Daily maximum TSS:	45 mg/L
Allowable pH range:	6.0 to 9.0 S.U.

Settleable Solids

In 1975, Ecology proposed effluent guidelines for use when issuing NPDES permits for municipal WTP process wastewater discharges. These guidelines set the settleable solids limit at 0.1 mL/L. (Ecology had determined that settleable solids was a simpler and less costly test than TSS, and that it may provide a more accurate measure of the efficiency of the sedimentation treatment process. Further, a settleable solids measurement of 0.1 mL/L was comparable to a 30 mg/L TSS measurement (letter from Stan Springer, Ecology, to Michael Lorenzo, SAIC, March 12, 1987)). Ecology reaffirmed this guidance in 1985 and justified it under the AKART requirements of RCW 90.52.040.

State legislation passed in 1987 provided a credit adjustment of technology-based effluent limits or standards for WTP facilities on the Chehalis, Columbia, Cowlitz, Lewis, and Skagit rivers that meet the criteria of RCW 90.54.020(3)(b). The adjustment set limits that would effectively allow residual solids to be returned to the river without removal treatment as long as water quality standards were not violated. Applying the federal requirements for BPT and BCT determinations, however, results in limits for residual solids that would not be achievable without removal treatment, per Appendix G-1 (Technology-Based Treatment). A settleable solids limit based on a credit adjustment would, therefore, be in conflict with a settleable solids limit based on BPT/BCT. Further, credit adjustment is only applicable to a few facilities that meet the requirements of RCW 90.54.020(3)(b), and a general permit is not the appropriate vehicle to accommodate the resulting site-specific complexity. Therefore, the WTP general permit does not include any provisions for credit adjustment of technology-based effluent limits for facilities that meet the criteria of RCW 90.54.020(3)(b). Those facilities may accept the terms and conditions of the proposed general permit and apply for coverage, but any facility wishing to claim a credit adjustment must request an individual permit and will not be eligible for coverage under the proposed general permit.

Lagoon/settling tank treatment is a relatively inexpensive form of treatment[3] , is effective in significantly reducing the amount of solids that are discharged and provides some reduction in the amount of total residual chlorine (TRC). Lagoon treatment requires about one acre of land per each million gallons per day of production. Design and construction requirements are readily available with no special requirements other than the availability of land. Treatment removes over 90 percent of the solids, reducing the amount of settleable solids from a range of 6 to 20 mL/L to less than 0.1 mL/L. TRC is reduced from as much as 1 mg/L to 0.3 mg/L or less. Cost can be a formidable barrier, however, where there is no room for expansion or when land acquisition is extremely expensive.

pH

In 1975, Ecology proposed effluent guidelines for use when issuing NPDES permits for municipal WTP process wastewater discharges. These guidelines set the allowable pH range to 6.0 to 9.0 S.U. Ecology reaffirmed this guidance in 1985 and justified it under the AKART requirements of RCW 90.52.040.

Normal WTP operation results in wastewater discharge pH in the range of 6.0 to 9.0. WTPs may adjust the pH of incoming water (raw water) to achieve optimal conditions for facility processes. For instance, a pH of 6.5 to 6.8 is usually considered "optimum" for alum coagulation. After filtration, facilities may also adjust pH up to about 7.5 or 8.5 for corrosion control in the distribution system. This adjusted pH water is typically what is used to backflush the filter. Historical discharge monitoring reports for WTP wastewater in Washington State indicate pH has been consistently within the range of 6.0 to 8.5 S.U.

Based on the federal study, existing facilities in Washington State, and “best professional judgment,” Ecology sets technology-based limits for WTPs as shown in Table 5.

Table 5: Technology-Based Limits

Parameter	Average Monthly Limit	Maximum Daily Limit
Settleable Solids	0.1 ml/L	0.2 ml/L
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0 S.U.	9.0 S.U.

mL/L = Milliliters per liter
S.U. = Standard units

[3] Ecology’s economic impact analysis in 1997 found that, based on a 20-year cost averaging, $100 per dry ton (5 cents per pound) was the estimated cost for one large facility to acquire land; design and build the lagoon; and pay operation, maintenance, and disposal costs. A medium sized facility, with 18,000 customers, estimated that its costs for design, build, and operate resulted in a 0.7% to 1% rate increase (based on 20-year cost recovery).

WATER QUALITY-BASED EFFLUENT LIMITS

The Washington State surface water quality standards (Chapter 173-201A WAC) are protective of the existing water quality and preserve the beneficial uses of the **surface waters of the State**. Waste discharge permits must include conditions that ensure that discharges meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual **wasteload allocation** or on a wasteload allocation developed during a basin-wide **total maximum daily load** (TMDL) study.

Designated Uses and Surface Water Quality Criteria

Fresh Water

WTPs in Washington State discharge wastewaters primarily to freshwater surface waters. The following is a list of the potential designated uses assigned to those waters:

1. Water supply: Domestic, agricultural, industrial, and stock watering.
2. Miscellaneous: Wildlife habitat, harvesting, commerce & navigation, boating, & aesthetics.
3. Recreational: Primary and secondary contact recreation.
4. Aquatic life: All indigenous fish and non-fish aquatic species.

Only aquatic life uses have surface water quality criteria that pertain to the pollutants that Ecology expects may be present in WTP discharges.

Marine Water

As of December 2022, none of the permitted WTPs in Washington State discharged wastewater directly to marine waters. Only aquatic life uses have surface water quality criteria that pertain to the pollutants that Ecology expects may be present in WTP discharges.

Numeric Criteria for the Protection of Aquatic Life and Recreation

The water quality standards for surface waters (Chapter 173-201A WAC) list numeric water quality criteria. They specify the maximum levels of pollutants allowed in receiving water that remain protective of aquatic life and recreation in and on the water. Ecology uses numeric criteria along with chemical and physical data for the wastewater and receiving water to derive effluent limits in discharge permits. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numeric Criteria for the Protection of Human Health

Numeric criteria for the protection of human health are promulgated in Chapter 173-201A WAC and 40 CFR 131.45. These criteria are designed to protect human health from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters. The water quality standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

Water Quality Impairments

Section 303(d) of the Federal Clean Water Act requires Washington State to periodically prepare a list of all surface waters in the State for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These waterbodies are water quality-limited estuaries, lakes, and streams that fall short of State surface water quality standards, and are not expected to improve within the next 2 years. Waters placed on the 303(d) list require the preparation of total maximum daily loads (TMDLs), a key tool in the work to clean up polluted waters. TMDLs identify the maximum amount of a pollutant to be allowed to be released into a waterbody so as not to impair uses of the water and allocate that amount among various sources.

Ecology's assessment of which waters to place on the 303(d) list is guided by Federal laws, State water quality standards, and the State 303(d) policy. This policy describes how the standards are applied, requirements for the data used, and how to prioritize TMDLs, among other issues. The goal is to make the best possible decisions on whether each body of water is impaired by pollutants, to ensure that all impaired waters are identified and that no waters are mistakenly identified.

In June 2023, only one of the permitted WTPs in Washington State discharged wastewater to a waterbody listed as impaired on the current **303(d) list** or for which Ecology is currently conducting or has completed a total maximum daily load (TMDL) analysis for the parameters that Ecology expects WTPs may discharge or parameters that may cause or contribute to an impairment. Facilities with coverage under this permit must comply with the terms and conditions of completed TMDLs and the detailed implementation plan. Table 6 identifies that a single WTP (Anacortes, listed for low pH), along with eight others that discharge to waterbodies impaired for elevated temperature or low dissolved oxygen. Water quality impairments on the 303(d) list can be found on Ecology's Water Quality Atlas[4].

[4] https://apps.ecology.wa.gov/waterqualityatlas/wqa/startpage

Table 6: Permittees Discharging to Impaired Waterbodies

Water Treatment Plant	Permit No.	Receiving Water	Impairment
Anacortes	WAG643002	Skagit River	Low pH
Arlington	WAG647003	Stillaguamish River	High temperature
Cathlamet	WAG641009	Elochoman River	High temperature
Chehalis	WAG641012	Coal Creek	Low dissolved oxygen
Cusick	WAG647000	Pend Oreille River	High temperature
Kalama	WAG641023	Kalama River	High temperature
Lynden	WAG643003	Nooksack River	Low dissolved oxygen
Pasco	WAG647001	Columbia River	High temperature
Whatcom PUD #1 Plant 1	WAG643007	Nooksack River	Low dissolved oxygen, High temperature

Impaired waters are those that have been identified and listed pursuant to Section 303(d) of the Clean Water Act. Listed waters may be awaiting further study, in which case applicable law is applied to the portion of the waterbody that was listed (segment or grid). For other listings, a water clean-up plan or TMDL identifies the actions that must be taken to restore the waters. TMDLs typically apply to a watershed and set conditions for identified contributors to the impairment.

General permit coverage cannot be issued to new facilities that will cause or contribute to the impairment of listed waterbodies. Existing facilities that have potential to cause or contribute to impairment of listed waterbodies must monitor their discharge for the listed pollutants.

This draft permit applies water quality-based numeric effluent limitations for facilities discharging to impaired water bodies that are “listed” due to pollutants typically present in WTP wastewater discharges. Facilities discharging to any waterbodies with 303(d)-listings (Category 5) would be subject to numeric effluent limitations for the 303(d)-listed parameter (e.g., if receiving waterbody listed for low pH, the facility would be subject to a numeric effluent limitation for pH). The technical basis for these limitations is described below.

pH

Facilities with outfalls to freshwater on the 303(d) list for pH are subject to a water quality based numeric effluent limitation, applied end-of-pipe, as follows:

- Between 6.0 and 8.5 if the 303(d) listing was for high pH only;
- Between 6.5 and 9.0 if the 303(d) listing was for low pH only; and
- Between 6.5 and 8.5 if the 303(d) listing was for both low and high pH.

Narrative Criteria

In addition to numerical criteria, "narrative" water quality criteria (WAC 173-201A-030) limit toxic, radioactive, or deleterious material concentrations below those which have the potential to adversely affect characteristic water uses, cause **acute** or **chronic toxicity** to biota, impair aesthetic values, or adversely affect human health. Narrative criteria protect the specific beneficial uses of all fresh (WAC 173-201A-130) and marine (WAC 173-201A-140) waters in the State of Washington. The typical discharge from WTPs is not expected to contain pollutants of concern other than those that are identified and discussed in this section. However, the general permit does not authorize any discharge that will adversely affect the characteristic water uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health. If Ecology determines that any specific discharge may be causing a water quality violation, the Permittee must correct the problem and may need to apply for an individual permit.

Antidegradation

The purpose of the State of Washington's **antidegradation policy** (WAC 173-201A Part III) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to impact the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).

The antidegradation policy requires that discharges into a receiving water shall not further degrade the existing water quality of that receiving water. In cases where the **natural conditions** of a receiving water are of lower quality than the assigned criteria, the natural conditions shall constitute the water quality criteria. Similarly, when the natural conditions of a receiving water are of higher quality than the assigned criteria, the natural conditions shall constitute the water quality criteria. Dischargers must maintain and protect existing and designated uses and must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in Chapter 173-201A WAC. Where water quality criteria are not met because of natural conditions, human actions are not allowed to further lower the water quality, except where explicitly allowed in Chapter 173-201A WAC.

WTP discharges are typically of high quality. The primary pollutants are chlorine and suspended solids. Chlorine dissipates rapidly and is not expected to degrade the receiving water outside of the area of initial discharge. This general permit includes a chlorine limit that addresses water quality concerns in the area of discharge. Suspended solids can degrade water quality in the receiving water. Although settleable solids are not a direct measure of suspended solids, low levels of settleable solids typically indicate low levels of suspended solids. This permit sets a discharge limit for settleable solids. Ecology expects that discharges that comply with that limit for settleable solids will not include suspended solids at levels that degrade the receiving water. For these reasons, plus the adaptive 5-year permit cycle that requires evaluation of any new data and public review at each iteration, the proposed permit conditions will protect existing and designated uses of the receiving water.

Mixing Zones

A **mixing zone** is the defined area in the receiving water surrounding the discharge point(s), where wastewater mixes with receiving water. Within mixing zones, the pollutant concentrations may exceed water quality numeric standards, so long as the discharge does not interfere with designated uses of the receiving waterbody (for example, recreation, water supply, and aquatic life and wildlife habitat, etc.) The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.

The Water Quality Standards allow the Ecology to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Ecology may authorize both "acute" and "chronic" mixing zones for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone.

However, mixing zones can only be authorized for discharges that are receiving AKART and in accordance with other mixing zone requirements of WAC 173-201A-400. RCW 90.48.555(12) applies to this permit and addresses mixing zones. It states: “The department may authorize mixing zones only in compliance with and after making determinations mandated by the procedural and substantive requirements of applicable laws and regulations”. The applicable laws and regulations include federal Clean Water Act, RCW 90.48, Chapter 173- 200 WAC, Chapter 173-201A WAC, Chapter 173-204 WAC, and human health-based criteria in the National Toxics Rule (40 CFR 131.36).

No mixing zones are authorized in this permit. Since a general permit must apply to a number of different sites, precise mixing zones and the resultant dilution are not applicable to facilities covered under a general permit. The use of a dilution factor in deriving a limit is not considered the authorization of a mixing zone, but Ecology has determined that a modest dilution factor is protective and consistent with WAC 173-201A-400. The conservative dilution factor of 3.5 used in this permit to calculate the chlorine water-quality based limit is carried over from the dilution factor used in the previous WTPGP.

Any discharger may request a mixing zone through an application for an individual permit in accordance with WAC 173-220-040 or WAC 173-216-070. The following conditions must be fulfilled prior to Ecology allowing a mixing zone for WTPs:

1. The permit must specify both the allowed size and location of the mixing zones.
   Since this is a general permit, the size and location of the mixing zones were based on assumptions that accounted for WTPs as a group.
2. AKART.
   Each permitted WTP must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.
3. Determination of dilution factors must be based on critical discharge conditions.
   Since this is a general permit, critical conditions were based on assumptions that accounted for generalized critical conditions for WTPs as a group.
4. Supporting information must clearly indicate the mixing zone will not:
   (a) Have a reasonable potential to cause the loss of sensitive or important habitat.
   (b) Substantially interfere with the existing or characteristic uses.
   (c) Cause or contribute to **damage to the ecosystem**.
   (d) Adversely affect public health.
5. Ecology has concluded that if WTP discharges comply with the permit limits, they will not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristic uses, cause damage to the ecosystem, or adversely affect public health.
6. The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of the mixing zone. Ecology conducted a reasonable potential analysis, using procedures established by the U.S. EPA and by Ecology, for each pollutant and concluded that if permit limits are met, the discharge and receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone.
7. The size of the mixing zone and the concentrations of the pollutants must be minimized.
   Ecology has effectively minimized the size of the mixing zone authorized in this permit.
8. Maximum size of mixing zone.
   The authorized mixing zone does not exceed the maximum size restriction.
9. Acute mixing zone.
   (a) The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.
   (b) Ecology determined the acute criteria will be met at 10% of the distance (or volume fraction) of the chronic mixing zone at the 10-year low flow.

(c) The pollutant concentration, duration, and frequency of exposure to the discharge will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.

(d) Comply with size restrictions.

(e) The mixing zone authorized for this discharge complies with the size restrictions published in Chapter 173-201A WAC.

10. Overlap of Mixing Zones. This mixing zone may not overlap another mixing zone.

The water quality standards allow Ecology to authorize mixing zones around a point of discharge in establishing surface water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment near the point of discharge. The concentration of pollutants at the boundary of these mixing zones may not exceed the numerical criteria for that type of zone. Mixing zones can only be authorized for discharges that are receiving all known, available, and reasonable methods of prevention, control and treatment (AKART) and in accordance with other mixing zone requirements of WAC 173-201A-100.

Sediment Quality

Ecology has promulgated aquatic sediment standards (Chapter 173-204 WAC) to protect aquatic biota and human health. These standards state that Ecology may require Permittees to evaluate the potential for their discharge to cause a violation of applicable standards (WAC 173-204-400). Ecology has determined through a review of WTP operations and their effluent characteristics that the discharges permitted by this WTP general permit present no reasonable potential to violate the sediment management standards.

Groundwater Quality

Ecology has promulgated groundwater quality standards (Chapter 173-200 WAC) to protect beneficial uses of groundwater. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100). In 2018, Ecology assessed the risk from arsenic contamination of WTP discharges (Ecology, April 2018) and found no reasonable potential to exceed water quality criteria for protecting aquatic life in surface waters. Ecology has determined to date that since incidental discharge to ground by WTPs is not a substantive risk to the groundwaters of the State, permit limits to protect groundwater quality are not required. Ecology reassessed the risk to groundwater with additional monitoring and operational data in 2021 (see Section 4.1, Wastewater Monitoring).

Whole Effluent Toxicity

The water quality standards for surface waters forbid discharge of effluent that has the potential to cause toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available analytical methods. However, laboratory tests can measure **toxicity** directly by exposing living organisms to the wastewater and measuring their responses. Since these tests measure the aggregate toxicity of the whole effluent, this approach is called whole effluent toxicity (WET) testing. Some WET tests measure ***acute toxicity***, and other WET tests measure chronic toxicity.

Ecology's reasonable potential analysis for total residual chlorine showed that WTP discharge has the potential "to discharge toxics in **toxic amounts**." However, Ecology has determined that WET testing is not a good tool for regulating chlorine toxicity (Ecology, 2008). The volatility of chlorine, aeration of test solutions, elevated test temperature, and duration of the test prevent the WET test method from producing an accurate assessment of chlorine toxicity. The use of U.S. EPA water quality criteria is adequate for determining water quality limits for chlorine. Therefore, this permit does not require WET testing. Ecology may require WET testing in the future if it receives information indicating that toxicity may be present in WTP effluent.

Evaluation of Surface Water Quality-Based Effluent Limits

Pollutants in an effluent may affect the aquatic environment near the point of discharge or at a considerable distance from the point of discharge. Thus, the method of calculating surface water quality-based effluent limits should vary with the point at which the pollutant has its maximum effect. The derivation of surface water quality-based limits must also account for the variability of the pollutant concentrations in both the effluent and the receiving water. Ecology determined the potential impacts of WTP discharges on dissolved oxygen, pH, chlorine, **turbidity**, and temperature and whether an effluent limit and periodic monitoring were required using the dilution factor mentioned above.

Arsenic

Ecology required Permittees to monitor the concentrations of total and dissolved arsenic in their effluent monthly from September 2016 through August 2017 (Ecology, April 2018). Analysis of the results found that there was not a reasonable potential to violate applicable arsenic criterion in discharges to surface waters. Therefore, an effluent limit for arsenic was not included in the proposed permit. A summary of this data is shown in Table 4.

Chlorine

Federal regulations (40 CFR 122.44) require NPDES permits to contain water quality based effluent limits for toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. This process occurs concurrently with the derivation of technology-based effluent limits. Facilities with technology-based effluent limits defined in regulation are not exempted from meeting the water quality standards for surface waters or from having surface water quality-based effluent limits.

Chlorine is frequently present in discharges of WTP backwash. Chlorine can cause acute toxicity in a very short exposure period. Chlorine concentrations in WTP discharges occasionally exceed surface water quality standards and sometimes exceed the technology-based limit. Available dilution may not always be sufficient to assure that chlorine will not exceed surface water quality standards outside of the acute mixing zone. However, Ecology does not consider chronic toxicity to be as great an issue due to the intermittent nature of the discharges and the adequate dilution available in the chronic mixing zone.

Since WTP discharges are brief and episodic, Ecology considered its use of the U.S. EPA calculation methodology (U.S. EPA, 1991), which assumed continuous discharge, to be conservative. Ecology assessed reported chlorine concentrations over time (Table 7) and conducted a reasonable potential analysis for chlorine to determine whether it would require an effluent limit for chlorine in this permit. The proposed permit retains the previous permits water quality-based limit for total residual chlorine (0.07 mg/L) based on the acute water quality criterion for aquatic life, and the requirement for routine monitoring will continue. The proposed permit includes a water quality-based limit for total residual chlorine of 0.07 mg/L based on the acute water quality criterion for aquatic life that was included in the previous permit.

Table 7: Reported Chlorine Concentrations in Discharges over Time

	1998 - 2013	September 2014 - August 2018	September 2018 – October 2023
Total number of samples	5,088	2,139	3,908
Average chlorine concentration (mg/L)	0.11	0.023	0.02
Coefficient of variation	11.9	1.29	0.65
95th Percentile (mg/L)	0.37	0.060	0.06
Total number of Permittees who exceeded the limit of 0.07 mg/L	30 (all of them)	10	5

Dissolved Oxygen

During the first permit cycle from January 1998 through August 2003, Permittees reported the dissolved oxygen concentration in their discharge. Dissolved oxygen values largely exceeded (were better than) standards for surface waterbodies. The few exceptions were not expected to violate standards after consideration of available dilution. Therefore, none of the subsequent WTP general permits included monitoring for dissolved oxygen. Based on this information, Ecology did not include limits for dissolved oxygen in the draft permit.

pH

The historical data for WTPs have consistently shown pH values in the range of 6.0 to 9.0 S.U. (Table 2). The technology-based limit for WTPs is a range of pH from 6.0 to 9.0 S.U. Considering the available dilution in and buffering capacity of receiving waters, Ecology expects that proper treatment of filter backwash wastewater will comply with the technology-based pH criteria in fresh waters under critical conditions. The proposed permit retains the technology-based effluent limits for pH and routine monitoring for pH from the previous permit. In addition, the proposed permit requires that certain facilities discharging to pH-impaired waterbodies are subject to numeric water quality based effluent limits according to Table 8.

Table 8: Effluent Limits applicable to Discharges to 303(d)-listed Waters

Parameter	Receiving Water Category	Daily Minimum Discharge Limit	Daily Maximum Discharge Limit
• pH[(a)]	• Marine waters	• 7.0 S.U.	8.5 S.U.
• pH[(a)]	• Fresh water – low pH impaired	• 6.5 S.U.	9.0 S.U.
• pH[(a)]	• Fresh water – high pH impaired	• 6.0 S.U.	8.5 S.U.
• pH[(a)]	• Fresh water – low and high pH impaired	• 6.5 S.U.	8.5 S.U.

(a) The averaging of pH values is not allowed.

Temperature

During the first permit cycle from January 1998 through August 2003, Permittees reported the temperature of their discharge. Temperature values were consistently below 18 degrees Celsius, with only a few exceptions. Those few exceptions would not have violated Washington State temperature standards (WAC 173-201A-200/-210 and 600-612) after allowance of the available dilution. Therefore, temperature monitoring is not required.

Turbidity

Based on the historical range of turbidity reported in WTP effluents and the typical turbidity of the receiving waters, turbidity is not likely to be a concern for WTP discharges of backwash wastewater. Specifically, WTP performance during the first 4 years of the current permit cycle (September 1, 2014, through August 31, 2018) was considerably improved compared with earlier monitoring results (Table 9). These facilities filter and/or allow a settling time to remove solids prior to discharging their wastewater. After even a small amount of dilution, the remaining turbidity in the discharge will likely not violate standards. However, when the source surface water for a water treatment facility is very turbid (e.g., during flood conditions) and frequent backwash is required, excessive turbidity may be an issue. A permit limit for turbidity will not be included in the permit, but the benchmark and monitoring for turbidity will continue.

Table 9: Reported Turbidity Concentrations in Discharges over Time

	1998 - 2013	September 2014 - August 2018	September 2018 – August 2023
Total number of samples	3,316	3,383	4795
Average turbidity concentration (NTU)	10.1	2.45	2.88
Coefficient of variation	4.4	4.27	1.49
95th Percentile (NTU)	38.9	6.61	11.2
Total number of Permittees who exceeded a benchmark of 25 NTU	8	6	4

While Ecology has not proposed a numerical effluent limit for turbidity, Ecology has identified (a) A **benchmark** level for turbidity; and (b) The adaptive management actions that Ecology expects from Permittees following an exceedance of that benchmark.

A benchmark is a pollutant concentration used as a threshold, below which a pollutant is unlikely to cause a water quality violation, and above which it may. Benchmark values are not water quality standards and not numeric effluent limits – they are indicator values. Often when a pollutant concentration exceeds a benchmark, some active response may be necessary, i.e., adaptive management. The benchmark for turbidity in discharges of treated wastewater from backwashing of water treatment filtration systems is 25 Nephelometric turbidity units (NTUs).

Adaptive management is a structured, iterative process of robust decision making in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring. In this way, decision making simultaneously meets one or more resource management objectives and, either passively or actively, accrues information needed to improve future management. Adaptive management is a tool which should be used not only to change a system, but also to learn about the system. Since adaptive management is based on a learning process, it improves long-run management outcomes. The challenge in using the adaptive management approach lies in finding the correct balance between gaining knowledge to improve management in the future and achieving the best short-term outcome based on current knowledge.

Applying benchmarks and adaptive management to address the infrequent instances of excessive turbidity in wastewater discharges from WTPs is similar to processes required by several other Ecology general permits. Permitted discharges of wastewaters to State waters must use all known, available, and reasonable treatment methods to prevent and control pollution of the waters of the State, i.e., AKART (RCW 90.48.010). Adaptive management is one component of AKART and is thus also required by State law.

In the event of a minor benchmark exceedance (26 through 250 NTUs), Ecology will require the Permittee to review facility operations, determine the likely cause of the benchmark exceedance, modify operations to prevent a reoccurrence of the exceedance, update the relevant planning document(s) as needed, and preserve documentation of the exceedance and corrective action within 10 **calendar days** of the date the discharge exceeded the benchmark. If a major exceedance of the turbidity benchmark occurs (greater than 250 NTUs), the same adaptive management steps are required, though preceded by (a) Containing and minimizing environmental harm; and (b) Reporting the exceedance to Ecology.

MONITORING REQUIREMENTS

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits. Samples and measurements must be representative of the volume and nature of the monitored discharge or pollutant, including representative sampling of any unusual discharge or discharge condition, including **bypasses**, **upsets**, and **maintenance**-related conditions affecting effluent quality [40 CFR 122.41(j)(1)]. Monitoring must occur at intervals sufficiently frequent to yield data that reasonably characterize the nature of the monitored discharge or pollutant.

Ecology may require monitoring of intake water, influent to treatment facilities, internal waste streams, and/or receiving waters to verify compliance with net discharge limits or removal requirements, to verify the maintenance of proper waste treatment or control practices, or to determine the effects of the discharge on the waters and sediments of the State.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, **detection level**, and **quantitation level** in the discharge monitoring report and in any other required report.

WASTEWATER MONITORING

Required monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, significance of pollutants, and cost of monitoring. The quantity of wastewater discharged from small facilities is significantly less than from large facilities, but the cost of monitoring for the small facility per residential connection is much greater than for larger facilities. The typical characteristics and treatment of groundwater produce less variability in the wastewater discharge than from the treatment of surface water. Therefore, Ecology has divided the monitoring schedule into two tiers based on the capacity of a facility to produce finished water (facility size) and the source of raw water (groundwater or surface water).

- Group 1 facilities are those that have a maximum production capacity of less than 4 million gpd or use only groundwater for their source water.
- Group 2 facilities are those with a maximum production capacity of at least 4 million gpd and treat surface water.

For the purpose of distinguishing the sources of raw water, "surface water" includes both surface waters of the State and "groundwater under the direct influence of surface water," as defined by the Washington State Department of Health. Sources of groundwater under the direct influence of surface water include all infiltration galleries, Ranney wells, springs, and **wells** less than 50 feet deep within 200 feet of surface water, unless designated otherwise by the Washington State Department of Health.

The permit requires monitoring of total residual chlorine, pH, and settleable solids to document compliance with permit limits. Monitoring for total **daily discharge** volume, total daily number of discharge events, and turbidity is also required to further characterize and quantify the effluent. Flow data will enable Ecology to develop better estimates of total pollutant loadings to State waters. Since WTPs are typically aware of the rates and volumes of their wastewater discharges, providing monthly summaries of these values in their discharge monitoring reports will not be a significant burden. The monitoring schedule is detailed in the proposed general permit under Special Condition S-5 (Monitoring Requirements).

Consistent Attainment

The draft permit proposes to reduce sampling based upon the "consistent attainment" of effluent limits. Consistent attainment means that two years of consecutive samples (Monthly for Group 1 and Weekly for Group 2) demonstrate a reported value equal to or less than the permit limit; or for pH, within the range of 6.0 – 9.0. For tallying consecutive samples, facilities need to account for periods when no sample is taken. If a discharge occurred during a sampling period and a facility did not grab a sample, then the facility must restart sampling. If a discharge did not occur during regular business hours, a facility does not have to restart sampling. A "No Discharge" period does not count as a sample.

Upon achieving consistent attainment, a permittee may reduce monitoring until September 30, 2029 (Quarterly for Group 1 and Monthly for Group 2). After the permit is reissued, the permittee must requalify for consistent attainment status. Once in consistent attainment, if a sample exceeds the limit for a parameter, the permittee no longer meets consistent attainment status and must resume the original sampling frequency. They may restart the count to requalify for consistent attainment.

Reduction of sampling based on consistent attainment does not apply to pollutant parameters subject to "report only" requirements (Total Daily Volume of Discharge or Total Daily Number of Discharge Event) or impaired water bodies subject to Section 303(d) of the Clean Water Act or a TMDL (Condition S-2.3).

Laboratory Accreditation

Ecology requires that Permittees use a laboratory registered or accredited under the provisions of Chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters specified therein). Facilities that conduct their own analyses for the required monitoring and reporting must be accredited. If a facility must monitor total residual chlorine, then its laboratory must be accredited for total residual chlorine, pH, and turbidity.

Effluent Limits which are Near Detection or Quantitation Levels

The effluent concentration limits for total residual chlorine and settleable solids are near the limits of current analytical methods to detect or accurately quantify. The detection level (DL) is the minimum concentration of a pollutant that a laboratory can measure and report with a 99% confidence that its concentration is greater than zero (as determined by a specific laboratory method). The quantitation level (QL) is the concentration at which a laboratory can reliably report values with a specified level of error. Estimated concentrations are the values between the DL and the QL. Ecology requires permitted facilities to report estimated concentrations. When reporting maximum daily effluent concentrations, Ecology requires the facility to report “less than X” where X is the required MDL if the measured effluent concentration falls below that level.

OTHER PERMIT CONDITIONS

REPORTING AND RECORDKEEPING

Ecology based Special Condition S-6 (Reporting and Recordkeeping Requirements) on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-220-210). Permittees must submit discharge monitoring reports to Ecology by the 15th of every month using the online Ecology WebDMR program[5].

Permittees are to maintain the following planning documents, up to date, and fully implemented:

- Operation and Maintenance Manual
- Solid Waste Control Plan
- Stormwater Pollution Prevention Plan
- Spill Contingency Plan

NON-ROUTINE AND UNANTICIPATED WASTEWATER

Non-routine and unanticipated wastewater consists of process wastewater not identified in Special Condition S-1.2.1 (Process Wastewater), not routinely discharged, and not anticipated at the time of permit application, such as waters used to pressure-test storage tanks or fire water systems, or leaks from drinking water systems.

The proposed general permit authorizes non-routine and unanticipated discharges under certain conditions. The Permittee must characterize the non-routine wastewater for pollutants and examine the opportunities for reuse. Prior to discharging the non-routine wastewater, the Permittee must obtain approval from Ecology on a case-by-case basis.

Any discharges not specified in Special Condition S-1.2.1 (Process Wastewater) must be addressed in accordance with the terms and conditions of this section.

1. Beginning on the effective date of this permit, prior to any discharge of non-routine and unanticipated wastewater, the Permittee must contact Ecology and provide the following information at a minimum:
   (a) The proposed discharge location.
   (b) The nature of the activity that will generate the discharge.
   (c) Any alternatives to the discharge, such as reuse, storage, or recycling of the water.
   (d) The total volume of water it expects to discharge.
   (e) The results of the chemical analysis of the water.

[5] https://ecology.wa.gov/regulations-permits/guidance-technical-assistance/water-quality-permits-guidance/wqwebportal-guidance

(f) The date of the proposed discharge.

(g) The expected rate of discharge, in gallons per minute.

2. The Permittee must analyze the wastewater for all parameters with effluent limits in this permit and must report the results as required by Special Condition S-5 (Monitoring Requirements), along with any other parameter deemed necessary by Ecology, using the methods and quantitation levels specified by Ecology.
3. Depending on the nature and extent of pollutants in the wastewater and any opportunities for reuse, Ecology may:

   (a) Authorize the facility to discharge the wastewater.

   (b) Require the facility to treat the wastewater.

   (c) Require the facility to reuse the wastewater.

4. All discharges must comply with the effluent limits established in Special Condition S-2 (Limits and Standards); water quality standards; and any other limits imposed by Ecology.

   (a) The discharge may not proceed until Ecology has reviewed the Permittee's request and has authorized the discharge by Administrative Order. Once approved and if the proposed discharge is to a municipal storm drain, the Permittee must obtain prior approval from the municipality and notify it when the permittee plans to discharge.

Operations, maintenance, and planning documents

Spill Plan

Ecology has determined that WTPs typically store a quantity of chemicals that have the potential to cause water pollution if accidentally released. Also, WTPs often employ hyper-chlorination treatment for facility and delivery system sanitation. Disposal of this highly chlorinated water has the potential to cause water pollution if appropriate measures are not taken. Ecology has the authority under Section 402(a)(1) of the CWA, RCW 90.48.180, and RCW 90.48.520 to require the Permittee to develop best management plans to prevent the accidental release of chemicals and to require appropriate handling and release of hyper-chlorinated water. Disposal of hyper-chlorinated water to surface water is prohibited.

The general permit requires the Permittee to develop, maintain, and implement a spill plan for:

1. Preventing the accidental release of pollutants to waters of the State and for minimizing damages if such a spill occurs.
2. Managing the safe release of hyper-chlorinated water either through de-chlorination or through containment followed by discharge to land.
3. The Permittee must keep an up-to-date version of the spill plan readily available onsite.

Solid Waste Control Plan

Treatment in a lagoon or settling tank to reduce the amount of solids in wastewater discharges produces an accumulation of residual solids. Ecology has determined that the accumulation of residual solids from WTPs has a potential to cause pollution of the waters of the State via leachate from that solid waste. Due to this potential of the solid waste generated by WTPs to pollute waters of the state, this general permit requires that the Permittee have a solid waste control plan that meets the minimum requirements found in Chapter 173-350 WAC.

The proposed permit requires the Permittee to submit the plan to the local permitting agency and to Ecology for approval and must keep an up-to-date version of the plan readily available on-site. Ecology has prepared a focus sheet[6] to assist permittees when creating their solid waste control plan. Improper storage or disposal can result in the entry of those solids into surface waters. Inattention to management of accumulating solids can result in pollutants entering groundwater. While the residual solids tend to be stable and insoluble, under acidic or anoxic conditions, this stability is not assured. If allowed to build up, solid materials may solubilize and be carried to groundwater. Therefore, periodic removal and beneficial use or disposal of the solid residuals is necessary.

Ecology encourages the application of residual solids to a beneficial use rather than to a landfill. In most cases, WTP residuals may be classified as nonhazardous solid waste, but a toxicity characteristic leaching procedure (TCLP) test will likely be necessary to assure that the residuals do not qualify as "hazardous" under federal or "**dangerous"** under State **waste** regulations. Beneficial use can include incorporation in a product such as concrete, direct application to soil at an approved **agronomic rate**, or addition as a component of a soil mix. Any beneficial use must be consistent with any local requirements for a solid waste permit, and approval must be obtained from the jurisdictional health department before undertaking a beneficial use project.

Operation and Maintenance Manual

Ecology requires WTPs to take all reasonable steps to properly operate and maintain their wastewater treatment system in accordance with federal and State regulations [40 CFR 122.41(e) and WAC 173-220-150 (1)(g)]. WTPs must prepare an operation and maintenance manual as required by state regulation for the construction of wastewater treatment facilities (WAC 173-240-150). Implementation of the procedures in the operation and maintenance manual must ensure compliance with the terms and limits in this permit. Each Permittee must keep an up-to-date version of their operation and maintenance plan readily available on site.

[6] https://apps.ecology.wa.gov/publications/SummaryPages/0710024.html

Stormwater Pollution Prevention Plan

In accordance with 40 CFR 122.44(k) and 40 CFR 122.44(s), the reissued permit includes requirements for the development and implementation of a stormwater pollution prevention plan (SWPPP) along with best management practices (BMPs) to minimize or prevent the discharge of pollutants via stormwater discharged from areas associated with industrial activity to waters of the State. BMPs constitute best conventional pollutant control technology (BCT) and best available technology economically achievable (BAT) for stormwater discharges. Ecology has determined that each Permittee that discharges stormwater associated with industrial activity to a surface waterbody or to a stormwater conveyance system that discharges to a surface waterbody must develop a SWPPP and implement adequate BMPs in order to meet the requirement for AKART.

The purpose of a SWPPP is to prevent the contamination of stormwater to the maximum extent practical. The SWPPP must identify the potential contaminants to stormwater, the potential sources of stormwater contamination from industrial activities, and the actions that the facility must implement to manage stormwater and the sources of contamination to comply with the requirement under Chapter 90.48 RCW to prevent or minimize contamination of stormwater to protect the beneficial uses of waters of the State.

Each Permittee must continuously review and revise its SWPPP as necessary to assure that stormwater discharges do not degrade water quality. Each Permittee must retain the SWPPP on site or within reasonable access to the site and available for review by Ecology.

Best Management Practices

Best management practices (BMPs) are the actions identified to manage, prevent contamination of, and treat stormwater. BMPs identify schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs also identify treatment systems, operating procedures, and practices used to control plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage. Permittees must ensure that their SWPPP includes the operational and **structural source control BMPs** listed as "applicable" in the applicable Ecology **stormwater management manual** (Stormwater manuals - Washington State Department of Ecology[7])

Ecology-Approved Stormwater Management Manuals

Consistent with RCW 90.48.555(5) and (6), the reissued permit requires each Permittee to implement BMPs described in the applicable "Stormwater Management Manual for Western [or Eastern] Washington," or any revisions thereof, or practices that are **demonstrably equivalent** to practices contained in stormwater technical manuals approved by Ecology. This should ensure that BMPs will prevent violations of State water quality standards and satisfy the State AKART requirements and the federal technology-based treatment requirements under 40 CFR Part 125.3. The SWPPP must document that the selected BMPs provide an equivalent level of pollution prevention, compared to the

[7] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals

applicable stormwater management manuals, including the technical basis for the selection of each stormwater BMP (scientific, technical studies, and/or modeling) which supports the performance claims for the selected BMPs.

Operational Source Control BMPs

Operational source control BMPs include a schedule of activities, prohibition of practices, maintenance procedures, employee training, good housekeeping, and other managerial practices to prevent or reduce the pollution of waters of the State. These activities do not require construction of pollution control devices but are very important components of a successful SWPPP. Employee training, for instance, is critical to achieving timely and consistent spill response. Pollution prevention is likely to fail if employees do not understand the importance and objectives of BMPs. Examples of pollution prevention include eliminating outdoor repair work on equipment and prohibiting the draining of crankcase oil onto the ground. Good housekeeping and maintenance schedules help prevent incidents that could result in the release of pollutants. Operational BMPs are cost-effective methods to control pollutants and protect the environment. The SWPPP must identify all the operational BMPs and how and where they are to be implemented. For example, the SWPPP must identify the subject matter of applicable training, when training will take place, and who is responsible to assure that employee training occurs.

Structural Source Control BMPs

Structural source control BMPs include physical, structural, or mechanical devices or facilities intended to prevent pollutants from entering stormwater. Examples of source control BMPs include **erosion** control practices, maintenance of stormwater facilities (e.g., cleaning out sediment traps), construction of roofs over storage and working areas, and direction of equipment wash water and similar discharges to the **sanitary sewer** or a dead-end sump. Structural source control BMPs likely include a capital investment but are cost effective compared to cleaning up pollutants after they have entered stormwater.

Treatment BMPs

Operational and structural source control BMPs are designed to prevent pollutants from entering stormwater. However, even with an aggressive and successful program, stormwater may still require treatment to achieve compliance with water quality standards. **Treatment BMPs** remove pollutants from stormwater. Examples of treatment BMPs are **detention ponds**, oil/water separators, biofiltration, and constructed **wetlands**.

Volume and Flow Control BMPs

Ecology recognizes the need to include specific BMP requirements for stormwater runoff quantity control to protect beneficial water uses, including fish habitat. Controlling the rate and volume of stormwater discharge maintains the health of the watershed. New facilities and existing facilities undergoing **redevelopment** must implement the requirements for peak runoff rate and volume control identified in the applicable “Stormwater Management Manual for Western [or Eastern] Washington,” or any revisions thereof. Permittees should identify volume and flow control measures that they can implement over time to reduce the impact of uncontrolled release of stormwater.

COMPLIANCE SCHEDULE

The proposed general permit does not include a compliance schedule that would require additional monitoring or reporting beyond that already required.

PERMIT ISSUANCE PROCEDURES

PERMIT MODIFICATIONS

Ecology may modify this permit to impose numeric limits, if necessary to comply with water quality standards for surface waters, with **sediment quality standards**, or with water quality standards for groundwaters, after obtaining new information from sources such as inspections, and effluent monitoring.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

PERMIT TERM

This permit includes all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the State of Washington. Ecology is issuing this permit for a term of 5 years.

ECONOMIC IMPACT ANALYSIS

This Small Business Economic Impact Analysis (SBEIA) estimates the costs of complying with the draft Water Treatment Plant General Permit ("permit"). This analysis is required by state rule in Washington Administrative Code (WAC) 173-226-120[8], which directs Ecology to determine if the permit imposes disproportionate burden on small businesses, and if it does, to mitigate the disproportion to the extent that is legal and feasible.

WAC 173-226-120 requires the SBEIA to include:

- A brief description of the compliance requirements of the general permit.
- The estimated costs of complying with the permit, based on existing data for businesses intended to be covered under the general permit.
- A comparison, to the greatest extent possible, of the cost of compliance for small businesses with the cost of compliance for the largest ten percent of businesses intended to be covered under the permit.
- A summary of how the permit provides mitigation to reduce the effect on small businesses (if a disproportionate impact is expected), without compromising the mandated intent of the permit.

The proposed general permit provides coverage for discharges of wastewater from water treatment filtration processes (filter backwash, sedimentation/pre-sedimentation wash-down, sedimentation/clarification, or filter-to-waste) to, and stormwater waters of, the State, if water treatment is the primary function of the facility and actual production volume of treated product water (finished water) is at least 35,000 gallons per day (gpd) as determined on an average monthly basis. The general permit does not provide coverage for water treatment plants (WTPs) with an average monthly production rate of less than 35,000 gpd under certain conditions, nor for wastewater resulting from ion exchange, reverse osmosis, or slow sand filtration processes.

The proposed general permit includes technology-based limits for pH and settleable solids, and a water quality-based limit for total residual chlorine. The proposed permit requires no additional water quality-based effluent limits, however, WTPs must monitor and report the turbidity and volume of their discharges.

Estimated costs of compliance under the Water Treatment Plant General Permit appear in Table 10.

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[8] Chapter 173-226 WAC Waste Discharge General Permit Program
https://apps.leg.wa.gov/wac/default.aspx?cite=173-226

Table 10: Summary of Compliance Costs.

Permit requirements	Cost per Group 1 facility	Cost per Group 2 facility
Initial Public newspaper notice (one-time)	$420	$420
Capital costs for sampling and testing equipment (one-time)	$480	$480
Sampling and testing (annual)	$793	$3,435
Reporting (annual)	$78	$156

Currently, the general permit does not cover any businesses (all permittees are municipal facilities). However, a business meeting the criteria for coverage could be covered by this permit. If this were to happen, the general permit would likely impose disproportionately larger costs on smaller businesses. While the compliance costs we estimate vary by facility size, size is not measured by number of employees. Group 1 facilities could be large based on number of employees and Group 2 facilities could be small based on number of employees. Since proportionality is determined by cost per employee, and the costs do not vary by number of employees, it necessarily must be disproportionate.

The general permit likely imposes disproportionate costs on small businesses, so Ecology took the legal and feasible actions described in this chapter to reduce small business compliance burden.

Ecology considered options for lessening the burden of permit compliance on businesses where possible while protecting water quality and maintaining compliance with federal and state law and rule. There are currently no exemptions for businesses with fewer than 50 employees. There are included, however, mitigation opportunities for all businesses.

Factors that mitigate disproportionate costs:

- Permittees may request a reduction in sampling frequency based on consistent attainment of permit limits. For permittees in Monitoring Group 1 who obtain consistent attainment, the new sampling frequency is quarterly. For permittees in Monitoring Group 2 who obtain consistent attainment, the new sampling frequency is monthly.
- Facilities with an actual production rate of less than 35,000 gallons per day of treated product water are exempt from the permit unless they:
  - (b) Are a significant contributor of pollutants to waters of the state, including groundwater; or
  - (c) May reasonably be expected to cause a violation of any water quality standard.

Group 1 facilities (those producing less than 4 million gpd or use only ground water for their water source sample less frequently than Group 2 facilities. This lessens the burden on the relatively smaller sites.

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Documents prepared after June 12, 2014, also identify information sources by the following 11 categories:

1) Peer review is overseen by an independent third party.
2) Review is by staff internal to Department of Ecology.
3) Review is by persons that are external to and selected by the Department of Ecology.
4) Documented open public review process that is not limited to invited organizations or individuals.
5) Federal and state statutes.
6) Court and hearings board decisions.
7) Federal and state administrative rules and regulations.
8) Policy and regulatory documents adopted by local governments.
9) Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under other processes.
10) Records of best professional judgment of Department of Ecology employees or other individuals.
11) Sources of information that do not fit into one of the other categories listed.

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APPENDIX A
ACRONYMS AND UNITS OF MEASURE

Acronym	Meaning
AKART	All known, available, and reasonable methods of prevention, control, and treatment
ANSI	American National Standards Institute
BAT	Best available technology economically achievable
BCT	Best conventional pollutant control technology
BMP	Best management practice
BPT	Best practicable control technology currently available
COD	Chemical oxygen demand
CFR	Code of Federal Regulations
CWA	Clean Water Act
Ecology	Washington State Department of Ecology
EER	Electrodialysis/electrodialysis reversal
EPA	Environmental Protection Agency
FWPCA	Federal Water Pollution Control Act (same as Clean Water Act)
IE	Ion exchange
IX	Ion exchange
MCL	Maximum contaminant level
NPDES	National Pollutant Discharge Elimination System
NSF	National Science Foundation
O&M	Operation and maintenance
PCHB	Pollution Control Hearings Board
PNOD	Public Notice of Draft
POTW	Publicly-owned treatment works
QL	Quantitation limit
RCW	Revised Code of Washington State

RO	Reverse osmosis
SAIC	Science Applications International Corporation
SEPA	State Environmental Policy Act, RCW 43.21C
SIU	Significant industrial user
SWPPP	Stormwater pollution prevention plan
TDS	Total dissolved solids
TMDL	Total maximum daily load
TRC	Total residual chlorine
TSS	Total suspended solids
TCLP	Toxicity characteristic leaching procedure
U.S.	United States
WAC	Washington Administrative Code
WET	Whole effluent toxicity
WTP	Water treatment plant

Unit of Measure	Meaning
cfs	Cubic feet per second
gpd	Gallons per day
gal/yr	Gallons per year
kg/day	Kilograms per day
lbs/yr	Pounds per year
mg/L	Milligrams per liter
µ/L	Micrograms per liter
mL/L	Milliliters per liter
NTU	Nephelometric turbidity units
S.U.	Standard units

APPENDIX B
Definitions

303(d) List
The list of waterbodies in Washington State that do not meet the water quality standards specified in Chapter 173-201A WAC. The Washington State Department of Ecology (Ecology) prepares, and the U.S. Environmental Protection Agency approves this list periodically (every 2 years). The list is posted on the Ecology web site[9].

Acute Toxicity
The adverse effects of a substance or a combination of substances on an organism that result either from a single exposure or from multiple exposures in a short period of time (usually from 48 to 96 hours).

Adaptive Management
A structured, iterative process of robust decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. In this way, decision making simultaneously meets one or more resource management objectives and, either passively or actively, accrues information needed to improve future management. Adaptive management is a tool which should be used not only to change a system, but also to learn about the system. Since adaptive management is based on a learning process, it improves long-run management outcomes. The challenge in using the adaptive management approach lies in finding the correct balance between gaining knowledge to improve management in the future and achieving the best short-term outcome based on current knowledge.

Agronomic rate
The **application rate** of biosolids or other source of nutrients that provides the amount of nutrients necessary for the optimum growth of targeted vegetation, and that does not cause the violation of applicable standards or requirements for the protection of groundwater or surface water. The agronomic rate is the rate at which a viable crop can be maintained with minimal leaching of chemicals (e.g., nutrients) downwards below the root zone. When the application field comprises part of a waste treatment system, the operator must manage the crop for maximum nutrient update.

All known, available, and reasonable methods of prevention, control, and treatment (AKART)
A technology-based approach of decision making for limiting pollutants from discharges. AKART represents the most current methodology for preventing, controlling, and abating pollution that can be installed or used at a reasonable cost. Adaptive management is an example of the AKART approach.

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[9] https://ecology.wa.gov/water-shorelines/water-quality/water-improvement/assessment-of-state-waters-303d

Ambient
The existing or typical environmental condition of a geographic area or waterbody at or surrounding a particular location.

Application for coverage
A formal request for coverage under this general permit using the paper or electronic form developed by the Washington State Department of Ecology for that purpose. Also known as a Notice of Intent (NOI).

Application rate
The quantity of material applied to a specific area within a specific timeframe. For example, the application rate of manure or algaecide onto a field or waterbody may be a total of X gallons per acre or Y pounds per acre for a given treatment date or growing season.

Average monthly effluent limit
The greatest average of daily discharges allowed for a calendar month. To calculate the value of the actual average monthly discharge for comparison with the limit, add the value of each daily discharge measured during a calendar month, and divide this sum by the total number of daily discharges measured.

Background
The biological, chemical, physical, and radiological conditions that exist in the absence of any influences from outside an area potentially influenced by a specific activity.

Benchmark
A pollutant concentration used as a threshold, below which a pollutant is unlikely to cause a water quality violation, and above which it may. Benchmark values are not water quality standards and not numeric effluent limits – they are indicator values. Often when a pollutant concentration exceeds a benchmark, some active response may be necessary, i.e., adaptive management.

Best management practice (BMP)
Activity, prohibition, maintenance procedure, or other physical, structural, and/or managerial practice to prevent or reduce pollution of and other adverse impacts to the waters of Washington State. BMPs include treatment systems, operating schedules and procedures, and practices used singularly or in combination to control plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage. BMPs may be further categorized as operational, source control, **erosion and sediment control**, and treatment BMPs.

Best professional judgment (BPJ)
The highest quality technical opinion developed by a permit writer after consideration of all reasonably available and pertinent data or information which forms the basis for the terms and conditions of a National Pollutant Discharge Elimination System permit.

Bypass
The diversion of stormwater or a wastestream from any portion of a treatment facility. A

bypass may be intentional or unintentional.

Carcinogen
Any substance or agent that produces or tends to produce cancer in humans. The term carcinogen applies to substances on the U.S. Environmental Protection Agency lists of A (known human) and B (probable human) carcinogens, and any substance which causes a significant increased incidence of benign or malignant tumors in a single, well conducted animal bioassay, consistent with the weight of evidence approach specified in the U.S. Environmental Protection Agency Guidelines for Carcinogenic Risk Assessment.

Chronic toxicity
The adverse effects of a substance or combination of substances on an organism that result from exposure over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity may affect survival, reproduction or growth rates, or other health-related conditions.

Clean Water Act (CWA) (same as Federal Water Pollution Control Act)
The primary federal law in the United States governing water pollution and that includes goals for eliminating releases of large amounts of toxic substances into water, eliminating additional water pollution by 1985, and ensuring that surface waters will meet standards necessary for human sports and recreation by 1983. (**Federal Water Pollution Control Act**, Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117, and 100-4; USC 1251, et seq.)

Compliance schedule
A schedule of remedial measures that includes an enforceable sequence of actions or operations leading to compliance with an effluent or other limit, prohibition, or standard.

Contaminant
Any biological, chemical, physical, or radiological substance that does not occur naturally in a given environmental medium or that occurs at concentrations greater than those in the natural or background conditions.

Control
1. To direct, oversee, supervise, manage, perform, or give instruction about any decision, action, or operation of the specific facility, site, field, wastestream, or other object "under control."
2. The partial removal or complete eradication of native plants, non-native non-noxious plants, algae, noxious or quarantine-list weeds, or other nonnative invasive organisms from a waterbody. The purpose of control activities may be to protect some of the beneficial uses of a waterbody, such as swimming, boating, water skiing, fishing access, etc. The goal may be to maintain some native aquatic vegetation for habitat, while accomplishing some removal for beneficial use protection. Control activities may include the application of chemical(s) to all or part of a waterbody.

Control plan
A plan that sets limits on discharges to a specific waterbody or groundwater recharge area.

Examples include total maximum daily load determinations, restrictions for the protection of endangered species, and groundwater management plans.

Conventional pollutant
Pollutant typical of municipal sewage, which include biological oxygen demand, fecal coliform, oil and grease, pH, and total suspended solids.

Conveyance
A mechanism for transporting water, wastewater, or stormwater from one location to another location, including, but not limited to, gutters, ditches, pipes, and/or channels.

Criteria
The numeric values and the narrative standards that represent contaminant concentrations which are not to be exceeded in the receiving environmental media (surface water, groundwater, sediment) to protect beneficial uses.

Critical condition
The situation during which the combination of receiving water and waste discharge conditions have the greatest potential for causing the greatest adverse impact on the receiving water environment (e.g., on aquatic biota and existing or designated water uses). A critical condition usually occurs when the flow within a waterbody is small, and, thus, its ability to dilute the waste discharge is reduced. For steady-state discharges to riverine systems the critical condition may be assumed to be equal to the 7Q10 flow event unless determined otherwise by the Washington State Department of Ecology.

Daily discharge
The amount of a pollutant discharged during any 24-hour period that reasonably represents a calendar day for purposes of sampling. For pollutants with limits expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged during the day. For pollutants with limits expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant throughout the day.

Daily maximum
The greatest allowable value for any calendar day.

Daily minimum
The smallest allowable value for any calendar day.

Damage to the ecosystem
Any demonstrated or predicted stress to aquatic or terrestrial organisms or communities of organisms which the Washington State Department of Ecology reasonably concludes may interfere with the health or survival success or the natural structure of such populations. This stress may be due to, but is not limited to, alteration in habitat or changes in water temperature, chemistry, or turbidity, and shall consider the potential build-up of discharge constituents or temporal increases in habitat alteration which may create such stress in the long term.

Damage to the ecosystem
Any demonstrated or predicted stress to aquatic or terrestrial organisms or communities of organisms which the Washington State Department of Ecology reasonably concludes may interfere with the health or survival success or the natural structure of such populations. This stress may be due to, but is not limited to, alteration in habitat or changes in water temperature, chemistry, or turbidity, and shall consider the potential build-up of discharge constituents or temporal increases in habitat alteration which may create such stress in the long term.

Dangerous waste
Any discarded, useless, unwanted, or abandoned nonradioactive substances, including but not limited to certain pesticides, or any residues or containers of such substances which are disposed of in such quantity or concentration as to pose a substantial present or potential hazard to human health, wildlife, or the environment because such wastes or constituents or combinations of such wastes: (1) Have short-lived, toxic properties that may cause death, injury, or illness or have mutagenic, teratogenic, or carcinogenic properties; or (2) Are corrosive, explosive, flammable, or may generate pressure through decomposition or other means. The exact definition of dangerous waste is provided at WAC 173-303-040.

Date of receipt
Five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed 45 days from the date of mailing. (RCW 43.21B.001(2))

Demonstrably equivalent
The technical basis for the selection of all stormwater best management practices are documented within a stormwater pollution prevention plan (SWPPP). The SWPPP must document: (1) The method and reasons for choosing the stormwater best management practices selected; (2) The pollutant removal performance expected from the practices selected; (3) The technical basis supporting the performance claims for the practices selected, including any available existing data concerning field performance of the practices selected;

(4) An assessment of how the selected practices will comply with State water quality standards; and (5) An assessment of how the selected practices will satisfy both applicable federal technology-based treatment requirements and State requirements to use all known, available, and reasonable methods of prevention, control, and treatment.

Designated use
The use specified in Chapter 173-201A WAC for each waterbody or segment, regardless of whether or not the use is currently attained.

Detection level
(Or method detection limit) means the minimum concentration of an analyte (substance) that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results as determined by the procedure given in 40 CFR part 136, Appendix B.

Detention
The temporary collection of water into a storage device or pond, with the subsequent release of that water either at a rate slower than the collection rate or after a specified time period has passed since the time of collection. The purposes of detention include, but are not limited to, improving the quality of the water released and reducing or smoothing the mass flow rate of its discharge over time.

Detention pond
Man-made structure constructed specifically to collect and manage stormwater. Detention ponds are generally dry until a significant storm event and subsequently gradually release the accumulated stormwater through an outlet.

Dilution factor (DF)
A measure of the amount of mixing of effluent and receiving water that occurs at the mixing zone boundary, expressed as the inverse of the effluent fraction. For example, a dilution factor of 16 means that, assuming complete mixing at the mixing zone boundary, the effluent comprises 6.25 percent by volume, and the receiving water comprises 93.75 percent by volume of the mixture of effluent and receiving water [DF = 1/(6.25/100) = 16].

Discharge (the noun form is the same as Effluent)
To release or add material to waters of the State, including via surface runoff.

Discharge to groundwater
A discharge of water into an unlined impoundment or onto the surface of the ground that allows the discharged water to percolate, or potentially percolate, to groundwater. Discharge to groundwater, discharge to land, and discharge to ground all have the same meaning.

Discharger
An owner or operator of any facility, operation, or activity subject to regulation under Chapter 90.48 of the Revised Code of Washington State or the federal Clean Water Act.

Domestic wastewater
Waste and wastewater containing human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such groundwater infiltration or surface waters as may be present.

Effluent (same as the noun form of Discharge)
Material (usually an aqueous liquid) released to waters of the State, including via surface runoff.

Effluent limit

Any restriction, including schedules of compliance, established by the local government, the Washington State Department of Ecology, or the U.S. Environmental Protection Agency on quantities, rates, and/or concentrations of biological, chemical, physical, radiological, and/or other characteristics of material discharged into any site including, but not limited to, waters of the State of Washington.

Entity (same as Party)

Any person or organization, including, but not limited to, cities, counties, municipalities, Indian tribes, public utility districts, public health districts, port authorities, mosquito control districts, special purpose districts, irrigation districts, state and local agencies, companies, firms, corporations, partnerships, associations, consortia, joint ventures, estates, industries, commercial pesticide applicators, licensed pesticide applicators, and any other commercial, private, public, governmental, or non-governmental organizations, or their legal representatives, agents, or assignees.

Erosion

The detachment and movement of soil or rock fragments and the wearing away of the land surface by precipitation, running water, ice, wind, or other geological agents, including processes such as gravitational creep.

Erosion and sediment control best management practice (ESC BMP)

Best management practice (BMP) intended to prevent erosion, sedimentation, or the release of sediment-laden water from the site. Examples include preserving natural vegetation, seeding, mulching and matting, and installation of plastic covering, filter fences, sediment traps, or ponds. (synonymous with stabilization and structural BMP)

Existing condition

The land cover, native vegetation, drainage systems, soils, and impervious surfaces that exist at a site prior to any changes associated with achieving proposed development conditions which may require approved permits and engineering plans. If a site has impervious areas and drainage systems that were built without approved permits, then the existing condition is that which existed prior to the issue date of this permit. The existing condition may be verified by using aerial photography or other records. Hydrologic analysis of a site typically employs its existing condition unless a City or County imposes other requirements.

Facility (same as Operation)

The physical premises (including the land and appurtenances thereto) owned or operated by a Permittee from which wastewater or stormwater is discharged subject to regulation under the National Pollutant Discharge Elimination System program.

Federal Water Pollution Control Act (FWPCA) (same as Clean Water Act)

The primary federal law in the United States governing water pollution and that includes goals for eliminating releases of large amounts of toxic substances into water, eliminating additional water pollution by 1985, and ensuring that surface waters will meet standards necessary for human sports and recreation by 1983. (Clean Water Act, Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117, and 100-4; USC 1251, et seq.)

General permit

A single permit that covers multiple characteristically similar dischargers of a point source category within a designated geographical area, in lieu of many individual permits that are specifically tailored and issued separately to each discharger.

Groundwater (same as Underground water)

The water located in a saturated zone or stratum beneath the surface of the land or below a surface waterbody. Groundwater is a water of the State and includes **interflow**, which is a type of perched water, and water in all other saturated soil pore spaces and rock interstices, whether perched, seasonal, or artificial. Although **underground water** within the **vadose zone** (unsaturated zone) also is a type of groundwater, the Washington State groundwater quality standards do not specifically protect soil pore water or soil moisture located in the vadose zone.

Hardness

The amount of calcium and magnesium salts present in water, typically expressed as milligrams of calcium carbonate per liter. The analytical procedure for determining this amount is typically Standard Methods for the Examination of Water and Wastewater, Method 314.

Hazardous waste

That waste designated by 40 CFR Part 261 and regulated by the U.S. Environmental Protection Agency.

Highly permeable soil

Soil with permeability greater than 10-6 centimeters per second.

Individual permit

A permit that covers only a single point source, discharger, or facility.

Industrial user

Those industries identified in the Standard Industrial Classification Manual, Bureau of the Budget, 1967, as amended and supplemented, under the category ‘‘Division D—Manufacturing’’ and such other classes of significant waste producers as, by regulation, the **Administrator** of the U.S. Environmental Protection Agency deems appropriate.

Industrial wastewater

Waste and wastewater generated from industrial or commercial processes, as distinct from domestic wastewater. These wastes may result from any process or activity of industry, manufacture, trade, or business, from the development of any natural resource, or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated stormwater and leachate from solid waste facilities.

Interflow

Underground water derived directly from rainfall or snowmelt that percolates into the shallow soil, travels a relatively short distance laterally through the soil near the land surface, and subsequently seeps either: (1) Back onto the land surface where it may evaporate, mix with runoff, or discharge to a surface waterbody, or (2) Below the surface into a surface waterbody. The presence and amount of interflow is a function of the soil system depth, permeability, and water-holding capacity.

Jurisdiction

1. The practical authority granted to a formally constituted legal body to deal with and make pronouncements on legal matters and, by implication, to administer justice within a defined area of responsibility.
2. The geographical area or subject-matter to which such practical authority applies.

Land application

The spreading, spraying, injection below the land surface, or other means of incorporation of waste (for the confined animal feeding operation permit, specifically agricultural waste, such as manure, litter, and process wastewater) or biosolids to a field to provide nutrients to support plant growth.

Land application site

An area where wastes are applied onto or incorporated into the soil surface for treatment or disposal, excluding manure spreading operations.

Landfill

An area of land or an excavation in which wastes are placed for permanent or temporary disposal and which is not a land application site, surface impoundment, injection well, and/or waste pile.

Leachate

Water or other liquid that has percolated through soil, raw material, product, or waste and that contains or may contain substances in solution or suspension as a result of its contact with those materials.

Maintenance
Activities conducted on currently serviceable structures, facilities, and equipment that involves no expansion or use beyond that previously existing. Maintenance includes those usual activities taken to prevent a decline, lapse, or cessation in the use of structures and systems. Those usual activities may include replacement of dysfunctional facilities, including cases where environmental permits require replacing an existing structure with a different structure, as long as the functioning characteristics of the original structure are not changed. One example is the repair of a deteriorating paved walkway along the top of the berm enclosing a settling pond that otherwise is fully functional with no overtopping or leaks to the ground surface. Maintenance of WTP settling ponds includes periodic assessment to ensure ongoing proper operation, removal of built-up pollutants (e.g., sediments), replacement of spent or failing treatment media, and other actions taken to prevent or correct degraded performance.

Maximum contaminant level (MCL)
The maximum concentration of a contaminant established by the U.S. Environmental Protection Agency under the Federal Safe Drinking Water Act (42 U.S.C. 300f) and published in 40 CFR 141, as presently promulgated or as subsequently amended or re-promulgated. A maximum contaminant level is an enforceable health-based standard which reflects the effects of certain risk management factors, such as laboratory confidence limits and economics.

Migration (same as Translocation)
Any natural movement of an organism or community of organisms from one locality to another locality.

Mixing zone
That portion of a waterbody adjacent to an effluent discharge point where mixing dilutes the effluent with the receiving water. The water within this zone need not meet numeric water quality criteria but must allow passage of aquatic organisms and not upset the ecological balance of the receiving water. The permit specifies the mixing area or volume fraction of the receiving water surrounding the discharge point.

Monthly average
The sum of all daily measurements obtained during a calendar month divided by the number of days measured during that month (arithmetic mean).

Municipality
A political unit incorporated for local self-government, such as a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal agency of two or more of the foregoing entities) created by or pursuant to state law; an authorized Indian tribe or tribal organization; or a designated and approved management agency under Section 208 of the Clean Water Act. Municipalities include special districts created under state law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar **entity**.

National Pollutant Discharge Elimination System (NPDES)
The federal wastewater permitting system for discharges of pollutants from point sources to the navigable waters of the United States authorized under Section 402 of the Clean Water Act. The U.S. Environmental Protection Agency has authorized the State of Washington to issue and administer NPDES permits for non-federal point sources within the State.

Natural condition
The environmental condition that existed before the introduction of any human-cause pollution or other disturbance. For estimating natural conditions in the headwaters of a disturbed watershed, a potentially useful reference condition may be the less disturbed condition of a neighboring or similar watershed.

Nonpoint source
A source from which pollutants may enter waters of the State that is not readily discernible, such as any dispersed land-based or water-based activities including, but not limited to, atmospheric deposition; surface water runoff from agricultural lands, urban areas, or forest lands; subsurface or underground sources; or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System program.

Operation (same as Facility)
The physical premises (including the land and appurtenances thereto) owned or operated by a Permittee from which wastewater or stormwater is discharged subject to regulation under the National Pollutant Discharge Elimination System program.

Operational source control best management practice (Operational source control BMP)
The schedule of activities, prohibition of practices, maintenance procedures, employee training, good housekeeping, and other managerial best management practices to prevent or reduce the pollution of waters of the State.

Organism
Any individual life form: an animal, plant, fungus, protistan, or moneran.

Outfall
The location of a point source where a discharge leaves a facility, site, or municipal separate storm sewer system and flows into waters of the State. Outfalls do not include open conveyances connecting two municipal separate storm sewers; or pipes, tunnels, or other conveyances which connect segments of the same stream or other waters of the State and are used to convey waters of the State (e.g., culverts).

Party (same as Entity)
Any person or organization, including, but not limited to, cities, counties, municipalities, Indian tribes, public utility districts, public health districts, port authorities, mosquito control districts, special purpose districts, irrigation districts, state and local agencies, companies, firms, corporations, partnerships, associations, consortia, joint ventures, estates, industries, commercial pesticide applicators, licensed pesticide applicators, and any other commercial, private, public, governmental, or non-governmental organizations, or their legal representatives, agents, or assignees.

Permeable
Porous; capable of allowing liquids or gases to pass through.

Permit
An authorization, license, or equivalent control document issued by a formally constituted legal body, such as the Washington State Department of Ecology, to a facility, activity, or entity to treat, store, dispose, or discharge materials or wastes, specifying the waste treatment and control requirements and waste discharge conditions. Unless the context requires differently, "permit" refers to individual and general permits authorized under the National Pollutant Discharge Elimination System program.

Permittee
The entity who receives notice of coverage under this general permit.

Person
Any individual or organization, including, but not limited to, cities, counties, municipalities, Indian tribes, public utility districts, public health districts, port authorities, mosquito control districts, special purpose districts, irrigation districts, state and local agencies, companies, firms, corporations, partnerships, associations, consortia, joint ventures, estates, industries, commercial pesticide applicators, licensed pesticide applicators, and any other commercial, private, public, governmental, or non-governmental organizations, or their legal representatives, agents, or assignees.

pH
A measure of the acidity or alkalinity of water. A pH of 7.0 is defined as neutral. Large variations above or below 7.0 are harmful to most aquatic life. Mathematically, pH is the negative logarithm of the activity of the hydronium ion (often expressed as the negative logarithm of the molar concentration of the hydrogen ion).

Point source
Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters of the State, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel, or other floating craft. Point source does not include agricultural stormwater discharges and return flows from irrigated agriculture. See 40 CFR 122.3 for exclusions.

Pollutant (in water)
Any discharged substance or pathogenic organism that would: (1) Alter the biological, chemical, physical, radiological, or thermal properties of any water of the State, or (2) Likely create a nuisance or render such water harmful, detrimental, or injurious (a) to the public health, safety, or welfare, (b) to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or (c) to any animal or plant life, either terrestrial or aquatic, either directly from the environment or indirectly by ingestion through the food chain.

Pollutants may include, but are not limited to, the following: solid waste, incinerator residue, garbage, sewage, sewage sludge, filter backwash, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, dredged spoil, rock, sand, cellar dirt, and other industrial, municipal, and agricultural wastes.

Pollutant does not mean: (1) Sewage from marine vessels or a discharge incidental to the normal operation of a vessel of the Armed Forces, within the meaning of Section 312 of the Clean Water Act (CWA); (2) Dredged or fill material discharged in accordance with a permit issued under Section 404 of the CWA; or (3) Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well, if the well is used either to facilitate production or for disposal is approved by authority of the Washington State Department of Ecology (Ecology), and if Ecology determines that such injection or disposal will not result in the degradation of groundwater or surface water resources.

Pollution (of water)
The man-made or man-induced contamination or other alteration of the biological, chemical, physical, or radiological properties of any water of the State, including change in temperature, taste, odor, color, or turbidity of the water; or such discharge of any solid, liquid, gaseous, or other substance into any water of the State that will, or is likely to, create a nuisance or render such water harmful, detrimental, or injurious to: (1) The public health, safety, or welfare; (2) Domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or (3) Any animal or plant life, either terrestrial or aquatic, either directly from the environment or indirectly by ingestion through the food chain.

Pollution Control Hearings Board (PCHB)
A three-member board appointed by the governor to hear and decide appeals of the decisions, orders, and permits or certain State regulatory agencies, including the Washington State Department of Ecology. (See Chapter 371-08 WAC.)

Pretreatment
The reduction of the amount or concentration of pollutants, elimination of pollutants, or alteration of the nature of pollutant properties to a less harmful state prior to or in lieu of discharging wastewater to a treatment plant. This reduction or alteration may be obtained by biological, chemical, or physical processes, by process changes, or by other means, except by diluting the pollutants.

Pretreatment standard
Any pollutant discharge limit, including those developed under the Clean Water Act Section 307(b) and (c) and implemented through regulations in 40 CFR Subchapter N, that apply to the discharge of nondomestic wastes to publicly-owned treatment works. Pretreatment standards include prohibitive discharge limits established pursuant to WAC 173-216-060.

Publicly-owned treatment works (POTW)
1. A sewage treatment plant and its collection system that is owned by a municipality, the State of Washington, or the federal government. A POTW includes the sewers, pipes and other conveyances that convey wastewater to the treatment plant, and any devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature.
2. The municipality or other entity that has jurisdiction over the indirect discharges to and the discharges from the treatment works.

Putrescible
Containing material capable of being decomposed by micro-organisms.

Quantitation level (QL)
Also known as Minimum Level (ML) – The term ''minimum level'' refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (DL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the DL in a method, or the DL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ''quantitation limit," ''reporting limit,'' and ''minimum level''.

Reasonable potential
A probability calculated or projected as likely that an effluent or discharge will cause or contribute to an excursion of a pollutant beyond a water quality criterion at the point of compliance in the receiving water, based on several factors including, as a minimum, the four factors listed in 40 CFR 122.44(d)(1)(ii).

Receiving water
The waterbody at the point of discharge, whether that discharge is through a point source or via sheet flow. If the discharge is to a stormwater conveyance system, either surface or subsurface, the receiving water is the waterbody to which the stormwater conveyance system discharges. Systems designed for groundwater drainage, redirecting stream natural flows, or conveyance of irrigation water/return flows that coincidentally convey stormwater, are considered the receiving water. Receiving waters may also be groundwater to which surface runoff is directed by infiltration.

Redevelopment

On a site that is already substantially developed (i.e., impervious surface covers at least 35 percent of its surface): (1) Creation, addition, or improvement of impervious surfaces; (2) Expansion of a building footprint; (3) Structural development, including construction, installation, expansion, or replacement of a building or other structure; (4) Replacement of impervious surface that is not part of a routine maintenance activity; or (5) Land disturbing activities.

Representative (sample)

A sample that yields data that accurately characterizes the nature of a discharge or other sampled matrix for the parameters of concern. A representative sample should account for the factors that contribute to the variability of the parameters, such as the quantity of the discharge, the date and time of the sampling event, and whether the particular sampling location or associated physical events may affect the material sampled. Combining grab samples collected from multiple outfalls from a designated area of the facility during a certain time range to create a flow-weighted composite sample may be required to obtain a representative sample.

Runoff

Water derived directly from rainfall or snowmelt that travels across the land surface and discharges: (1) To waterbodies either directly or through a constructed collection and conveyance system, or (2) To the subsurface through a constructed collection and conveyance system.

Sanitary sewer

A sewer designed to convey domestic wastewater.

Saturated zone

The subsurficial zone in which all soil pore spaces, and rock interstices are completely filled with groundwater. Saturated zones include aquifers, whether or not they produce a significant yield, areas of perched groundwater, and interflow.

Sediment

The fragmented material that originates from the weathering and erosion of rocks, unconsolidated deposits, or unpaved yards; and is suspended in, transported by, or deposited by water.

Sediment management standard (SMS)

Numerical and narrative criterion for sediments to protect the beneficial uses of the waters of the State. Sediment management standards are identified within Chapter 173-204 WAC.

Sediment quality standard
A standard for sediments that identifies chemical concentration and biological toxicity criteria that (a) Correspond to no observable acute or chronic adverse effects on biological resources, and (b) Do not pose a significant health threat to humans. Sediment quality standards are a basis for identifying contaminated surface sediments and for limiting toxic discharges to waters of the State (WAC 173-204 Part III).

Sedimentation
The deposition or formation of sediment.

Sensitive area
For the construction stormwater permit, a waterbody, wetland, stream, aquifer recharge area, or channel migration zone.

Settleable solids
The material that settles out of suspension within a certain timespan measured volumetrically.

Significant industrial user (SIU)
All **industrial users** subject to categorical pretreatment standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to a publicly-owned treatment works (POTW) (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process waste stream that makes up five percent or more of the average dry weather hydraulic or organic capacity of the POTW; or is designated as such by the POTW control authority on the basis that the industrial user has a reasonable potential for adversely affecting the operation of the POTW or for violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)). Upon finding that an industrial user that meets the criteria above has no reasonable potential for adversely affecting the operations of the POTW or for violating any pretreatment standard or requirement, the control authority may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

Site
1. The land or water area where any facility, operation, or activity is physically located or conducted, including any adjacent land or buffer areas used in connection with such facility, operation, or activity.
2. The land or water area receiving any effluent discharged from any facility, operation, or activity.

Small business
Any business entity, including a sole proprietorship, corporation, partnership, or other legal entity, that is owned and operated independently from all other businesses, and that has 50 or fewer employees.

Solid waste
All **putrescible**, non-putrescible, solid, and semisolid waste. Examples of solid waste are: garbage, rubbish, ashes, industrial wastes, swill, demolition and construction wastes, abandoned vehicles or parts thereof, discarded commodities, sludge from wastewater treatment plants and septic tanks, wood waste, contaminated soils, contaminated dredged material, **dangerous waste**, and problem wastes.

Source control best management practice (Source control BMP)
Best management practice intended to prevent or reduce the release of pollutants. Two types of source control BMPs exist: (1) Structural, which include physical, structural, or mechanical devices or facilities (e.g., roofs covering storage and working areas); and (2) Operational, which include management of activities that are sources of pollutants (e.g., directing wash water and similar discharges to the sanitary sewer or a dead-end sump).

Spent
The condition of a chemical solution or other material where prior usage has substantially reduced its effectiveness.

State Environmental Policy Act (SEPA)
The Washington State law intended to prevent or eliminate damage to the environment that requires State and local agencies to consider the likely environmental consequences of development proposals prior to their approval (Chapter 43.21C RCW, as implemented through Chapter 197-11 WAC).

State waste discharge permit
A wastewater discharge permit issued under State authority (Chapter 90.48 RCW) to control the discharge of pollutants to waters of the State. State waste discharge permits are generally issued for discharges to groundwater and for industrial discharges to a municipal sewage system when that municipal system does not have a delegated **pretreatment** program.

Storm drain
Any constructed inlet that drains directly into a storm sewer, usually found along roadways or in parking lots.

Stormwater
Water derived directly from rainfall or snowmelt that either: (1) Travels across the land surface and discharges to waterbodies either directly or through a collection and conveyance system; or (2) Percolates into the shallow soil, travels laterally through the soil near the land surface, and subsequently seeps back onto the land surface where it mixes with runoff or discharges to a surface waterbody. (Same as Runoff plus Interflow)

Stormwater Management Manual (SWMM)
The two technical manuals published by the Washington State Department of Ecology (Ecology) for use by local governments that describe stormwater management techniques and contain descriptions of and design criteria for best management practices to prevent, control, or treat pollutants in stormwater. One of the manuals applies to sites in eastern Washington (SWMMEW), and the other applies to sites in western Washington (SWMMWW). Ecology periodically updates the two manuals.

Stormwater pollution prevention plan (SWPPP)
The written plan that describes the measures to be employed at a facility to identify, prevent, and control the contamination of point source discharges of stormwater.
Structural source control best management practice (Structural source control BMP)
Physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. Examples of structural source control BMPs typically include: (1) Enclosing and/or covering the pollutant source (building or other enclosure, a roof over storage and working areas, temporary tarp, etc.); and (2) Segregating the pollutant source to prevent run-on of stormwater, and to direct only contaminated or potentially contaminated stormwater to appropriate treatment BMPs.

Substantial
Of considerable size, quality, value, degree, amount, extent, or importance.

Surface water
Lakes, rivers, ponds, streams, inland waters, wetlands, marine waters, estuaries, and all other fresh or brackish waters and water courses, plus drainages to those waterbodies. Surface waters do not include hatchery ponds, raceways, pollution abatement ponds, and wetlands constructed solely for wastewater treatment.

Surface waters of the State of Washington
All waters within the geographic boundaries of the State of Washington defined as “waters of the United States” in 40 CFR 122.2, and all waters defined as “waters of the state” in RCW 90.48.020 excluding underground waters. These include lakes, rivers, ponds, streams, inland waters, wetlands, marine waters, estuaries, and all other fresh or brackish waters and water courses, within the jurisdiction of the State of Washington, plus drainages to those waterbodies. Surface waters of the State do not include hatchery ponds, raceways, pollution abatement ponds, and wetlands constructed solely for wastewater treatment.

Technology-based effluent limit
An effluent limit that is based on the ability of a treatment method to reduce the amount (e.g., concentration) of a pollutant.

Total dissolved solids (TDS)
Those materials capable of passing through a specified glass fiber filter, dried to a constant weight at 180 degrees Celsius.

Total maximum daily load (TMDL)

1. An estimate of the maximum amount of a pollutant that a specific impaired waterbody or waterbody segment can receive in a day and still be protective of its designated beneficial uses, i.e., meet water quality standards. The TMDL must incorporate seasonal variation, include a margin of safety, and account for all point and nonpoint sources that contributed to the impairment of the specific waterbody.
2. A water cleanup plan and a mechanism for establishing water quality-based controls on all point and nonpoint sources of pollutants within a watershed basin, sub-basin, or hydrographic segment associated with a specific impaired waterbody. Percentages of the TMDL of a single pollutant are allocated to the various pollutant sources as waste load allocations for point sources and **load allocations** for nonpoint sources and background. A TMDL becomes effective after the U.S. Environmental Protection Agency has reviewed and approved it.

Total residual chlorine

The amount of chlorine remaining in water or wastewater, which is equivalent to the sum of the combined residual chlorine (non-reactive) and the free residual chlorine (reactive).

Total suspended solids (TSS)

The amount of particulate material in water, either that which floats on the surface or remains in suspension. Large quantities of suspended solids may cause solids to accumulate in receiving waters. Apart from any toxic effects attributable to substances leached from the solids by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries or by clogging their gills and respiratory passages. Suspended solids can also screen out light and can promote and maintain noxious conditions through oxygen depletion.

Toxic

Causing death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations in any organism or its offspring upon exposure, ingestion, inhalation, or assimilation.

Toxic amount

Any amount, concentration, or volume of a pollutant which causes, or could potentially cause, the death of, or injury to, fish, animals, vegetation, or other resources of the State, or otherwise causes, or could potentially cause, a reduction in the quality of waters of the State below the standards set by the Washington State Department of Ecology or, if no standards have been set, causes significant degradation of water quality.

Toxic substance

Poison or substance, which if present in sufficient quantity or concentration, is capable of producing a toxic or adverse effect in a native or test organism.

Toxicity

The quality or state of being toxic.

Toxicity test
A procedure to determine the toxicity of a chemical or an effluent using living organisms. A toxicity test measures the degree of effect a specific chemical or effluent has on exposed test organisms.

Translocation (same as Migration)
Any natural movement of an organism or community of organisms from one locality to another locality.

Treatment

1. The application of an algaecide, herbicide, or other control product to the water, vegetation, or soil to control or kill algae, vegetation, insects, or some other pest or target species, or to remove or inactivate bioavailable phosphorus.
2. The removal of a pollutant from wastewater or some other manipulation of wastewater to reduce or control the adverse effects of a pollutant therein.

Treatment best management practice (Treatment BMP)
Best management practice intended to remove pollutants from wastewater, such as detention ponds, oil/water separators, biofiltration, and constructed wetlands.

Turbidity
The optical property of water that causes light to be scattered and absorbed rather than transmitted in a straight line. Turbidity in water is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms.

Underground water (same as Groundwater)
The water located in a saturated zone or stratum beneath the surface of the land or below a surface waterbody. Groundwater is a water of the State and includes interflow, which is a type of perched water, and water in all other saturated soil pore spaces and rock interstices, whether perched, seasonal, or artificial. Although **underground wate**r within the vadose zone (unsaturated zone) also is a type of groundwater, the Washington State groundwater quality standards do not specifically protect soil pore water or soil moisture located in the vadose zone.

Upset
An exceptional incident in which an unintentional and temporary non-compliance with technology-based, permit effluent limits occurs due to factors beyond the reasonable control of the permittee. An upset does not include non-compliance to the extent caused by operational error, improperly designed treatment facilities, inadequate storage or treatment facilities, lack of preventive maintenance, or careless or improper operation.

Vadose zone
The subsurficial zone where soil pore spaces and rock interstices are typically occupied at least partially by air. The vadose zone may extend from the surface of the ground down to the top of the water table, i.e., the top of the saturated zone, whether perched or not.

Waste

Any discarded, abandoned, unwanted, or unrecovered material, except the following are not waste materials for the purposes of this permit: (1) Discharges into the ground or groundwater of return flow, unaltered except for temperature, from a groundwater heat pump used for space heating or cooling, provided that such discharges do not have significant potential, either individually, or collectively, to affect groundwater quality or uses; and (2) Discharges of stormwater that is not contaminated or potentially contaminated by industrial or commercial sources.

Water quality (WQ)

The biological, chemical, physical, and radiological characteristics of water, usually with respect to its suitability for a particular purpose.

Water quality-based effluent limit

A limit on the concentration of an effluent parameter that is intended to prevent the concentration of that parameter from exceeding its water quality criterion after it is discharged into a receiving water. The limit may include a dilution factor if all known, available, and reasonable methods of prevention, control, and treatment have been accomplished and other restrictions are met.

Waters of the State of Washington

All waters within the geographic boundaries of the State of Washington defined as "waters of the United States" in 40 CFR 122.2, and all waters defined as "waters of the state" in RCW 90.48.020. These waters of the state include lakes, rivers, ponds, streams, inland waters, wetlands, marine waters, estuaries, underground waters, and all other fresh or brackish waters and water courses within the jurisdiction of the State of Washington, plus drainages to those waters.

Waters of the United States

All waters within the geographic boundaries of the State of Washington defined as "waters of the United States" in 40 CFR 122.

Well

A bored, drilled, or driven shaft, or dug hole whose depth is greater than the largest surface dimension.

Wellhead protection area

That defined portion of a zone of contribution of a well, well field, or spring based on the criteria established by the Washington State Department of Health.

Wetland

Any area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Jurisdictional wetlands are wetlands that have been identified as such by local, state, or federal agencies. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands.

Whole effluent toxicity (WET)

The total toxic effect of an effluent measured directly with a toxicity test so that the interaction of all toxicants present in the effluent are assessed.

APPENDIX C. GUIDANCE FOR REGULATORY OVERSIGHT OF WATER TREATMENT PLANTS: WASTEWATER AND SOLID WASTE DISPOSAL

Wastestream Generator	**Wastestream Characteristics (daily volume, content, etc.)**	**Disposal Method**	**Agency with Regulatory Oversight Authority**
Water Treatment Plant (≥35K gpd actual production; not Ion Exchange (IE), Reverse Osmosis (RO), or slow sand filtration)	**Wastewater (not the settled sludge)** (generated by filter backwash (including from microfiltration and ultrafiltration), sedimentation/presedimentation basin washdown, sedimentation/clarification, and filter-to-waste processes)	Discharge to surface water	Department of Ecology (WTP General Permit)
Water Treatment Plant (≥35K gpd actual production; not IE, RO, or slow sand filtration)	**Wastewater (not the settled sludge)** (generated by filter backwash (including from microfiltration and ultrafiltration), sedimentation/presedimentation basin washdown, sedimentation/clarification, and filter-to-waste processes)	Discharge to ground	Department of Ecology (no reasonable potential to pollute) Department of Health (wellhead protection policy)
Water Treatment Plant (≥35K gpd actual production; not IE, RO, or slow sand filtration)	**Wastewater (not the settled sludge)** (generated by filter backwash (including from microfiltration and ultrafiltration), sedimentation/presedimentation basin washdown, sedimentation/clarification, and filter-to-waste processes)	Discharge to POTW	Local municipality
Water Treatment Plant (>35K gpd actual production; not IE, RO, or slow sand filtration)	**Settled sludge (from wastewater)** (generated by filter backwash (including from microfiltration and ultrafiltration), sedimentation/presedimentation basin washdown, sedimentation/clarification, and filter-to-waste processes)	Agronomic or silvicultural use	Land application: Local health jurisdiction Statewide Beneficial Use Determination: Department of Ecology

APPENDIX D. PUBLIC INVOLVEMENT INFORMATION

The Washington State Department of Ecology (Ecology) proposes to reissue the Water Treatment Plants National Pollutant Discharge Elimination System and State Waste Discharge General Permit (permit). The current permit was issued on July 17, 2019, and is scheduled to expire at the end of August 2024. The draft permit and accompanying fact sheet, which explains the technical basis for the permit, are available for review and public comment from **Wednesday, March 20, 2024, through Friday, May 3, 2023, at 11:59 pm**. Ecology will host two public workshops and public hearings on the draft permit.

PURPOSE OF THE PERMIT

The statewide permit provides coverage for water treatment plants in the State of Washington that discharge filtration backwash effluent to a surface waterbody. This general permit provides coverage to facilities:

- That produce 35,000 gallons per day or more (monthly total divided by the number of days in the month) of finished drinking and industrial water.
- Where the primary function of the facility is treatment and distribution of potable or industrial water.
- That produces wastewater by filtration processes.
- That are not a part of a larger permitted facility.

This general permit does *not* provide coverage to facilities that:

1. Produce water by one of the following processes:
   (a) Ion exchange
   (b) Reverse osmosis
   (c) Slow sand filtration
2. Treat or remove per- and polyfluoroalkyl substances (PFAS) from the source water.
3. Send wastewater exclusively to a publicly-owned treatment works delegated by Ecology.
4. Release wastewater to land where runoff or overflow is impossible.

COPIES OF THE DRAFT PERMIT AND FACT SHEET

The draft permit and fact sheet will be available online at Ecology's Water Treatment Plant General Permit webpage[10] by end of day on March 20, 2024. You may also request physical copies from Jessica Shook at jessica.shook@ecy.wa.gov.

Ecology Contact
James Hovis
WA State Department of Ecology
P.O. Box 47696
Olympia, WA 98504-7696

Telephone: (564) 999-3244
Email: james.hovis@ecy.wa.gov

SUBMITTING WRITTEN COMMENTS

Ecology will accept written comments on the draft permit and fact sheet from March 20, 2024, through May 3, 2024 by 11:59 pm. Ecology prefers online comment submission via the eComment form (link below) on the permit webpage. Written comments by mail must be postmarked by May 3, 2024. Comments should reference specific permit text when possible.

Online eComment form[11] (preferred)

By mail (See address information above)

PUBLIC WORKSHOPS AND HEARINGS

The purpose of the workshop is to explain the general permit and to answer questions prior to the formal public hearing. The purpose of the hearing is to provide an opportunity for people to give formal oral testimony and written comments on the proposed draft permit. Oral testimony will receive the same consideration as written comments.

The public hearing will begin immediately following the public workshop and will conclude when public testimony is complete.

The Water Treatment Plants General Permit hearings will occur at the following dates and times:

Monday, April 22, 2024 – 9:00 AM
Webinar*
Join the webinar

Tuesday, April 23, 2024 – 5:30 PM
Webinar*
Join the webinar

[10] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Water-treatment-plants
[11] https://wq.ecology.commentinput.com/?id=CkjDY7TKQ

*Workshops and hearings offered via webinar allow individuals to view the presentation and provide testimony via computer or mobile device.

ISSUING THE PERMIT

After Ecology receives and considers all public comments, we will make a final decision on permit issuance. Ecology expects to make a decision on the general permit in August 2024. If you have questions, please contact James Hovis, Water Treatment Plant General Permit Writer, at james.hovis@ecy.wa.gov or (360) 407-6588.

The response to comments will also be posted on Ecology's Water Treatment Plant webpage[12].

RIGHT TO APPEAL

Permittees and the public have a right to appeal this permit to the Pollution Control Hearings Board (PCHB) within 30 days of the date of issuance of the final permit. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC.

To appeal you must do the following within 30 days of the date of issuance of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form by mail or in person (see addresses below). Email is not accepted.

Appealing parties must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC

Street Addresses

Department of Ecology
Attn: Appeals Processing Desk 300 Desmond Drive SE
Lacey, WA 98503

Pollution Control Hearings Board
1111 Israel Road SW
Suite 301
Tumwater, WA 98501

[12] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Water-treatment-plants

Mailing Addresses

Department of Ecology
Attn: Appeals Processing Desk
P.O. Box 47608
Olympia, WA 98504-7608

Pollution Control Hearings Board
P.O. Box 40903
Olympia, WA 98504-0903

APPENDIX E. RESPONSE TO COMMENTS FOR THE WATER TREATMENT PLANT GENERAL PERMIT

This Response to Comments addresses comments received on the formal draft of the Water Treatment Plant General Permit and addresses changes made to the formal draft based upon comments received. It is included as Appendix E to the Fact Sheet for the Water Treatment Plant General Permit and will be published as a separate document on the permit webpage. The public comment period for this permit began on March 20, 2024 and lasted until 11:59 p.m. of May 3, 2024.

Look for the Response to Comments document on the Water Treatment Plant General Permit webpage[13] .

[13] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Water-treatment-plants

APPENDIX F. LEGAL BASES FOR PERMIT CONDITIONS

Ecology bases the terms and conditions of its NPDES general permits on State and federal law and regulations and standardizes the general conditions across all NPDES general permits. The summary below identifies each of the conditions in the WTP general permit, describes their content, and cites the laws and regulations upon which they are based.

SPECIAL CONDITION S-1 PERMIT COVERAGE

Identifies the activities, discharges, and facilities that require coverage by the permit; the discharges that are authorized or conditionally authorized under the permit, the geographic area covered by the permit; the chemicals and products authorized for use under the permit, and the activities, discharges, and facilities excluded from coverage under the permit.

WAC 173-226-050 (2), (3), and (4)

WAC 173-226-100 (2)

SPECIAL CONDITION S-2 LIMITS AND STANDARDS

Identifies the standards and requirements for compliance with the permit, including discharge limits and other requirements for impaired waterbodies.

WAC 173-226-070 (1), (2), (3), and (6) (a)

SPECIAL CONDITION S-3 PLANNING REQUIREMENTS

Identifies the procedural documentation and plans that the Permittee must maintain to ensure continuous operational control and permit compliance.

SPECIAL CONDITION S-4 OPERATIONAL REQUIREMENTS

Identifies requirements for facility operation and maintenance; operational restrictions; and responding to excursions from compliance with the permit.

40 CFR 122.41 (e) and (m)

RCW 90.48.120

WAC 173-201A-110

WAC 173-226-070 (1) (d) and (3) (d)

WAC 173-226-080 (1) (i)

SPECIAL CONDITION S-5 MONITORING REQUIREMENTS

Identifies the objectives for monitoring; the required sampling and analytical procedures for monitoring the characteristics and toxicity of discharges; and requirements for effectiveness monitoring, inspections, and operational recordkeeping.

40 CFR 122.41 (j) (1) and (4)

Chapter 173-205 WAC

WAC 173-226-090 (1) (a), (b), (c), (d), and (e); (4); and (5)

SPECIAL CONDITION S-6 REPORTING AND RECORDKEEPING REQUIREMENTS

Identifies the results that the Permittee must record; and the requirements for engineering documentation, notification and posting, reporting, records retention, public access to information, coordination of inspections, and other reporting.

40 CFR 122.41(j) (2) and (3); and (l) (2), (4), (5), (6), and (7)

WAC 173-226-080 (1) (b) and (4)

WAC 173-226-090 (2) and (3) (a)

WAC 173-226-180 (4)

SPECIAL CONDITION S-7 PERMIT ADMINISTRATION

Identifies the processes and requirements for obtaining and terminating permit coverage; and requirements for when the Permittee is to notify Ecology of certain changes.

WAC 173-226-080 (2)

WAC 173-226-130 (5)

WAC 173-226-200 (1) and (3)

GENERAL CONDITION G-1 OPERATION AND MAINTENANCE

Identifies the activities and discharges authorized by the permit; discharges from activities not covered by the permit; and requirements concerning system failures, removed substances, and upsets.

40 CFR 122.41 (c), (e), and (n)

RCW 90.48.080

WAC 173-226-080 (1) (a), (d), and (j)

GENERAL CONDITION G-2 OTHER DUTIES AND RESPONSIBILITIES

Identifies additional requirements and prohibitions of the Permittee, including compliance; monitoring; mitigation; reporting of non-compliance, spills, and other information; and reapplication.

40 CFR 122.41

40 CFR 122.42

RCW 90.48.110(1)

RCW 90.48.170

WAC 173-226-020

WAC 173-226-070 (3) and (5)

WAC 173-226-100 (1)

WAC 173-226-200 (1) and (2)

WAC 173-226-220 (2)

WAC 173-240-110 (1)

GENERAL CONDITION G-3 ENFORCEMENT AND PENALTIES

Identifies Permittee’s property rights; Ecology’s rights of inspection, entry, and enforcement; and the penalties for violating permit conditions and tampering with monitoring equipment and data.

40 CFR 122.41 (a) (2) and (3); (g) and (i); (j) (5); and (k) (2)

RCW 90.48.090

RCW 90.48.140

RCW 90.48.144

WAC 173-226-080 (1) (h)

WAC 173-226-250 (1), (2), (3), and (4)

GENERAL CONDITION G-4 PERMIT MANAGEMENT AND COORDINATION

Identifies dates of coverage; requirements for appeals, signatures, certifications, and fee payment; and conditions and requirements for permit modification, transfer, termination, and revocation.

40 CFR 122.21

40 CFR 122.22

40 CFR 122.41 (f); (k); and (l) (1) and (3)

40 CFR 122.61

40 CFR 122.62

40 CFR 122.63 (d)

RCW 90.48.190

RCW 90.48.195

RCW 90.48.465

Chapter 173-224 WAC

WAC 173-220-040 (5)

WAC 173-220-150 (1) (b)

WAC 173-220-210 (3) (b)

WAC 173-226-080 (1) (b), (e), (f), and (g); (3); and (4)

WAC 173-226-090 (3) (b)

WAC 173-226-130 (5)

WAC 173-226-180 (5)

WAC 173-226-190

WAC 173-226-200 (2), (3) (d), and (7)

WAC 173-226-210

WAC 173-226-220

WAC 173-226-230 (1)

WAC 173-226-240 (1), (2), (4), (5), and (6)

APPENDIX G. INDUSTRIAL PROCESS DESCRIPTIONS

APPENDIX G-1. TECHNOLOGY-BASED TREATMENT

The Washington State Department of Ecology (Ecology) has concluded that:

1. Using the criteria for setting case-by-case limits pursuant to 40 CFR Part 125.3(d) results in effluent limits that require the removal of residual solids from water treatment plant (WTP) effluent; and
2. The credit adjustment allowed under RCW 90.54.020(3)(b) is in conflict with the federal requirements for applying technology-based effluent limits.

Residual Solids are Pollutants

It has been suggested that returning residual solids to the same waterbody as is the source of the solids does not constitute an addition of pollutants to navigable waters of the United States under the Federal Clean Water Act, and hence technology-based treatment of these solids is not required. This line of logic is often supported by some case law involving pollutants that pass through a hydroelectric facility. In these cases the pollutants that pass through the hydroelectric facility never leave the waterbody, unlike WTPs that physically alter and remove the pollutants. The Ninth Circuit has made it clear that the resuspension of pollutants that originally come from a navigable waterbody constitutes the addition of a pollutant under the Clean Water Act.

In Rybachek v. EPA, 904 F.2d 1276 (9th Cir. 1990), placer miners argued that they do not "add" pollutants to navigable waters of the United States within the meaning of the Clean Water Act. In rejecting this argument, the Ninth Circuit concluded:

> ". . . even if the material discharged originally comes from the streambed itself, such resuspension may be interpreted to be an addition of a pollutant under the Act. See Avoyelles Sportsmen's League, Inc. v. Marsh, 715 F.2d 897, 923 (5th Cir. 1983) (stating that "[t]he word 'addition', as used in the definition of the term 'discharge,' may reasonably be understood to include 'redeposit'")" Rybachek, 904 F.2d at 1285-86.

Technology-Based Considerations Independent of Water Quality

The Clean Water Act (CWA) set a national goal of zero discharge of pollutants and a way to achieve this goal through technology-based treatment. Recognizing that technology-based treatment would not produce zero discharge immediately and would not always be protective of receiving waters, water quality-based standards were also set. The important distinction between these approaches is that technology-based treatment considerations were not dependent on receiving water conditions but require an industry to apply reasonable treatment without regard to the impact of a discharge on a specific waterbody. It is instructive to consider the performance standards that have been developed by the United States Environmental Protection Agency (EPA) for industrial categories. These are national standards and as such are not based on the water quality of specific receiving waters but on industry-wide characteristics and treatment options. Although the EPA has not developed performance standards for WTPs, this same process of evaluating industry-wide characteristics and treatment options would apply to a case-by-case determination of technology-based limits for an individual facility.

Determining Technology-Based Limits

In the case of WTPs, there is a substantial amount of information available on technology-based determinations. In a WTP general permit developed by Ohio EPA, and in WTP general permits issued by other states in the last few years, limits are consistently being set on the suspended solids in the wastewater discharge. Although the amount of suspended solids allowed varies some, from about 15 mg/L monthly average to 50 mg/L daily maximum, the limits all reflect treating the discharge to remove residual solids before discharge.

The U.S. EPA commissioned Science Applications International Corporation (SAIC) to draft a model permit for the water supply industry. SAIC released their findings in a document entitled **Model Permit Package - Water Supply Industry**, January 30, 1987. In this document SAIC conducted both best practicable control technology (BPT) and best conventional pollutant control technology (BCT) analyses which addressed “conventional” pollutants. Best available control technology economically achievable (BAT) requirements, which address “toxic” pollutants, were not developed since WTP process effluent is characterized as principally containing conventional pollutants, with insufficient evidence of toxic pollutants for development of across-the-board limits. SAIC proposed limits based on their “Best Professional Judgment” after considering existing permits and WTP monitoring data and achievable WTP wastewater treatment levels.

In determining technology-based limits for the WTPs in Washington State, considerations were based on the references above, a review of facilities currently permitted by the State, telephone interviews with additional facilities operating in the State, current and past policies of Ecology, a review of the literature, and site visits. This approach provided the necessary information for developing technology-based treatment requirements and addressed both the spirit and intent of the CWA and the factors that must be considered when making a case-by-case determination.

Total Cost vs. Effluent Reduction Benefits

The BPT economic reasonableness test evaluates the cost of applying a treatment against the amount of pollutants removed. The BPT economic reasonableness test is not an evaluation of cost versus environmental benefits received. If the treatment is very effective, then it is likely to be acceptable. The intent of the BPT cost-benefit requirement is to avoid requiring wastewater treatment where the additional degree of effluent reduction is wholly out of proportion to the costs of achieving such marginal level of reduction. The EPA weighs more heavily the cost per pound of pollutants removed by the treatment technology than the effect of the annual cost of the treatment technology on the profitability of the facility. Settling solids is very effective treatment for WTP wastewater, resulting in very low costs per pound of solids removed.

The intent of the CWA has been to give the EPA broad discretion in considering the cost of pollution abatement in relation to its benefits and to preclude the EPA from giving the cost of compliance primary importance. An economic analysis, however, does include a consideration of the impact on prices, production, employment, profits, and the ability to finance expansion and pass costs on to consumers. In the case of WTPs, for instance, not providing drinking water is not a viable option and, therefore, the costs associated with technology-based treatment could never be so great that drinking water would no longer be considered affordable.

A BPT consideration must include a review of the treatment options that are available, the effectiveness of the treatment options, and the cost of treatment. There is not a wide range of treatment options for backwash and sedimentation solids. WTPs either do not treat the wastewater at all, or they incorporate some type of solids settling strategy. Settling retention time may be for no more than an hour in a settling basin or it may be hours to days in one or more lagoons. For most WTPs that do incorporate wastewater treatment, settling has been very effective. Ninety percent or more of the solids can be expected to be removed from the effluent by settling. The cost associated with this removal appears to be reasonable. Based on a 20-year cost averaging, $100/dry ton, or 5 cents a pound, was the estimated cost for one large facility to acquire land, design and build the lagoon, and pay operation and maintenance and disposal costs. A medium-sized facility, around 18,000 customers, estimated that their costs to design, build, and operate resulted in a 0.7 percent to 1 percent rate increase (based on a 20-year cost recovery). Most WTPs in this state that have had NPDES permits currently provide solids settling treatment. It would appear that, at least for most facilities, the costs incurred from implementing treatment can be covered by a water rate that is affordable.

While this BPT determination found the cost of settling solids effective and economically reasonable, the current level of treatment required by the CWA is BCT. In determining the level of treatment which represents BCT it is assumed that BPT has been established and is in place. As a result, when evaluating BCT it is the marginal cost and treatment effectiveness of going beyond BPT which is evaluated.

BCT has a very specific economic test to determine cost effectiveness. It is a two-part test, and the increased level of treatment must meet both parts. These tests are applied to treatment options that could further reduce the amount of pollutants discharged. Ecology agrees with the SAIC report that the treatment options available beyond BPT to further reduce the amount of pollutants in WTP wastewater discharge will not pass the BCT economic test and, therefore, BCT treatment requirements are presently considered to be the same as BPT.

Age of Equipment and Facility

Treatment technology utilized at WTPs has not changed significantly in many years. WTPs continue to use the basic operation of solids removal through simple settling. Age is not a relevant factor because age does not affect either the characteristics of the process wastewater or the treatment of wastewater. Therefore, the age of facilities is not a factor in the development of technology-based limits.

Process Employed

Operations used for settleable solids removal are essentially the same in all WTPs. Although wastewater quality and quantity may vary from plant to plant, residual solids removal technology is equally applicable to all WTPs and similar final effluent concentrations of settleable solids should be achieved by all WTPs. Therefore, processes employed are not a relevant factor in the development of limits for settleable solids.

Engineering Aspects

Operations used for settleable solids removal will be substantially the same at all WTPs, with the exception of capacity from plant to plant. The settleable solids technologies in use are well known and feasible in their application. Therefore, the design and construction of appropriate treatment facilities are not relevant factors in the development of limits for settleable solids.

Process Changes

There are no limits being considered that are based on process changes at WTPs. Therefore, this factor is not significant in evaluating subcategorization in this industry.

Non-Water Quality Environmental Impact

Non-water quality environmental impacts of WTP waste and wastewater treatment processes include residual solids disposal, air pollution, and energy consumption.

The major non-water quality environmental impact of WTP treatment processes is residual solids disposal. Residual solids consist of fine sands, silt, clay, and various organic materials. Coagulation residuals and iron and manganese removal residuals are usually nontoxic and may be safely land applied. Ecology encourages the application of residual solids to a beneficial use rather than to a landfill. Beneficial use can include incorporation in the production of a product such as concrete, direct application to soil at an approved agronomic rate, or as a component of a soil mix. Because land application and other beneficial uses are available for disposal of this nontoxic material, residual solids disposal is not a limiting factor in technology-based treatment considerations.

Implementation of sedimentation technologies has minimal, if any, air pollution impacts, and is therefore not a limiting factor in developing effluent limits.

Solids settling is not energy intensive, nor is removal exceptionally energy consumptive compared to the solids removed. Energy consumption is not a significant factor in the development of technology-based effluent limits for this industry.

APPENDIX G-2. ION EXCHANGE AND REVERSE OSMOSIS

Issue

Wastewater discharges from ion exchange (IX) and reverse osmosis (RO) are very high in total dissolved solids (TDS) and may contain specific ions of concern such as chloride, iron, manganese, arsenic (as arsenite or arsenate), or nitrate. Ecology proposes an approach to assess the environmental impact of these discharges and provide guidance on best management practices and permitting requirements.

Background

Ion exchange/inorganic adsorption uses resins and other media to remove cations/anions when more inexpensive solutions cannot remove the undesirable substance. IX can be used to soften water (remove **hardness**) and to remove inorganics (e.g., nitrates, iron, manganese, barium, arsenate, selenate, fluoride, lead, chromate, radionuclides). The typical IX systems in use in Washington State are the water softener type and are used primarily by single domestic systems and some small, group domestic systems (less than 500 residential connections). Although these IX systems remove hardness, they are most frequently employed to remove dissolved iron and manganese from groundwater. When the resins become saturated with iron and manganese ions, they must be regenerated with a concentrated brine, typically salt brine (most often sodium chloride, but potassium chloride can also be used). IX system wastewater discharge is composed of brine, dissolved iron and manganese, and rinse water, with a volume that is 1.5 to 10.0 percent of the raw water. The discharge from an average single domestic IX unit can be characterized as:

Discharge:	7,000 gal/yr
TDS:	15,000 - 35,000 mg/L
Salt:	312 lbs/yr
Total Iron:	100 to 200 mg/L
Total Manganese:	70 to 100 mg/L

Oxidative filters such as greensand are not ion exchange systems. These filters act as catalysts and facilitate chemical reactions (e.g., oxidation of manganese) and require continuous or periodic activation with an oxidant such as potassium permanganate but result in the filtration of a precipitate (iron oxide, manganese oxide). The nature and characteristics of the filter backwash from these systems is much more consistent with other filtration processes than with the discharge from IX.

Reverse osmosis uses water under pressure and semipermeable membranes to separate water and dissolved solids. It is one of several membrane processes (e.g., reverse osmosis, ultrafiltration, nanofiltration, microfiltration, and electrodialysis/electrodialysis reversal) which are used to treat water. Raw water (feedwater) is usually pretreated, which may consist of filtering, adding an antiscalant, and adjusting pH to 5.5 to 7.0. RO is very effective in removing dissolved salts but has a high wastewater discharge volume (up to 80 percent of the raw water volume) which is very site-specific in composition but typically has a concentrated salt content and may classify as brine. RO is also very effective at removing hardness ions, dissolved organics, undesirable color, trihalomethane precursors, specific inorganics, and radionuclides.

There are few RO systems currently in operation in the State, and none of those identified had more than 100 residential connections. However, it is expected, that RO desalination will become more common in the State in order to meet increased water demand for limited freshwater resources. RO technology is also advancing improved membranes and units designed to meet a variety of applications from small point-of-use models, producing from 5 to 30 gallons per day and operating on water line pressure, to large municipal units, producing from 150,000 to 5 million gallons per day. The discharge from a typical RO unit can be characterized in Table G-1 below.

Table G-1: Typical RO Unit Discharge

	Point-of-Use	**Point-of-Entry**	**Municipal**
Wastewater (percent of raw water)	70 to 90%	15 to 25%	10 to 25%
Average TDS (raw water, brackish)	15,000 mg/L	40,000 mg/L	50,000 mg/L
Average TDS (raw water, salt water)	20,000 mg/L	50,000 mg/L	60,000 mg/L

Electrodialysis/electrodialysis reversal (EER) is another membrane type process that produces a discharge that is not eligible for coverage under this WTP general permit and should be disposed with the same considerations as RO wastewater. EER is very effective at desalting brackish water and, depending on the makeup of the feedwater, removing specific inorganics and radionuclides. The pollutants in the wastewater discharge are concentrates of the feedwater and are therefore also site-specific. For example, the salts in brackish feedwater may be concentrated 3 to 10 times greater in the wastewater discharge resulting from the EER process.

Other membrane-type processes include microfiltration, ultrafiltration, and nanofiltration. Microfiltration and ultrafiltration are effective at removing particulates, microorganisms, and larger organics and typically have an associated wastewater discharge that is similar in character to traditional filtration processes. Microfiltration and ultrafiltration would likely qualify for coverage under the WTP general permit because their typical wastewater discharge is similar to filter backwash from conventional filtration processes.

Nanofiltration is very effective in removing hardness ions, dissolved organics, undesirable color, trihalomethane precursors, and depending on the feedwater constituents, removing specific inorganics and radionuclides. Nanofiltration is not likely to qualify for coverage under the WTP general permit because the typical wastewater discharge is similar to RO wastewater. In all cases, the pollutants in the wastewater discharge are concentrates of the feedwater and are site-and process-specific. If the process is removing suspended solids, produces finished water at a rate of 35,000 gpd or more, and discharges backwash effluent to surface water, then an **application for coverage** under this WTP general permit must be submitted. If the process is removing dissolved solids and discharging wastewater to surface water, then an application for an individual permit must be submitted.

Discharge of RO and IX wastewater may be to ground, to a POTW, or to surface water. Most single domestic and small group domestic IX systems discharge to ground. A telephone survey during the initial issuance of the WTP general permit identified three IX systems with more than 100 residential connections that discharged to ground, one to a POTW, and none to surface water. The State groundwater criteria have been set for regulated contaminant substances including chlorides (250 mg/L), total dissolved solids (500 mg/L), iron (0.3 mg/L), manganese (0.05 mg/L), arsenic (0.05 ug/L), nitrate (10 mg/L), nitrite (1 mg/L), and total nitrogen (10 mg/L). Corresponding surface water criteria for fresh waters are set for dissolved chloride (860 mg/L acute, 230 mg/L chronic) and arsenic (360 ug/L acute, 190 ug/L chronic). The beneficial uses of a specific surface waterbody must also be protected, and any RO or IX wastewater discharge that would degrade the water quality, impacting a beneficial use such as water supply, stock watering, or aquatic life, would be prohibited.

The composition of the wastewater discharge from an IX process varies greatly from individual system to system. There can be three distinct phases: backflush (plain water used to remove any suspended solids from the resin medium), regeneration (saturated brine solution to reactivate the resins), and final rinse (plain water used to remove the excess brine before production of drinking water resumes). The amount of water used to backflush and to rinse the system versus the concentration and quantity of the brine will affect the concentration of dissolved solids that is discharged in the wastewater. The discharge may also be direct, producing variable concentrations with a peak concentration, or controlled, allowing mixing of the different phases and a timed release of the discharge thereby producing a relatively constant concentration of dissolved solids. Careful analysis is typically necessary to accurately characterize the wastewater discharge of an individual system and to evaluate its impact.

Arsenic Removal

Arsenic occurs naturally in groundwater in at least 16 counties in Washington State at concentrations high enough to be a public health concern. The source of this arsenic is arsenopyrite and other arsenic rich minerals located throughout the Cascade Mountains foothills and the mining districts in the northeastern part of the State. These minerals dissolve into groundwater to form inorganic arsenic ions, arsenate (AsO_4-3) and arsenite (AsO3-3). Both arsenate and arsenite can occur in groundwater. Most of the arsenic in State aquifers occurs as arsenate. However, arsenite is the predominant form in oxygen-poor environments, such as those found in deeper aquifers. Arsenic may also be found in its soluble pentavalent state, arsenic acid (H_2AsO_4), in shallow aquifers.

In several locations the arsenic concentrations from both public and private water distribution systems routinely exceeded the drinking water standard of 0.010 mg/L, and thereby required treatment to remove arsenic. Some methods of treatment require the oxidation of arsenite to arsenate. Treatment results in the generation of waste products, which must be properly managed to avoid a negative impact on the environment.

Arsenic binds strongly to iron and aluminum oxides. As a result, two of the main types of arsenic treatment employ this principle to remove arsenic from groundwater. When the concentration of iron in groundwater is high, iron can be oxidized and the iron oxide precipitate filtered, removing arsenic from the water. The column must be backwashed frequently to prevent the accumulated oxide particles from clogging the filter. This process is more effective when the mass ratio of iron to arsenic is at least 20 to 1 and the pH is less than 7.5.

Similarly, a column packed with iron or aluminum oxides can be used to remove arsenic from water. Periodically, the column must be backwashed to remove accumulated precipitates and replaced once the finished water exceeds State Drinking Water Standards. The replacement period can be from weeks to years depending upon the type of oxide particles and raw water quality to be treated. The used iron and aluminum oxides are typically stable enough for disposal in a “351” municipal solid waste landfill.

Ion exchange (IX) is another form of arsenic treatment that may be used. While anionic resins may be used, IX typically uses activated alumina (AlO3) and has been shown to be effective in removing 90 to 95% of the arsenic from the source water. However, pretreatment with a strong oxidant and pH adjustment may be necessary to achieve maximum efficiency, and the alumina column may be regenerated by washing periodically with 4% NaOH to remove the captured arsenic. However, this treatment process generates a concentrated liquid waste stream with high concentration of arsenic that may make disposal problematic.

Reverse osmosis (RO) may be practical for domestic or smaller water systems where the arsenic concentration in the source water does not exceed 0.10 mg/L, and where extensive oxidative pretreatment has occurred. However, RO creates a large volume of reject water that contains several times the source water concentration of arsenic which may create a disposal problem.

Nitrate Removal

Nitrate contamination of groundwater has become an increasing concern in Washington State. Pregnant women and infants are at risk if nitrate levels exceed 10 mg/L. Larger systems that have a nitrate-contaminated groundwater source will generally have other water sources which are not contaminated, and they may blend their sources of water to achieve a product that is less than 10 mg/L. Small systems will typically have to treat the water before distribution or at the point-of-use for persons at risk.

IX with strong base resins can be used to remove nitrate from water, but sulfate ions will also be removed which can significantly reduce the efficiency of the IX process. Salt brine (sodium chloride) is used to regenerate the resin and nitrate levels in the spent brine can be as high as 6,000 mg/L. RO can also be used to remove nitrate. The newer polyamide thin-film composite membranes provide improved nitrate rejection over traditional cellulose acetate membranes. Small counter-top and under-counter units are available for point-of-use applications, as are larger point-of-entry units and very large commercial/municipal sized units. If the wastewater discharge from IX or RO is suitable for agronomic purposes, vegetation can effectively treat the nitrates when the wastewater is applied at appropriate agronomic rates and growing conditions.

Considerations - Discharge to Land

Ion exchange wastewater is typically discharged to land in Washington State. Wastewater from reverse osmosis may also be discharged to land and if so, the considerations put forth here would be equally applicable to an RO discharge. IX/RO wastewater discharges to land include discharges to an infiltration pond/trench, drain field, swale, or land irrigation. While the soil and vegetation may afford some treatment, pollutants are likely to travel to groundwaters of the State. Treatment options to remove or reduce the dissolved solids before discharge to land are unavailable or economically prohibitive. Chapter 173-200 WAC establishes water quality criteria of 250 mg/L for chloride, 500 mg/L for total dissolved solids, 0.30 mg/L for iron, and 0.05 mg/L for manganese. Criteria are threshold limits which should never be exceeded in groundwater. However, the criteria are not the groundwater protection goal for groundwater quality. The standards also contain an antidegradation policy which protects existing high-quality groundwater. Therefore, the intent is to protect **existing conditions** and not allow groundwater degradation beyond the criteria. These standards protect all groundwater in the **saturated zone** and their protection is not limited to drinking water aquifers.

Ecology assessed whether a potential existed for certain major constituents in the episodic discharges from WTPs to pollute surface waters and groundwaters. The methods for this assessment were those provided in Sections 3.3.1 and 3.3.2 of the “Technical Support Document for Water Quality-Based Toxics Control” (U.S. EPA, 1991). One set of calculations addressed a one-time discharge of briny wastewater to the ground, and another set addressed a continual daily discharge to the ground.

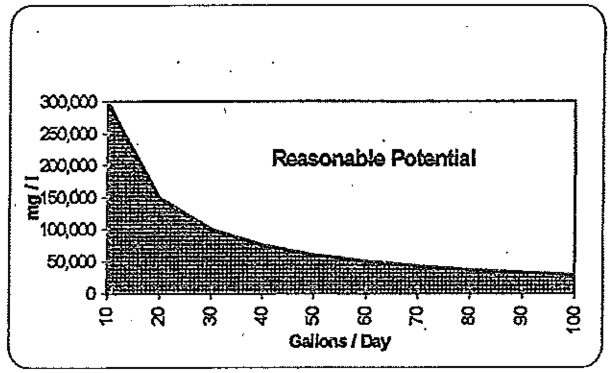
The charts in Figure G-1 and the isoconcentration curves in Figure G-2 summarize the results of several computer modeling exercises designed to predict the potential impact to groundwater of salt brine wastewater discharges with no attempt to factor in retardation or sorption. The model contained the assumptions that only one source was present within a 0.25-acre area, and subsurficial dispersion characteristics were typical across the State. The assessment was based on not exceeding the water quality criteria. The charts in Figure G-1 depict the impact of a one-time discharge to ground of varying volumes of wastewater containing varying concentrations of total dissolved solids. Wastewater discharges that fall above the line in the charts present a risk of violating the State groundwater standards, and those below the line are not likely to do so. The isoconcentration curves in Figure G-2 depict the impact on the groundwater of an ongoing daily discharge of salt brine wastewater to the ground, along with the model variables.

Figure G-1: Potential to Pollute Groundwater Through a One-Time Discharge

Potential to Pollute Ground Water

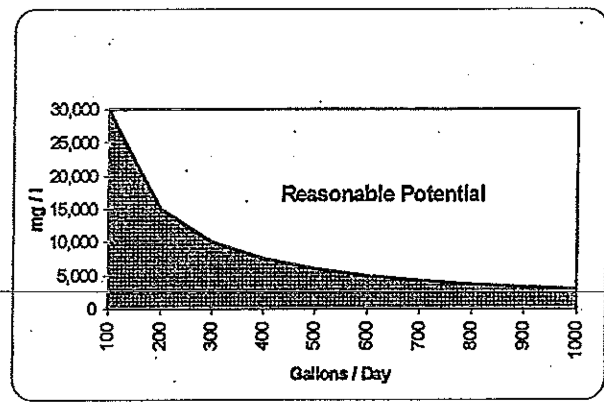
Wastewater Discharge

Gal/Day	TDS - mg/L
10	300,000
20	150,000
30	100,000
40	75,000
50	60,000
60	50,000
70	43,000
80	37,000
90	33,000
100	30,000



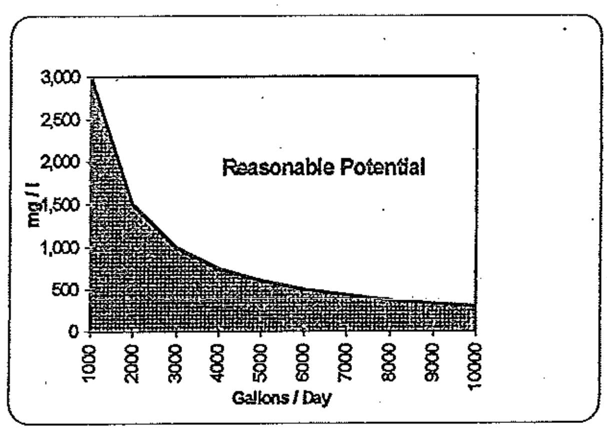
Wastewater Discharge

Gal/Day	TDS - mg/L
100	30,000
200	15,000
300	10,000
400	7,500
500	6,000
600	5,000
700	4,300
800	3,700
900	3,300
1000	3,000



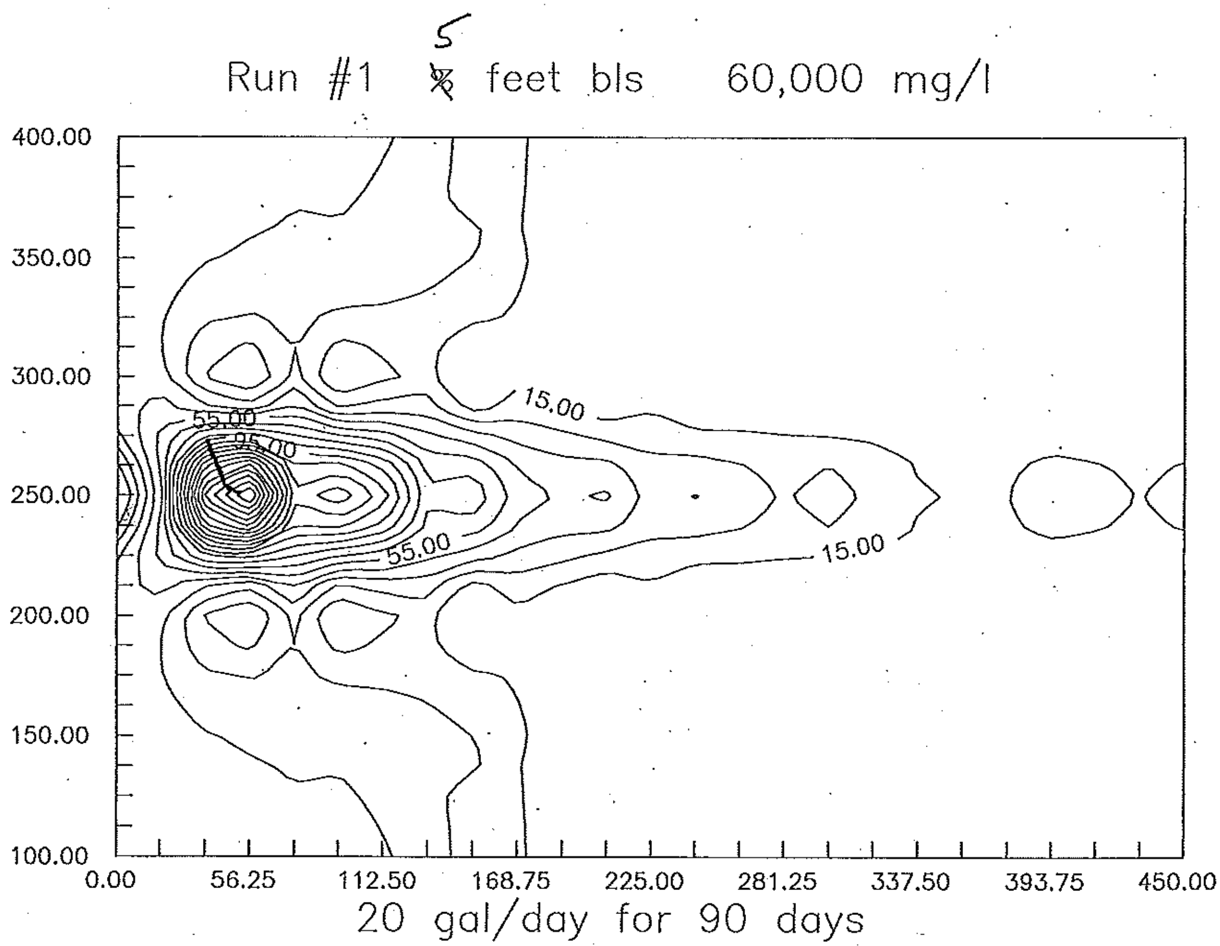
Wastewater Discharge

Gal/Day	TDS - mg/L
1000	3,000
2000	1,500
3000	1,000
4000	750
5000	600
6000	500
7000	430
8000	370
9000	330
10000	300



Volume of aquifer impacted: 0.25 acres x 10 feet
Soil porosity: 0.25

Figure G-2: Potential to Pollute Groundwater Through an Ongoing Daily Discharge



Wastewater brine concentration: 60,000 mg/L as Chloride
Volume discharged: 20 gallons per day for 90 days (episodic)
Area of discharge: 50-foot radius
Total depth of aquifer: 10 feet deep
Soil porosity: 0.25 to 0.30
Darcy velocity: 2 to 3 feet per day
Longitudinal dispersivity: 5
Horizontal and vertical dispersivity: 1
The x- and y-axes are expressed as feet from an arbitrary origin.
The isopleth labels are expressed as mg/L of chloride in the ground water.

Ecology has not developed a "one-size-fits-all" threshold for risk to violate groundwater standards for WTP discharges, primarily due to the episodic nature of the discharges. Also, risk varies from site to site based on the volume of discharge, soil characteristics, depth to the aquifer, the background concentrations of the subject constituents in the groundwater, and exceptional sensitivities such as aquifers with limited recharge or saltwater intrusion. Group domestic facilities that discharge regeneration brine should consult with the appropriate Ecology regional office to determine if a discharge permit is required for their facility.

At this time the most cost effective and environmentally responsible method of arsenic removal and management of the concentrated arsenic appears to be ion exchange with the disposal of spent resin/alumina column **without** regeneration. Arsenic contained in this waste product is likely to be stable enough for disposal in a “351” municipal solid waste landfill. It may also be possible to market the solid waste to industry or recycling operations. Options that remove arsenic through sorption may also be used as long as the sorption media is properly disposed and does not result in a discharge of concentrated arsenic.

Considerations - Discharge to POTW

Saltwater brines from IX or RO treatment systems can have an adverse impact on a POTW (sewage treatment plant and its delivery system). The typical discharge is high in chloride ions and may be corrosive to materials it contacts, especially concrete components and metal surfaces which are particularly vulnerable to corrosion from the salt brine. The impact of the wastewater discharge will be influenced by: the total discharge volume and flow rate; the hydraulic capacity of the POTW; the peak and average concentration of dissolved solids; and the size, age, and physical characteristics of the sewer collection system.

A discharge to a POTW from IX/RO systems which remove **toxic substances** such as arsenic are typically unacceptable. Additionally, biological processes of the treatment works may be adversely impacted if the concentration at the headworks of the POTW of some compounds typical to IX/RO wastewater discharges exceed acceptable levels. The threshold concentrations of concern are listed in the table below. These concentrations far exceed typical domestic wastewater concentrations and set reasonable potential for concern at 25 percent of levels that have been recognized to cause inhibition.

Table G-2: Pollutant Concentrations of Concern for a POTW

Pollutants	Threshold Concentration of Concern as Measured at Headworks of the POTW
NaCl (Sodium chloride)	2,500 mg/L (Kincannon, D.F., 1965; and Lawton, G.W. and Eggert, C.V. 1957)
Na + (Sodium ion)	2,000 mg/L (Kugelman, I.J. and McCarty, P.L. 1964)
K+ (Potassium ion)	3,000 mg/L
Ca++ (Calcium ion)	2,000 mg/L
Mg++ (Magnesium ion)	500 mg/L

References cited in Federal Guidelines: Pretreatment of Pollutants Introduced Into Publicly-Owned Treatment Works, U.S. EPA Office of Water, October 1973.

Considerations - Discharge to Surface Water

Federal and State law requires an NPDES permit for wastewater discharge to surface waters. A discharge of wastewater from desalinization processes to salt water may pose no environmental threat. However, without significant dilution, discharge of wastewater from IX/RO treatment systems to fresh water will likely violate the State surface water quality standards as stipulated in Chapter 173-201A WAC. The discharge of high levels of dissolved solids to fresh water can have a negative impact on aquatic life and can degrade the water quality, limiting water supply and stock watering uses. Likewise, the discharge of wastewater high in arsenic or nitrates is likely to degrade the receiving water quality and impair uses associated with the surface water body.

Conclusion - Discharge to Land

Land application will most often be the best disposal option for wastewater from ion exchange systems that remove iron and manganese. RO wastewater discharges may also be land applied if the discharge does not contain significant levels of any toxics or groundwater primary pollutants and the volume, and concentration of dissolved solids does not demonstrate reasonable risk to contaminate groundwater. Small IX/RO systems that discharge wastewater containing less than 25 pounds of salt per day (Figure G-1) do not typically demonstrate risk to violate groundwater criteria for chloride and total dissolved solids and, therefore, will not typically be required to apply for a State Wastewater Discharge Permit. Ecology may require such a discharge permit, however, if the discharge is to a shallow aquifer, **highly permeable soil**, an aquifer with limited recharge, or when groundwater quality appears to be threatened. Discharge to a "dry well" is technically underground injection and is prohibited under the State Underground Injection Control Act, Chapter 173-218 WAC. Discharge to a drain field, infiltration pond or trench, although not prohibited, should be utilized only when discharge via land application (irrigation) or into a grass-lined swale is not possible. Wastewater discharges must be properly managed so that there is no reasonable potential to discharge to surface water, cause soil erosion, or deteriorate land features.

Discharge to land from single domestic and point-of-use treatment for arsenic will not be prohibited, although ion exchange treatment for arsenic without regeneration is recommended. An individual State wastewater discharge permit will be required for systems (excluding single domestic and point-of-use systems) that provide arsenic or nitrate removal treatment either by reverse osmosis or ion exchange with regeneration.

Conclusion - Discharge to POTW

Discharge to a POTW from a single domestic or point-of-use IX/RO water treatment system will typically not be required to obtain a wastewater discharge permit. However, larger IX/RO water treatment systems will be required to obtain an individual State wastewater discharge permit (unless they discharge to a POTW that has been fully delegated) under any of the following conditions:

1. They designate as a **significant industrial user (**SIU) as defined by 40 CFR § 403.3;
2. The wastewater TDS exceeds 20,000 mg/L;
3. The wastewater contains significant levels of toxics (e.g. those from arsenic removal); or
4. Ecology determines that it is necessary for any reason.

IX/RO systems that are not required to obtain an individual State wastewater discharge permit are still required to properly identify the character and quantity of their discharge to the POTW, identify and mitigate potential corrosion problems, and provide discharge control as necessary to minimize any negative impact on the POTW. Failure to do so may result in the requirement to obtain an individual wastewater discharge permit.

Conclusion - Discharge to Surface Water

It is recommended that the wastewater from desalinization processes be discharged to salt water provided the **outfall** is properly located to assure mixing and avoids environmentally **sensitive areas** such as estuaries. An application for a wastewater discharge permit shall be submitted to Ecology for all desalinization systems where the discharge of wastewater exceeds 5,000 gallons per day.

It is recommended that under most other circumstances, wastewater from RO/IX should not be discharged to surface water. However, if the wastewater discharge (excluding single domestic and point-of-use systems) from RO/IX processes must go to a surface waterbody, an application for an individual wastewater discharge permit must be submitted to Ecology.

APPENDIX G-3. DISCHARGE TO LAND OR POTWS

Issue – Discharge to Land

No pollutants may be discharged from any commercial or industrial operation into waters of the State except as authorized under a valid wastewater discharge permit. In Washington State as of December 1997, 20 water treatment plants (WTPs) with more than 100 residential connections were identified as discharging wastewater to land. The WTP general permit under development could include WTPs that discharge to land if that discharge had reasonable risk to pollute groundwater. However typical discharges of filtration backwash to land will not have reasonable risk of polluting groundwater (discussed below), and land application of filtration backwash is not included the WTP general permit.

Issue – Discharge to POTW

Both federal law and State law have established permitting requirements to implement the national pretreatment standards for **industrial wastewater** discharges to publicly owned treatment works (POTWs). The pretreatment standards have been implemented to control pollutants which pass through or interfere with treatment processes in POTWs or which may contaminate sewage sludge. In Washington State as of December 1997, ten WTPs with more than 100 residential connections discharge wastewater to a POTW. The WTP general permit under development could include WTPs that discharge to a POTW if that discharge requires a permit.

- Is the discharge subject to pretreatment standards under section 307 of FWPCA?
- Are these significant industrial users (SIUs)?
- Are they exempt under WAC 173-216-050?

Background

The WTP general permit is being developed for facilities that have a wastewater discharge from filtration processes. Authorization for discharge from WTPs that employ ion exchange (IX), or reverse osmosis (RO) will not be included in the proposed general permit. Potable water production from surface water or from groundwater can employ filtration as part of the treatment necessary to comply with drinking water standards. Typical surface water treatment applies filtration to remove organic and inorganic matter and to remove pathogenic organisms. Typical groundwater treatment precipitates dissolved minerals followed by filtration to remove the minerals. Regardless, filters lose their effectiveness as the solids accumulate and must be cleaned to avoid breakthrough and unacceptable head loss. Filter cleaning is accomplished by reversing the flow of water and backflushing the filter, producing wastewater composed of the solids and backflush water. The solids include substances removed from the raw water as well as additives applied to enhance filtration, and the backflush water may include additives such as chlorine. This wastewater is known as backwash and constitutes the majority of the wastewater discharge.

The frequency of discharge is highly variable, from several times a day for large WTPs with several filters to once or twice a week for small WTPs. Likewise, the quantity of the discharge varies somewhat by the size of WTP from about 3,000 gallons to backflush a small filter to 60,000 gallons for large filters. The duration of backwash discharge, however, is relatively constant, about 10 to 15 minutes per episode. Following a backflush of the filter, WTPs may also discharge the filtered water for a period of time while the filter settles and "cures" (filter-to-waste).

Processes can vary depending on the treatment the raw water requires. Treatment of groundwater most frequently removes dissolved iron and manganese and typically includes oxidation (e.g. ozonation, addition of chlorine or potassium permanganate) to precipitate the iron and manganese followed by filtration to remove the iron and manganese oxides. Some data has shown that backwash from these oxidation/filtration processes can be characterized as follows:

Total Iron:	100 to 200 mg/L
Total Manganese:	70 to 100 mg/L
Total Residual Chlorine (TRC):	0.6 to 1 mg/L

However, data collected from facilities covered by this permit have shown much lower concentrations of iron and manganese, see the section on Wastewater Characterization and Appendix H for more information on this. Surface water is most frequently treated by filtration to remove suspended solids and may incorporate presedimentation and sedimentation basins before filtration. Precipitation, coagulation and flocculation are frequently used to increase the effectiveness of filtration and sedimentation. Aluminum sulfate, alum, is the most common additive and is used by WTPs for coagulation. Polymers are another common additive that may be used to enhance coagulation, flocculation, or filtration. Chlorine may be added before filtration as an oxidizing agent for precipitation and to remove unwanted taste and color and is frequently added after filtration for disinfection purposes producing the "finish water" for distribution as drinking water. This chlorinated finish water is typically used to backflush the filters. Filter backwash from standard coagulation/flocculation processes associated with treating surface water can be characterized as follows:

Suspended Solids:	50 to 400 mg/L
Aluminum Hydroxide or Ferric Hydroxide (additive)	25 to 50%
Clay/Silt (source water)	35 to 50%
Organic Matter (source water)	15 to 25%
Total Residual Chlorine, TRC (additive):	0.1 to 1 mg/L

Filtration processes, whether associated with groundwater or surface water, remove suspended solids. Neither the physical processes nor process additives tend to add significant levels of dissolved solids or chemicals with the exception of TRC. Suspended solids are the pollutants of concern in WTP process wastewater discharge, and they are readily removed by the filtering capacity of the **land application site** or typical POTW processes.

Considerations - Discharge to Land

Discharges to land are those discharges which are designed to be completely contained by land with no reasonable risk, during all weather conditions, of discharging to surface water. Discharge to land includes discharges to a drain field, infiltration pond/trench, swale, or land application (irrigation) as long as the discharge is contained and there is no overflow or runoff to surface water. Surface water includes all lakes, rivers, ponds, streams, inland waters, salt waters, and associated intermittent streams and wetlands.

Many WTPs obtain their raw source water from groundwater aquifers. Groundwater frequently contains dissolved iron and manganese at concentrations that require removal to meet drinking water standards. Under typical, natural, aerobic conditions and in most filter backwash discharges, iron and manganese exist as relatively stable and non-mobile oxides. When WTPs discharge this wastewater to soil, the soil acts as a filter and prevents the oxides from migrating down to the groundwater. However, non-mobility is not as certain for anionic contaminants, such as nitrate and arsenic (as arsenate or arsenite), and when quantities of precipitates build up in the soil, are exposed to anoxic conditions, and thereby become soluble and likely to migrate to groundwater. Therefore, appropriate removal and disposal of the residuals is necessary to assure that iron and manganese precipitates do not become mobile and pollute waters of the State.

Many WTPs obtain their raw source water from surface waterbodies. Surface water is typically treated by filtration to remove silt, clay, organics, and pathogens. When the solid residue is discharged to land, the soil itself will act as a filter making it unlikely for these substances to be carried to groundwater. However, material from this discharge could be carried to groundwater if the residual solids are allowed to build up and acidic or anoxic conditions develop. Additionally, land application of alum residuals could cause a reduction in available phosphorus. However, application rates of up to 7.34 tons/acre-year should not cause environmental degradation. Therefore, appropriate management and disposal of the residual solids is necessary to assure that the residual solids remain non-mobile and do not pollute waters of the State.

Chlorine can combine with organic material in water and produce toxic and carcinogenic byproducts, e.g., trihalomethanes, which are regulated under the State water quality standards as well as by the Washington State Department of Health. The State drinking water standards prohibit these substances to exceed certain maximum levels in the finished product (potable water). The WTP process wastewater should contain these chlorine-related substances at a concentration level that is very close to that found in the potable water, and those concentrations are unlikely to exceed water quality standards. Residual chlorine may also be found in the process wastewater. Because of its highly reactive and volatile nature, however, it will quickly dissipate, and it is highly unlikely to persist and pollute groundwater.

“Toxics in toxic amounts” should not be found in additives used by the WTP industry. ANSI/NSF Standard 60 defines requirements for the control of potentially adverse human health effects from products added to drinking water for treatment. Only certified chemicals that meet Standard 60 requirements are acceptable for use in the treatment of drinking water. Certification assures that water treatment chemicals will not exceed a maximum allowable limit which, in general, is set at 1/10th of the maximum contamination level (MCL) set by the EPA for drinking water and 1/10th of the maximum drinking water levels (based on toxicological criteria) for unregulated contaminants.

Total dissolved solids (TDS) are not typically increased by filtration processes and should not be a problem for WTP process wastewater unless the source water (raw water) is already unacceptably high in TDS. Likewise, “toxics in toxic amounts” do not typically result from water treatment processes unless the source water has significant levels of toxics. Since the product is drinking water, it is unlikely that the source water would contain significant concentrations of toxics or high levels of TDS.

Sometimes, however, WTPs in Washington State must rely on a raw water source that contains significant amounts of arsenic, usually groundwater. In those cases, depending on the type of treatment employed by the WTP, significant concentrations of arsenic may be present in the filter backwash wastewater. Table G-3 shows the total arsenic concentrations detected in the wastewaters of 15 small WTPs in correspondence with the treatment processes that each of those WTPs employed.

Table G-3: Results of Total Arsenic Analyses of Filter Backwash Wastewater

Study Location Name	Code	Treatment Process	Arsenic (ug/L)
Bayview Beach	--	Unknown.	**140**
Harbor Hills Water System	--	Unknown.	<60
Naches Water Treatment	--	Unknown.	<60
Outlook	--	Unknown.	**6.9**
Mountain Road Estates	**AC**	Remove arsenic, taste, and odor, and dechlorinate. Use anthracite/activated carbon filter.	<60
Mariners Cove Beach Club	**GS**	Remove iron and manganese. Use a green sand filter.	<60
Mutiny View Manor Community Club	**GS**	Remove iron and manganese. Use a green sand filter.	<60
Ridgeview Estates	**GS**	Remove iron and manganese. Use aeration and a green sand filter.	<60
Boxx Berry Farm	**IE**	Remove nitrate. Use ion exchange.	<60

Bummer #2	**Ox**	Remove arsenic. Use ferric chloride and chlorine to oxidize, then filter.	<60
Coupeville	**Ox**	Remove arsenic, iron, and manganese. Use aeration to oxidize, then filter.	<60
Ledgewood Beach Water District	**Ox**	Remove iron and manganese. Use aeration to oxidize, then filter.	**150**
Lost Lake	**Ox**	Remove iron and manganese. Use ozonation to oxidize, then filter.	<60
Westside Water System	**Ox**	Remove arsenic. Use oxidation, then filter.	**190**
Mission Ranch Estates	**RO**	Remove chloride. Use reverse osmosis.	<60

Ecology collected the samples shown in this table in November 2008 (Ecology, in preparation).

While it is true that detention ponds, whether lined or unlined, as well as infiltration ponds and drying beds have the potential to **discharge to groundwater**, the question is whether that discharge will contain pollutants. Since the primary pollutants are suspended solids, they are likely to be filtered by the ground and are not likely to reach groundwater. Under typical conditions it is also highly unlikely that there will be contaminants in the source water or from process additives that will persist and be carried to groundwater.

The Washington State Department of Health has implemented a risk reduction/ pollution prevention wellhead protection policy which prohibits the discharge of filter backwash within the short-term recharge areas of public drinking water wells. While there does not appear to be a significant probability of chemical pollutants that would affect the groundwater quality and compromise drinking water standards, there is some concern about the possibility of microbial pathogens in the discharge. Therefore, all infiltration ponds or trenches should be located outside of any delineated 1-year time-of-travel **wellhead protection areas**.

Considerations - Discharge to POTW

Under federal law, pretreatment may be required of any industrial user that discharges to a POTW and has the potential to introduce pollutants that will pass through the POTW or interfere with the operation of the POTW. This control may be affected by issuing a wastewater discharge permit and for significant industrial users, a permit or equivalent individual control mechanism must be issued. Significant industrial users (SIUs) are: (1) all industrial users that are subject to categorical pretreatment standards; (2) industrial users that discharge an average of 25,000 gallons per day or more of process wastewater; (3) industrial users that contributes a waste stream which makes up 5 percent of more of the average dry weather hydraulic or organic capacity of the POTW; or (4) industrial users which are designated as such. Although WTPs are not designated as subject to categorical pretreatment standards, some of the WTPs in Washington State do discharge an average of 25,000 gallons per day or more of process wastewater. These WTPs would qualify as SIUs unless there is a determination that there is no reasonable potential to adversely affect the POTW's operation and the discharge will not violate any pretreatment standard or requirement. Such a determination appears appropriate based on the characteristics of this wastewater discharge.

Filter backwash from WTPs should not introduce pollutants that will pass through the POTW. Backwash contains solids that are typically nontoxic and will readily settle out at the POTW. It would be possible if the raw water contained a substance such as arsenic, that that substance could be concentrated by the filtration process and contaminate the sewage sludge. It is improbable, however, that any raw water that can be treated to meet drinking water standards would contain contaminants at levels that would have this result. It would also be possible to cause hydraulic loading problems if a large WTP were discharging to a small POTW, and discharges from WTPs can overload delivery systems if the sewer system is operating near design capacity or undersized for the instantaneous flow of backwash. Filter backwash may also be more abrasive than typical sanitary wastes, resulting in a reduced life span for pumps and other system components.

One WTP has tested the amount of total suspended solids (TSS) in their effluent and compared it to TSS in the POTW influent. Both had concentrations that varied between 170 to 320 mg/L demonstrating a similarity to domestic wastewater. WTP wastewater is typically low in organic content, does not contain significant levels of BOD or COD that would be of concern, and has a relatively neutral pH range. WTP process additives are not likely to introduce any toxicity of consequence nor interfere with POTW operation. Polymers used in WTP processes are similar in nature and function and sometime the same as those polymers used by POTWs. Settling of solids can occur in sanitary delivery lines but this is no more likely than typical sanitary wastes. WTP wastewater may be more abrasive than typical sanitary wastewater but requires no special delivery system other than a delivery system that is appropriately sized for flow demands. Typical WTP wastewater does not appear to pose any operational concern for those POTWs that have the capacity to accept the wastewater.

Conclusion - WTP Discharge to Land

Based on current information, WTPs that discharge process wastewater from filtration processes associated with the production of potable water shall be conditionally exempt from State-based permit requirements for discharge to ground. This exemption will be subject to periodic review of WTP processes and discharge characteristics, and the following conditions must all be met:

1. Discharge must be free of additives that have the potential to reach waters of the State;
2. Infiltration ponds/trenches must have sufficient free board to prevent over-topping and be managed so that there is no reasonable potential to discharge to surface water;
3. Discharge must not result in unmanaged soil erosion or deterioration of land features;

4. Residual solids that accumulate in infiltration ponds/trenches must be disposed of as necessary to avoid a build-up and concentration of these materials; and
5. Disposal of solids must be consistent with requirements of local health department.

Conclusion - WTP Discharge to POTW

WTPs are not subject to categorical pretreatment standards and typical discharge does not have reasonable potential to adversely affect the POTW's operation or introduce pollutants that will pass through the POTW, nor will it violate any pretreatment standard or requirement. Therefore, it is reasonable to conclude that WTPs that discharge to a POTW are not significant industrial users and hence are not inherently subject to permit requirements under federal law. Typical process wastewater from filtration processes has about the same concentration of suspended solids as domestic wastewater, with lower BOD and fewer pollutants than domestic wastewater. The strength and character of the effluent is no greater risk to the POTW than normal domestic wastewater. Therefore, WTP wastewater discharge is not necessarily subject to permits under Chapter 173-216 WAC.

WTPs that discharge process wastewater from filtration processes associated with the production of potable water shall be conditionally exempt from State-based permit requirements for indirect discharge to non-delegated POTWs (have not received the authority to issue permits under RCW 90.48.165). This exemption will be subject to periodic review and the following conditions must both be met:

1. The POTW has agreed to accept the wastewater; and
1. Process wastewater discharge will not overload the delivery system or design capacity of the POTW.

State-based discharge permit decisions are not applicable to a POTW that has received the authority to issue permits under RCW 90.48.165 (delegated POTW). This proposal has no effect on and is not intended to affect any requirements of WTPs by municipalities with delegated authority.

APPENDIX H. GROUNDWATER DISCHARGE ANALYSIS

Ecology has several tools available to assist with the calculation of limits for inclusion in permits. Each tool uses a slightly different method of calculation to arrive at a unique limit value and each tool has certain strengths and weaknesses. Two of the methods available use data for effluent, receiving water, and water quality criteria, while the third method (TSD for WQ Limits) is a direct calculation method using all available effluent or groundwater data. PermitCalc and TSDCalc were originally written for discharges to surface water but have been modified to calculate groundwater limits. Modifications include: adding parameters with groundwater quality standards to the list of available parameters and changing values for existing parameters from the surface water to the groundwater standard; changing the calculation of dilution factor from that used for surface water to that used for groundwater; removal of "acute" and "chronic" criteria and substitution with a single line for groundwater criteria; and changing units from micrograms per liter (µg/L) to milligrams per liter (mg/L). The strength of both PermitCalc and TSDCalc are that they use information from the receiving waters to arrive at a limit value. A weakness for both is that they assume a log-normal distribution for the data set and use single values (average, maximum, or 95th percentile) in their calculations.

The TSD for WQ Limits tool's strength lies in the fact that it uses all available data to calculate a limit and allows for the application of the any normality distribution. The weakness lies with the fact that the limit value calculated from effluent values may not be protective of groundwater. This is due to using only effluent data in the calculations, thus there is no opportunity to add a dilution factor or perform a comparison to ***ambient*** groundwater conditions.

Because of the different strengths and weaknesses of the tools, both PermitCalc and TSDCalc are used to determine which constituents show a reasonable potential to exceed groundwater limits. The PermitCalc tool is often used to calculate limits and early warning values for the effluent discharged to the ground surface. TSD for WQ Limits is used to calculate limits and early warning values for groundwater. Groundwater limits and early warning values are calculated using receiving water data. As the backwash data used lacked background information the geometric mean of the data was used for receiving water data and the 95th percentile of the groundwater quality standard for the background concentration.

Before any limit calculations are conducted the entire data set is subjected to basic descriptive statistical analyses. Backwash data was supplied from 29 different water treatment plants from around the state and included 11 parameters. For most locations data was provided for the water treatment plant treated water leaving the plant (WTP and WTP TRT) and for the backwash effluent (WTP UNT). Parameters for each data set are further sub-divided into single sample and quarterly average results. For this general permit analysis we are only interested in the backwash effluent (WTP UNT). Basic statistics for each parameter are presented in Tables H-2 to H-4.

Each parameter for each data set is evaluated for statistical outliers, seasonality, normality, and equality of variance. All statistics are done using the Sanitas statistical software program by Sanitas Technologies, and the methods detailed in the EPA 530/R-09-007, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance, March 2009 (Unified Guidance)[i].

Outliers are determined by the method set out in EPA G-89-00018, Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities Interim Final Guidance, April 1989. Outlier normality is tested using the Shapiro-Francia method (Shapiro-Wilk if $n \le 10$) with an alpha of 0.05. Seasonality is tested using the Kruskal-Wallis test and the default of four seasons. If the calculated Kruskal-Wallis statistic is greater than the tabulated Chi-squared value, then seasonality is confirmed. If a parameter is determined to have seasonality the software program automatically deseasonalizes before conducting any analysis. Normality of the data set is tested using the Ladder of Powers at an alpha of 0.05. The Ladder of Powers allows for testing of multiple statistical distributions at one time. Statistical distributions include normal, log-normal, square-root normal, cube-root normal, square normal, cube normal, x^4 normal, x^5 normal, and x^6 normal. Equality of variance is tested using Levene's Equality of Variance method.

Statistical outliers are determined for the water treatment plant backwash effluent for single sample and quarterly average chloride and TDS (WTP UNT). To be able to use certain statistical methods all zero values were removed from the data sets and basic statistics are run on those reduced data sets. With zeros removed outliers are only found in the backwash effluent data (WTP UNT) for single sample and quarterly average total manganese.

Seasonality is found in the backwash effluent data set (WTP UNT) for single sample total iron with zero values.

Inequality in variance was determined for only quarterly dissolved manganese with and without zero values for the backwash effluent (WTP UNT) data set.

The Mann-Whitney test is another statistical method for determining the equality of data sets. Differences in equality are determined at the 80th, 90th, 95th, 98th, and 99th percent confidence levels. None of the backwash effluent data set (WTP UNT) showed any statistical differences. Statistical differences greater than the 95th percentile level are considered significant.

Through the Ladder of Powers normality testing of backwash effluent data (WTP TRT) single sample and quarterly average chloride with outliers included and with and without zeros removed both have a square-root and cube-root distributions. When the outlier is removed this data set has also shows a natural log distribution. Single sample and quarterly average total iron with the single identified outlier removed has a cube-root distribution. The data set without zeros shows a natural log distribution. With both zeros and the outlier removed the data set has both a cube-root and natural log distribution as best fits. Dissolved manganese with zero values and outliers removed shows a natural log distribution, while single sample and quarterly average total manganese both with zeros removed and zeros and outliers removed have a natural log distribution. All the other data sets are non-normal (show no distribution as a best fit) under the ladder of powers.

All the above distributions are validated by visual review of a closeness of fit determined from a probability plot. In addition, data that was shown as non-normal by both the outlier and ladder of power methods had data visually compared using probability plots to determine a best fit distribution.

Table H-5 lists the normality results for the backwash effluent (WTP UNT) data set from the Shapiro-Francia outlier test and the Ladder of Powers test, and what distribution was used for subsequent analyses. Only those parameters that have a groundwater quality standard are shown (single sample chloride, single sample total iron, single sample total manganese, and single sample TDS).

DETERMINATION OF EFFLUENT PERMIT LIMITS AND EARLY WARNING VALUES

To expand the statistical strength for limit calculation and as a form of sensitivity analysis, multiple scenarios are run for PermitCalc and TSDCalc. The scenarios are common through each method. The scenarios used for this permit are provided in the Table H-1 below.

Table H-1: Permit Limit Calculation Scenarios

Effluent [a]	Receiving Water [b]	Water Quality Criteria 1 [c]	Water Quality Criteria 2 [d]	Other
Effluent [e]	50% Effluent [f]	Geomean Effluent [g]	GWQS [h]	Default CV [i, j]
Effluent	50% Effluent	Geomean Effluent	GWQS	Calculated CV [k]
Treated [l]	50% Treated [m]	Geomean Treated [n]	GWQS	Default CV
Treated	50% Treated	Geomean Treated	GWQS	Calculated CV
Effluent no zeros [o]	Effluent no zeros	95% GWQS [p]	GWQS	Default CV
Effluent no zeros	Effluent no zeros	95% GWQS	GWQS	Calculated CV
Effluent no zeros	90% GWQS [q]	95% GWQS	GWQS	Calculated CV
Treated no zeros [r]	Treated no zeros	95% GWQS	GWQS	Default CV
Treated no zeros	Treated no zeros	95% GWQS	GWQS	Calculated CV
Treated no zeros	90% GWQS	95% GWQS	GWQS	Calculated CV

a Effluent ≡ value is used for the effluent concentration (rows 14 and 15 in PermitCalc).

b Receiving Water ≡ value used for receiving water in calculations (rows 16 and 17 in PermitCalc). Data is the 50th percentile value from the backwash effluent data.

c Water Quality Criteria 1 ≡ the 95th percentile value of the groundwater quality standard.

d Water Quality Criteria 2 ≡ the groundwater quality standard.

e Effluent ≡ backwash data (WTP UNT) from the reporting water treatment plants.

f 50% Effluent ≡ the 50th percentile of the backwash data (WTP UNT) from the reporting water treatment plants.

g Geomean Effluent ≡ the geometric mean of the backwash data (WTP UNT) from the reporting water treatment plants.

[h] GWQS ≡ Groundwater Quality Standard.

[i] CV ≡ Coefficient of Variation.

[j] Default CV ≡ the default CV value in the PermitCalc worksheet of 0.6.

[k] Calculated CV ≡ CV value calculated for each parameter using the equation "CV =" $\bar{X}/\sigma$, where $\bar{x}$ is the sample mean and σ is the sample standard deviation.

[l] Treated ≡ treated backwash effluent (WTP and WTP TRT) released to the environment from the water treatment plant.

[m] 50% Treated ≡ the 50th percentile of the treated backwash effluent (WTP and WTP TRT) released to the environment from the reporting water treatment plants.

[n] Geomean Treated ≡ the geometric mean of the treated backwash effluent (WTP and WTP TRT) released to the environment from the reporting water treatment plants.

[o] Effluent no zeros ≡ backwash effluent data (WTP UNT) from the reporting water treatment plants with zero values removed.

[p] 95% GWQS ≡ the 95th percentile of the Groundwater Quality Standard.

[q] 90% GWQS ≡ the 90th percentile of the Groundwater Quality Standard.

[r] Treated ≡ treated backwash effluent (WTP and WTP TRT) released to the environment from the water treatment plant with zero values removed.

The different combinations of receiving water/ambient concentration, water quality, coefficient of variation (CV), and dilution attenuation factor (DAF) are done as a form of sensitivity analysis to see if changes in one result in a significant change in the calculated reasonable potential. Overall scenarios between each method yielded very similar results as to which constituents might pose a potential threat to groundwater quality. Only pH showed differences in potential to contaminate between calculation methods (PermitCalc vs. TSDCalc).

PermitCalc was used to determine reasonable potential and appropriate effluent limits. The final limit values are calculated using the 95th percentile for the effluent, the calculated CV, and a calculated DAF of 5.14. Because of a lack of receiving water criteria values for receiving water were set at the 90th percentile calculated from the data set and the 90th percentile of the applicable groundwater quality standard. Background water quality criteria is set at and the 95th percentile of the groundwater quality standard for all calculations.

Using the above inputs PermitCalc shows a reasonable potential to impact groundwater for all parameters tested in untreated and treated effluent for only total iron and total manganese. Table H-6 shows the PermitCalc spreadsheet calculations using the selected values discussed above for the untreated (WTP UNT) data set.

Statistical analyses were run on all available data sets. However, for determination of permit limits only the largest single sample data sets for parameters with groundwater quality standards were used. Treated backwash effluent (WTP) limits are evaluated for chloride (28 samples), maximum chlorine (260 samples), total iron (30 samples), total manganese (27 samples), TDS (6 samples), and maximum turbidity (259 samples). Maximum pH has 271 samples, while minimum pH has 272 samples. Table H-7 provides descriptions for variables shown in Table H-8, which presents the TSD for WQ Limits results for the major constituents for the untreated backwash effluent (WTP UNT).

Table H-2: Descriptive Statistics for WTP UNT (Backwash Effluent)

Parameter	Count	Average [a]	Maximum	Minimum	Median	Geomean	Std Dev [b]	Variance	CV [c]	90th Percentile	95th Percentile
Chloride [d]	25	8.39	31	0.2	5.3	5.47	7.56	57.16	0.9014	20	20.8
Iron, Total [e]	23	2.69	26	0.01	0.71	0.549498	5.55	30.85	2.07	6.204	7.38
Manganese, Total [f]	26	0.261824	2.88	0.003	0.036	0.038579	0.656688	0.43124	2.51	0.4865	1.58
TDS [g, h]	24	61.97	185	5.5	50.1	52.12	37.98	1,442.31	0.6129	105.6	126.7

[a] All values are in milligrams per liter (mg/L); except pH, which is in standard units (SU).
[b] Std Dev ≡ Standard Deviation.
[c] CV ≡ Coefficient of Variation.
[d] Chloride data set has three zero values and one outlier (value of < 0.2 on 3/23/2021) removed.
[e] Total iron data set has three zero values removed.
[f] Total Manganese data set has two zero values removed.
[g] TDS ≡ Total Dissolved Solids.
[h] TDS data set has four zero values and one outlier (value on 10/5/2021 of 5.5) removed.

Table H-3: Descriptive Statistics for WTP (Treated Water)

Parameter	Count	Average [a]	Maximum	Minimum	Median	Geomean	Std Dev [b]	Variance	CV [c]	90th Percentile	95th Percentile
Chloride	32	3.06	10.6	0.001	1.84	0.502	3.002	9.01	0.98	7.43	7.5
Chlorine, Max [d]	242	0.024	0.07	0.001	0.02	0.0189	0.01666	0.000278	0.6829	0.05	0.06
Iron, Total	31	1.802	25.2	0.001	0.055	0.069257	5.05	25.53	2.804	6.34	9.7
Manganese, Total	31	0.397	1.8	0.001	0.038	0.033305	0.63916	0.408526	1.61	1.8	1.8
pH Max	271	7.13	8.89	6	7.14	7.12	0.459569	0.211203	0.0644	7.7	7.85
pH Min [e]	272	7.07	8.89	6	7.1	7.06	0.447284	0.200063	0.0633	7.7	7.8
pH [f]	702	7.29	8.89	6	7.3	7.27	0.445356	0.198341	0.0611	7.84	7.91
TDS [g]	10	90.1	157	41	107	79.36	43.66	1,906.32	0.4846	123.7	140.35
Turbidity, Max [h]	271	4.17	34.5	0.001	2	2.35	4.85	23.498	1.16	11	14

[a] All values are in milligrams per liter (mg/L); except pH, which is in standard units (SU).
[b] Std Dev ≡ Standard Deviation.
[c] CV ≡ Coefficient of Variation.
[d] Chlorine, Max data set included thirty-three statistical outliers. Results are with thirty zero values were removed.
[e] Daily minimum pH data set had one outlier. Value on 04/10/2021 of 8.89.

f pH data set are the total daily readings.
g TDS = Total Dissolved Solids.
h Turbidity, Max data set had one-hundred thirteen outliers identified.

Table H-4: Descriptive Statistics for WTP TRT (Treated Water)

Parameter	Count	Average [a]	Maximum	Minimum	Median	Geomean	Std Dev [b]	Variance	CV [c]	90th Percentile	95th Percentile
Chloride [d]	28	15.496	104.3	0.01	8.15	7.196	21.46	460.46	1.38	36	46.92
Iron, Total [e]	25	0.30388	1.54	0.01	0.1	0.122316	0.457931	0.2097	1.51	1.13	1.37
Manganese, Total [f]	29	0.1189	1.77	0.00252	0.016	0.02282	0.33883	0.11481	2.85	0.2232	0.4526
TDS [g, h]	28	71.53	234	1	59.4	56.21	46.04	2,119.45	0.644	130	136.5

a All values are in milligrams per liter (mg/L); except pH, which is in standard units (SU).
b Std Dev ≡ Standard Deviation.
c CV ≡ Coefficient of Variation.
d Chloride data set had three zero values and one outlier (values of <0.01 on 11/08/2021) removed.
e Total Iron data set had four zero values removed.
f Total Manganese data set had three zero values removed.
g TDS ≡ Total Dissolved Solids.
h TD data set had three zero values and one outlier (value on 11/08/2021 of < 1) removed.

Table H-5: Statistical Distributions for WTP UNT (Untreated [Raw] Water).

Parameter	Outlier Statistic [a]	Ladder of Powers [b]	Probability Plot [c]	Statistic Used [d]
Chloride	Non-normal [e]	Square-root [f], cube root [g]	Cube-root	Cube-root
Chloride (no zeros) [h]	Natural log [i]	Square-root, cube root, Natural log	Cube-root	Cube-root
Iron, Total	Non-normal	Non-normal	Cube-root	Cube-root
Iron, Total (no zeros) [j]	Non-normal	Natural log	Natural log	Natural log
Iron, Total-Suspect [k]	Non-normal	Cube-root	Cube-root	Cube-root
Manganese, Total	Non-normal	Non-normal	Cube [l]	Cube
Manganese, Total (no zeros) [m]	Non-normal	Natural log	Natural log	Natural log
Manganese, Total - Suspect [n]	Non-normal	Natural log	Natural log	Natural log
TDS	Non-normal	Non-normal	Cube-root	Cube-root
TDS (no zeros) [o]	Non-normal	Non-normal	Cube-root	Cube-root

[a] Outlier Statistic ≡ Data set normality for the outlier analyses used the Shapiro-Francia method at an alpha level of 0.05.

[b] Ladder of Powers ≡ Data set normality was determined using Ladder of Powers at the 0.05 alpha level. Statistic listed software selected from testing of multiple distributions (normal, square-root, square, cube-root, cube, natural log, x^4, x^5, and x^6.

[c] Probability Plot ≡ Data set normality was visually confirmed by comparing the spread of the data points to a straight line connecting the quartiles. Various distributions (same as the ladder of powers) were tested for a best fit.

[d] Statistic Used ≡ Data set normality was determined using Ladder of Powers at the 0.05 alpha level.

[e] Non-normal ≡ The data set has a non-normal distribution (non-parametric).

[f] Square-root ≡ The data set has a square-root normal distribution (√"x").

[g] Cube-root ≡ The data set has a Cube-root normal distribution (∛"x").

[h] (no zeros) ≡ The data set has had three zero values removed.

[i] Natural log ≡ The data set has a log normal distribution (ln(x)).

[j] (no zeros) ≡ The data set has had three zero values removed.

[k] Suspect ≡ The data set has had the suspect value of 26 on 10-06-2021 removed along with the three zero values.

[l] Cube ≡ The data set is a power distribution. In this case, the values taken to the third power (cubed).

[m] (no zeros) ≡ The data set has had two zero values removed.

[n] Suspect ≡ The data set has had the suspect values of 2.88 on 02/09/2021 and 1.9 on 06/23/2021 removed along with the two zero values.

[o] (no zeros) ≡ The data set has had four zero values removed.

Table H-6: Groundwater Reasonable Potential and Limit Calculations from PermitCalcDec2016V1.1_GW.

Backwash Effluent Reasonable Potential Calculation

Facility	Backwash Effluent
Water Body Type	Wastewater
Rec. Water Hardness	

Dilution Factors:	95th Percentile
Background Groundwater	1.0
Human Health Carcinogenic	1.0
Human Health Non-Carcinogenic	0.5

	Pollutant, CAS No. & NPDES Application Ref. No.	**CHLORIDE (dissolved) in mg/L 16887006**	**IRON (inorganic - Total) 7439896**	**MANGANESE (inorganic - Total) 7439965**	**SOLIDS, TOTAL DISSOLVED AND SALINITY**					
Effluent Data	# of Samples (n)	28	25	29	28					
	Coefficient of Variation (Cv)	0.90143	2.07	2.51	0.61287					
	Effluent Concentration, mg/L (Max. or 95th Percentile)	20.8	7.384	1.584	126.7					
	Calculated 50th percentile Effluent Conc. (when n>10)									
Receiving Water Data	90th Percentile Conc., mg/L	225	0.27	0.045	450					
	Geo Mean, mg/L									
	95th Percentile Background Groundwater, mg/L	237.5	0.285	0.285	475					
Water Quality Criteria	GWQ Criteria for Protection of Human Health, mg/L	250	0.3	0.05	500					
	Metal Criteria Translator, decimal	-	-	1	-					
	Carcinogen?	N	N	N	N					

Table H-6: PermitCalcDec2016V1.1_GW – Groundwater (continued)

Effluent Reasonable Potential Calculation

Pollutant, CAS No. & NPDES Application Ref. No.		CHLORIDE (dissolved) in mg/L 16887006	IRON (inorganic - Total) 7439896	MANGANESE (inorganic - Total) 7439965	SOLIDS, TOTAL DISSOLVED AND SALINITY	
Background Groundwater Reasonable Potential						
Effluent percentile value		0.95	0.95	0.95	0.95	
σ	$\sigma^2 = \ln(CV^2+1)$	0.771	1.290	1.409	0.565	
P_n	$P_n = (1\text{-confidence level})^{1/n}$	0.887	0.878	0.891	0.883	
Multiplier		1	1	1	1	
Max concentration (mg/L)	[Effluent 95th Percentile]	20.8	7.384	1.584	126.7	
Reasonable Potential? Limit Required?		**NO** [a]	**YES**	**YES** [b]	**NO**	

Limit Calculation

# of Compliance Samples Expected per month		1	1		
LTA Coefficient Variation (CV), decimal		2.068	2.50813		
Permit Limit Coefficient Variation (CV), decimal		2.068	2.50813		
Waste Load Allocations, mg/L		0.285	0.285		
Long Term Averages, mg/L		0.0785	0.07574		
Metal Translator or 1?		1	1		
Average Monthly Limit (AML), mg/L		**0.285**	**0.285**		
Maximum Daily Limit (MDL), mg/L		**0.6863**	**0.74464**		

Human Health Reasonable Potential								
σ	$\sigma^2 = \ln(CV^2+1)$	0.771	1.290	1.409	0.565			
P_n	$P_n = (1\text{-confidence level})^{1/n}$	0.887	0.878	0.891	0.883			
Multiplier		0.602	0.323	0.267	0.715			
Dilution Factor		0.5	0.5	0.5	0.5			
Max. Concentration, mg/L		-199.96	4.499	0.80013	-268.83			
Reasonable Potential? Limit Required?		**NO**	**YES**	**YES**	**NO**			
Human Health Limit Calculation								
# of Compliance Samples Expected per month			1	1				
Average Monthly Effluent Limit (AML), mg/L			**0.07125**	**0.57125**				
Maximum Daily Effluent Limit (MDL), mg/L			**0.08296**	**0.61267**				

A **NO** INDICATES THERE IS NOT A REASONABLE POTENTIAL TO CONTAMINATE GROUNDWATER.

B **YES** INDICATES THERE IS A REASONABLE POTENTIAL TO CONTAMINATE GROUNDWATER.

Table H-7: Limit Calculations from EPA/505/2-90-001, Technical Support Document for Water Quality-based Toxics Control

COLUMN	Where:	Description
A	Location ≡	Location of the sampling point. LAGOON is the sample from the pump station after the treatment lagoon and before land application. MW-3 is the up gradient well, located outside the land application area at the west center of the area.
B	Date ≡	The collection date of the sample.
C	Parameter ≡	The parameter analyzed.
D	Units ≡	The units of the parameter value.
E	K ≡	Total number of results.
F	ND ≡	Formula to determine if a value is a non-detect. Equation is: =IF((E2 = “ND”), “Y”, (IF((E2 = “B”), “Y”, “”)))
		Where E2 ≡ The value in the column E (Qlf).
		Where “ND” ≡ The designation for a non-detect in most samples.
		Where “B” ≡ The designation for a non-detect in nitrate samples.
G	r ≡	Total number of non-detects.
H	k – r ≡	Total number of detected samples.
I	δ = r / k ≡	The ratio of non-detected results to the total number of results.
J	μ_y ≡	The estimated mean (average) of all results. Equation is: $\Sigma[x_i]/_k$, 1 ≤ i ≤ k.
		Where: xi =The value in Colum E if parameter is normally distributed (e.g., pH).
		Where: xi =The value in Column J (natural log) if the parameter is log-normally distributed (e.g., chloride).
		Where: xi =The value in Column K (delta-lognormal [natural log without non-detects]) if the parameter results contain non-detects (r > 0) (e.g., BOD_5); OR if the parameter is some other distribution (e.g., TSS is a cube-root normal distribution).
K	$\sigma^2{}_y$ ≡	The estimated variance of all results. Equation is: $\Sigma[(x_i - \hat{\mu})^2]/_{(k-1)}$, 1 ≤ i ≤ k. x_i is the same as the mean, above.
L	σ^y ≡	The standard deviation of all results. Equation is: $\sqrt{\hat{\sigma}^2}$.
M	1 – δ ≡	Percent of parameters detected.
N	E(x) ≡	The Daily Average of a log-normal distribution. Equation is: $e^{\left(\mu_y + {\sigma^2}_y/_2\right)}$
O	V(x) ≡	The Variance of a log-normal distribution. Equation is: $E(x) * \left(e^{\sigma^2 y} - 1\right)$

COLUMN	Where:	Description
P	cv(x) ≡	The Coefficient of Variation of a log-normal distribution. Equation is: $\sqrt{(e^{\sigma^2 y} - 1)}$
Q	Ê(X*) ≡	The Daily Average of a delta-lognormal distribution (e.g., a log-normal distribution that contains both measured and non-detect values). Equation is: $\delta D + (1 - \delta)\, e^{\left(\mu_y + \sigma^2 y / 2\right)}$
R	V^(X*) ≡	The Variance of a delta-lognormal distribution. Equation is: $(1 - \delta)\, e^{\left(\mu_y + \sigma^2 y / 2\right)} *$ $\left[e^{\sigma^2 y} - (1 - \delta)\right] + \delta(1 - \delta)D\left[D - 2e^{\left(\mu_y + \sigma^2 y / 2\right)}\right]$
S	cv(X*) ≡	The Coefficient of Variation of a delta-lognormal distribution. Equation is: $\sqrt{V\hat{}(X^*)} / \hat{E}(X^*)$
T	$Z^*_{(0.95)}$ ≡	Z-score determined from a standard table of percentiles. For a parameter WITH NO non-detects $z^*_{(0.95)} = 1.6449$. For a parameter WITH non-detects $z^*_{(0.95)} = \varphi^{-1}\left[(0.95 - \delta) / 1 - \delta\right]$; where φ^{-1} is the mathematical notation for z-score, δ is from Column P, and 1 – δ is from Column T.
U	$Z^*_{(0.99)}$ ≡	Z-score determined from a standard table of percentiles. For a parameter WITH NO non-detects $z^*_{(0.99)} = 2.3263$. For a parameter WITH non-detects $z^*_{(0.99)} = \varphi^{-1}\left[(0.99 - \delta) / 1 - \delta\right]$; where φ^{-1} is the mathematical notation for z-score, δ is from Column P, and 1 – δ is from Column T.
V	Daily Max ($X_{.95}$) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + 1.6449\hat{\sigma}$, for a normal distribution; or $exp^{[\widehat{\mu_y} + 1.6449\hat{\sigma}_y]}$, for a log-normal distribution.
W	Daily Max ($X_{.99}$) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + 2.3263\hat{\sigma}$, for a normal distribution; or $exp^{[\widehat{\mu_y} + 2.3263\hat{\sigma}_y]}$, for a log-normal distribution.
X	Daily Max ($X_{.95}$) (w NDs) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + {z^*}_{0.95}\hat{\sigma}$, for a delta-normal distribution; or $exp^{[\widehat{\mu_y} + {z^*}_{0.95}\hat{\sigma}_y]}$, for a delta-lognormal distribution.
Y	Daily Max ($X_{.99}$) (w NDs) ≡	The daily maximum value at the 95 percent confidence interval. Equation is $\hat{\mu} + {z^*}_{0.99}\hat{\sigma}$, for a delta-normal distribution; or $exp^{[\widehat{\mu_y} + {z^*}_{0.99}\hat{\sigma}_y]}$, for a delta-lognormal distribution.
Z	Daily Max 0.95 Variability Factor ≡	The ratio of the calculated Daily Maximum to the average value for that parameter. The larger the value the more likely the calculated value may be biased high. For a normal distribution the equation is: $\hat{X}_{0.95} / \hat{\mu}$, where $X\hat{}_{0.95}$ is the calculated Daily Max

COLUMN	Where:	Description
		($X_{0.95}$). For log-normal distributions the equation is: $\hat{X}_{0.95}/E(X)$. For delta-lognormal distributions the equation is: $\hat{X}_{0.95}/\hat{E}(X^*)$.
AA	Daily Max 0.99 Variability Factor ≡	The ratio of the calculated Daily Maximum to the average value for that parameter. The larger the value the more likely the calculated value may be biased high. For a normal distribution the equation is: $\hat{X}_{0.99}/\hat{\mu}$, where X^$_{0.99}$ is the calculated Daily Max ($X_{0.99}$). For log-normal distributions the equation is: $\hat{X}_{0.99}/E(X)$. For delta-lognormal distributions the equation is: $\hat{X}_{0.99}/\hat{E}(X^*)$.
AB	n ≡	The average of yearly sample size. This value of "n" is the one denoted in the variables and equations.
AC	σ^$^2{}_n$ ≡	Variance of the distribution of the n-day monthly average. The equation is: σ^2/n, where σ^2 is the estimated variance (Column S), and n is the average of yearly sample size in cell AJ4.
AD	μ^$_n$ ≡	Mean of the distribution of the n-day monthly average. The equation is: μ^, the estimated mean from Column Q.
AE	σ^$_n$ ≡	Standard deviation of the distribution of the n-day monthly average. The equation is: $\sqrt{\hat{\sigma}^2{}_n}$, where σ^$^2{}_n$ is from Column AJ.
NOTE: Values for σ^$^2{}_n$, μ_n, and σ^$_n$ are used for normal distribution ONLY.		
AF	$\hat{E}(X_n)$ ≡	E(x). From Column U for a log-normal distribution, or Column X for a delta-lognormal distribution (log-normal WITH non-detects).
AG	V^(X_n) ≡	$\hat{V}(x)/n$, where V^(x) is from Column V for a log-normal distribution, or Column Y for a delta-lognormal distribution; and n is from cell AK4.
AH	X_n ≡	Average of the n-day monthly average values. N-day monthly average values are in Column AJ for log-normal distributions and other distribution types, and Column AK for delta-lognormal distributions.
AI	cv^(X_n) ≡	Coefficient of variation of the distribution of the n-day monthly average. The equation is: $\hat{\sigma}^2{}_n/\hat{\mu}_n$, where σ^$^2{}_n$ is from Column AJ and μ^$_n$ is from Column AK for a normal distribution. Equation is $\sqrt{V(X_n)}/X_n$ for log-normal and delta-lognormal distributions.
AJ	Average Monthly 0.95 ($X_{0.95(n)}$) ≡	The average monthly value at the 95 percent confidence interval. Equation is: $\hat{\mu}_n + 1.6449\hat{\sigma}_n$ for a normal distribution; or $\hat{E}(X_n) + 1.6449\sqrt{\hat{V}(X_n)}$ for a log-normal distribution or other distribution type.

COLUMN	Where:	Description
AK	Average Monthly 0.99 ($X_{0.99(n)}$) ≡	The average monthly value at the 95 percent confidence interval. Equation is, $\hat{\mu}_n + 2.3263\hat{\sigma}_n$ for a normal distribution; or $\widehat{\mathrm{E}}(\mathrm{X_n}) + 2.3263\sqrt{\widehat{\mathrm{V}}(\mathrm{X_n})}$ for a log-normal distribution or other distribution type.
AL	Average Monthly 0.95 ($X_{0.95(n)}$) (w/ NDs) ≡	The average monthly value at the 95 percent confidence interval. Equation is $\hat{\mu}_n + z^*{}_{0.95}\hat{\sigma}_n$, for a delta-normal distribution; or $\widehat{\mathrm{E}}(\mathrm{X_n}) + z^*{}_{0.95}\sqrt{\widehat{\mathrm{V}}(\mathrm{X_n})}$ for a delta-lognormal distribution.
AM	Average Monthly 0.99 ($X_{0.99(n)}$) (w/ NDs) ≡	The average monthly value at the 95 percent confidence interval. Equation is $\hat{\mu}_n + z^*{}_{0.99}\hat{\sigma}_n$, for a delta-normal distribution; or $\widehat{\mathrm{E}}(\mathrm{X_n}) + z^*{}_{0.99}\sqrt{\widehat{\mathrm{V}}(\mathrm{X_n})}$ for a delta-lognormal distribution.
AN	Normality ≡	List the normality of the distribution type (normal, log-normal, etc.).
AO	Comments ≡	Miscellaneous notations from the original DMR data set.

Table H-8: Groundwater Limit Calculation Results from TSD for WQ Limits for Groundwater. (Zero values and outliers included.)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
Location	**Date Range**	**Parameter**	**Units**	**k**	**NDs**	**r**	**k - r**	**δ = r / k**	**$\mu^{\wedge}_{y}$**	**$\sigma^{\wedge 2}_{y}$**	**$\sigma^{\wedge}_{y}$**	**1 - δ**	**E(X)**	**V(X)**	**cv(X)**	**Ê(X*)**	**V^(X*)**	**cv(X*)**
WTP UNT	01/26/2021 – 12/30/2021	Chloride	mg/L	28		3	25	0.10714	4.26	0.21339	0.4619							
WTP UNT	01/26/2021 – 12/30/2021	Chloride (no zeros)	mg/L	25		3	22	0.12	6.25	0.016825	0.129712							
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total	mg/L	26		2	24	0.07692	0.8348	0.14191	0.3767							
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total (no zeros)	mg/L	23		2	21	0.08696	-0.0156	0.180882	1.902	0.913				0.984	0.3025	
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total-Suspect	mg/L	22		2	20	0.09091	0.94633	0.020746	0.144036							
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total	mg/L	28		4	24	0.14286	1.29	25.11	5.01							
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total (no zeros)	mg/L	26		4	22	0.15385	-0.1441	0.198851	2.04	0.8462				0.8092	0.2893	
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total -Suspect	mg/L	24		4	20	0.16667	-0.1786	0.144165	1.66	0.8333				0.7491	0.2167	
WTP UNT	01/26/2021 – 12/30/2021	TDS	mg/L	28		2	26	0.07143	31.69	13.32	3.65							
WTP UNT	01/26/2021 – 12/30/2021	TDS (no zeros)	mg/L	24		2	22	0.08333	52.31	0.182914	0.427684							

A	B	C	D	T	U	V	W	X	Y	Z	AA
Location	**Date Range**	**Parameter**	**Units**	**Z* (0.95)**	**Z* (0.99)**	**Daily Max ($X_{.95}$)**	**Daily Max ($X_{.99}$)**	**Daily Max ($X_{.95}$) (w NDs)**	**Daily Max ($X_{.99}$) (w/ NDs)**	**Daily Max 0.95 Variability Factor**	**Daily Max 0.99 Variability Factor**
WTP UNT	01/26/2021 – 12/30/2021	Chloride	mg/L	0.944	0.989			4.996	5.32	1.17	1.25
WTP UNT	01/26/2021 – 12/30/2021	Chloride (no zeros)	mg/L	0.943	0.989			6.46	6.55	1.03	1.05
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total	mg/L	0.946	0.989			1.44	1.698	1.73	2.03
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total (no zeros)	mg/L	0.945	0.989			20.58	76.77	20.901	77.97
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total-Suspect	mg/L	0.945	0.989			1.18	1.276	1.24	1.35
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total	mg/L	0.942	0.988			3.78	4.95	3.47	4.54
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total (no zeros)	mg/L	0.941	0.988			21.12	87.203	24.395	100.72
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total -Suspect	mg/L	0.940	0.988			11.12	35.056	13.292	41.91
WTP UNT	01/26/2021 – 12/30/2021	TDS	mg/L	0.946	0.989			37.56	40.05	1.19	1.26
WTP UNT	01/26/2021 – 12/30/2021	TDS (no zeros)	mg/L	0.945	0.989			52.9996	53.29	1.01	1.02

Table H-8: Groundwater Limit Calculation Results from TSD for WQ Limits for Groundwater. (continued)

A	B	C	D	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
Location	Date Range	Parameter	Units	n	σ^2_n	μ_n	σ_n	$E(X_n)$	$V(X_n)$	X_n	cv (X_n)	Average Monthly 0.95 ($X_{.95(n)}$)	Average Monthly 0.99 ($X_{.99(n)}$)	Average Monthly 0.95 ($X_{.95(n)}$) (w/ NDs)	Average Monthly 0.99 ($X_{.99(n)}$) (w/ NDs)
WTP UNT	01/26/2021 – 12/30/2021	Chloride	mg/L	2.08	0.102427	4.26	0.320042				0.0751			4.74	4.98
WTP UNT	01/26/2021 – 12/30/2021	Chloride (no zeros)	mg/L	1.83333	0.009177	6.25	0.095799				0.01532			6.41	6.47
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total	mg/L	2	0.07096	0.8348	0.26638				0.31909			1.23	1.44
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total (no zeros)	mg/L	1.75				0.984	0.1729	-0.184	-2.25			1.65	1.94
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total-Suspect	mg/L	1.66667	0.012448	0.9463263	0.11157				0.1179			1.13	1.202
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total	mg/L	2	12.55	1.29	3.54				2.74			1.9005	2.102
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total (no zeros)	mg/L	1.83333				0.8092	0.1578	-3.202	-0.1241			1.43	1.71
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total -Suspect	mg/L	1.66667				0.7491	0.13	-3.4	-0.1061			1.31	1.56
WTP UNT	01/26/2021 – 12/30/2021	TDS	mg/L	2.17	6.15	31.69	2.48				0.07824			35.68	37.37
WTP UNT	01/26/2021 – 12/30/2021	TDS (no zeros)	mg/L	1.83333	0.099771	52.31	0.315866				0.00604			52.82	53.04

A	B	C	D	AN	AO
Location	Date Range	Parameter	Units	Normality	Comments
WTP	01/26/2021 – 12/20/2021	Chloride	mg/L	Cube-root	
WTP UNT	01/26/2021 – 12/30/2021	Chloride (no zeros)	mg/L	Cube-root	
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total	mg/L	Cube-root	
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total (no zeros)	mg/L	Natural log	
WTP UNT	01/26/2021 – 12/30/2021	Iron, Total-Suspect	mg/L	Cube-root	
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total	mg/L	Cube	
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total (no zeros)	mg/L	Natural log	
WTP UNT	01/26/2021 – 12/30/2021	Manganese, Total -Suspect	mg/L	Natural log	
WTP UNT	01/26/2021 – 12/30/2021	TDS	mg/L	Cube-root	
WTP UNT	01/26/2021 – 12/30/2021	TDS (no zeros)	mg/L	Cube-root	

[a] WQ TSD Limits for Groundwater calculated for full data set. Includes zero and outlier values.

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[i] https://archive.epa.gov/epawaste/hazard/web/pdf/unified-guid.pdf