Fact Sheet for NPDES Permit WA0032182
King County Carnation Wastewater Treatment Facility
December 13, 2013

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for King County's Carnation Wastewater Treatment Facility (WWTF). This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit and accompanying fact sheet for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for the Carnation WWTF, NPDES permit WA0032182, are available for public review and comment from November 6, 2013, until December 6, 2013. For more details on preparing and filing comments about these documents, please see *Appendix A – Public Involvement Information*.

Washington State Department of Health (DOH) and King County (the County) reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, wastewater discharges, or receiving water prior to publishing this draft fact sheet for public notice.

After the public comment period closes, Ecology will summarize substantive comments and provide responses to them. Ecology will include the summary and responses to comments in this fact sheet as *Appendix H – Response to Comments*, and publish it when issuing the final NPDES permit. Ecology will not revise the rest of the fact sheet, but the full document will become part of the legal history contained in the facility's permit file.

Summary

The City of Carnation is located in rural King County, twenty miles east of Bellevue. King County owns and operates the Carnation wastewater treatment facility and the City of Carnation owns and operates the collection system. This facility produces Class A reclaimed water using membrane biological reactor (MBR) technology with UV disinfection, and is designed for a maximum month flow of 0.48 MGD.

The proposed permit authorizes the facility to discharge secondary treated effluent to the Snoqualmie River and to distribute reclaimed water to the Chinook Bend Wetland Enhancement project site. It includes technology-based limits when the river flows are high, November through July, and additional TMDL-based limits when the river flow is low, August through October. Ecology based the TMDL limits on the 1994 *Snoqualmie River Total Maximum Daily Load Study*.

Ecology previously issued separate NPDES and Reclaimed Water permits to the County for the Carnation WWTF. The proposed permit combines the previously separated NPDES and reclaimed water permits into a single permit. Significant changes from the previous permit include:

- recalculated dilution factors based on actual facility data,
- residual chlorine limit changed from technology-based limit to water quality-based limit for the river discharge (resulting in a stricter limit),
- monitoring revisions to provide more consistency between the river and reclaimed water discharges,
- required web-based reporting of monthly data,
- removal of receiving water temperature monitoring and outfall evaluation requirements that were completed during the previous permit term,
- removal of priority pollutant and whole effluent toxicity (WET) testing requirements that are not typically required for small wastewater treatment facilities (< 1.0 MGD), and
- a net environmental benefit study for the wetlands discharge.

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I. Introduction

This fact sheet is a companion document to NPDES Permit No. WA0032182. The Department of Ecology (Ecology) proposes to issue this permit that allows the discharge of treated domestic wastewater to the Snoqualmie River and also allows the beneficial use of reclaimed water at the Chinook Bend Wetland. This fact sheet explains the nature of the proposed treatment processes, the distribution and use of reclaimed water, Ecology's decisions on limiting the constituents in the effluent, and the regulatory and technical basis for those decisions.

The Federal Clean Water Act (FCWA, 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 federal Environmental Protection Agency (EPA). The EPA authorized the state of Washington to manage the NPDES permit program in our state. Our state legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The Legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 Revised Code of Washington (RCW).

The following regulations apply to domestic wastewater NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC).
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC).
- Water quality criteria for surface waters (chapter 173-201A WAC).
- Water quality criteria for groundwaters (chapter 173-200 WAC).
- Whole effluent toxicity testing and limits (chapter 173-205 WAC).
- Sediment management standards (chapter 173-204 WAC).
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC).

These rules require any treatment facility owner/operator to obtain an NPDES permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for requirements imposed by the permit.

Reclaimed Water

The Reclaimed Water Act, Chapter 90.46 RCW, authorized the development of *Water Reclamation and Reuse Standards* for the beneficial use of reclaimed water. These standards were completed in 1997. All reclaimed water permits issued by Ecology must specify conditions demonstrating that the wastewater has been adequately and reliably treated to meet the requirements in the *Water Reclamation and Reuse Standards* appropriate for the use. In addition to meeting the water quality limit, the standards require specific treatment and disinfection requirements beyond those of most conventional wastewater treatment facilities. The standards also require automated alarms, redundancy of treatment units, emergency storage, stringent operator training requirements and public notification of reclaimed water use. RCW 90.46.220 states that generators of reclaimed water must obtain a permit prior to distributing reclaimed water for beneficial use.

Public Involvement

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice)

telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See *Appendix A – Public Involvement Information* for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft NPDES permit in response to comments. Ecology will summarize the responses to comments and any changes to the permit in *Appendix H – Response to Comments*.

II. Background Information

Table 1. General Facility Information

Facility Information	
Applicant	King County, Department of Natural Resources and Parks, Wastewater Treatment Division
Facility Name and Address	Carnation Wastewater Treatment Facility 4405 Larson Avenue Carnation, WA
Mailing Address	1200 Monster Road SW Mail Stop RTP NR 0100 Renton, WA 99057-2962
Contact at Facility	John Cameron, Offsite Operations Supervisor, 206-684-2400
Responsible Official	Christie True, Director of King County Dept. of Natural Resources and Parks, 206-296-6500
Type of Treatment	Membrane Bio-Reactor
Facility Location (NAD83/WGS84 reference datum)	Latitude: 47.647429 Longitude: -121.918153
Discharge Waterbody Name and Location (NAD83/WGS84 reference datum)	Snoqualmie River, River mile 22.8 Latitude: 47.6658333º Longitude: -121.925186º
Reclaimed Water Use Area	Chinook Bend Wetland Enhancement project site 47.666389º, Longitude: -121.9261111º

Permit Status	
Issuance Date of Previous Permit	April 16, 2008
Application for Permit Renewal Submittal Date	October 16, 2012
Date of Ecology Acceptance of Application	March 27, 2013

Inspection Status	
Date of Last Non-sampling Inspection Date	September 23, 2009

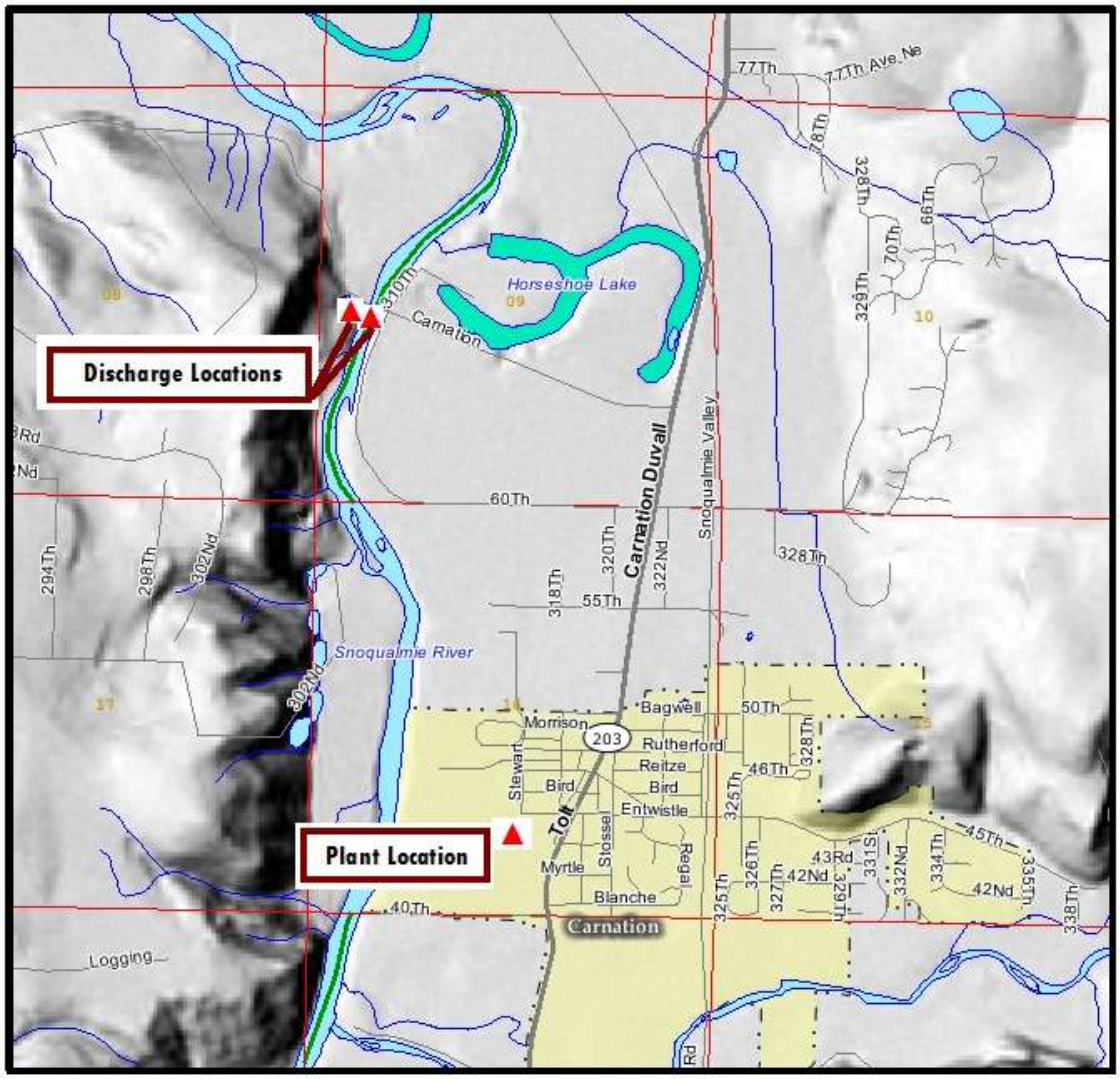

Figure 1. Facility Location Map

A. Facility description

History

King County Department of Natural Resources & Parks-Wastewater Treatment Division owns and operates the Carnation wastewater treatment facility (WWTF) located east of the Snoqualmie River in the City of Carnation (City). This facility treats wastewater from the City, which is located on the Snoqualmie River in the Snoqualmie Valley and is an incorporated city within King County.

Carnation residents previously used individual septic systems to treat their domestic wastewater. Providing disposal for businesses in the commercial district and many of the homes on smaller lots, particularly west of Tolt Avenue, had become problematic over the years. Many of the businesses and home sites were unable to meet the Seattle and King County Public Health (SKC-Health) septic treatment and disposal standards because of lack of disposal area. In 1987, the City was declared a public health hazard area based on the number of inadequate septic systems and the likely contamination of the unprotected aquifer from which drinking water is derived.

At the City's request, King County built and now operates the membrane bioreactor (MBR) treatment facility that serves the sewage treatment needs of the City's designated Urban Growth Area. The facility began operating and discharging to the Snoqualmie River in May 2008. Ecology currently permits the facility to discharge secondary treated effluent to the Snoqualmie River (NPDES permit number WA0032182) and reclaimed water to the Chinook Bend Wetland Enhancement project site (reclaimed water permit ST7450). The proposed permit will combine these two permits into a single NPDES permit.

Collection system

The City collects domestic wastewater from residential and commercial users in the city and urban growth area. No significant industrial users discharge to the collection system. The City constructed the collection system in 2007 and maintains and operates the system. The collection system consists of 15,500 feet of 10-inch vacuum sewer pipeline, 8,900 linear feet of 8-inch vacuum sewer pipeline, 9,100 linear feet of 6-inch vacuum sewer pipeline, and 23,400 linear feet of 4-inch vacuum sewer pipeline. The system collects wastewater at a central vacuum station (that has standby power) and pumps wastewater to the adjacent King County Carnation WWTF.

Treatment processes

The Carnation WWTF has a maximum month average flow capacity of 0.48 MGD for a design population of 3871. King County designed the facility to meet secondary treatment standards and the reliability and redundancy requirements of Class A reclaimed water. The process flow diagram in Appendix G illustrates the treatment path at the facility. The treatment process includes 2-mm rotary drum screens for influent screening, grit removal, two activated sludge basins in parallel (each with four aeration zones), flow equalization, five Zenon ZeeWeed 500 ultra-filtration MBR units in parallel, and two in-vessel ultraviolet (UV) disinfection modules in parallel. King County added a second UV system into each treatment train to meet the reliability and redundancy requirements for Class A reclaimed water. Supporting systems include two solids thickening and storage basins, odor control, chemical feed systems, backup power, and operations/maintenance facilities.

Solid wastes/residual solids

The Carnation WWTF removes solids at the headworks (grit and screenings) with a 2 mm rotary drum screen. The County cleans, dewaters, compacts, and transports headworks screenings and grit removed at the influent screens to a local landfill for disposal. The solids holding basins collect and store residual solids, including waste activated sludge (WAS) which is wasted from the membrane reactor, and scum from the aeration basin scum launders. The County transports the thickened solids to one of their other regional facilities, either South Plant or Brightwater WWTP, for further stabilization, dewatering, and processing in their biosolids facilities.

Discharge locations

The Carnation WWTF discharges to two locations: the Snoqualmie River at river mile 22.8 and the Chinook Bend Wetland site. Under normal operating conditions the facility provides Class A reclaimed water to the Chinook Bend wetland site. The County discharges secondary-treated wastewater to the river outfall under the following conditions: (1) when the facility cannot meet reclaimed water permit conditions, including but not limited to plant upsets or disinfection system failures; (2) as required by a regulatory agency with jurisdiction to augment in-river flows in the Snoqualmie River; and (3) scheduled maintenance of the piping, controls, or facilities associated with the Chinook Bend Project.

Treated effluent flows from the treatment facility through approximately 8780 linear feet of buried 12-inch diameter HDPE pipeline to the Carnation Farm Road Bridge (see Figure 2). The effluent pipeline is supported along the lower girder across the bridge to the western bank of the Snoqualmie River. Diversion valves direct the flow to either the Chinook Bend wetlands or the river outfall attached to the west pier of the Carnation Farm Road Bridge.

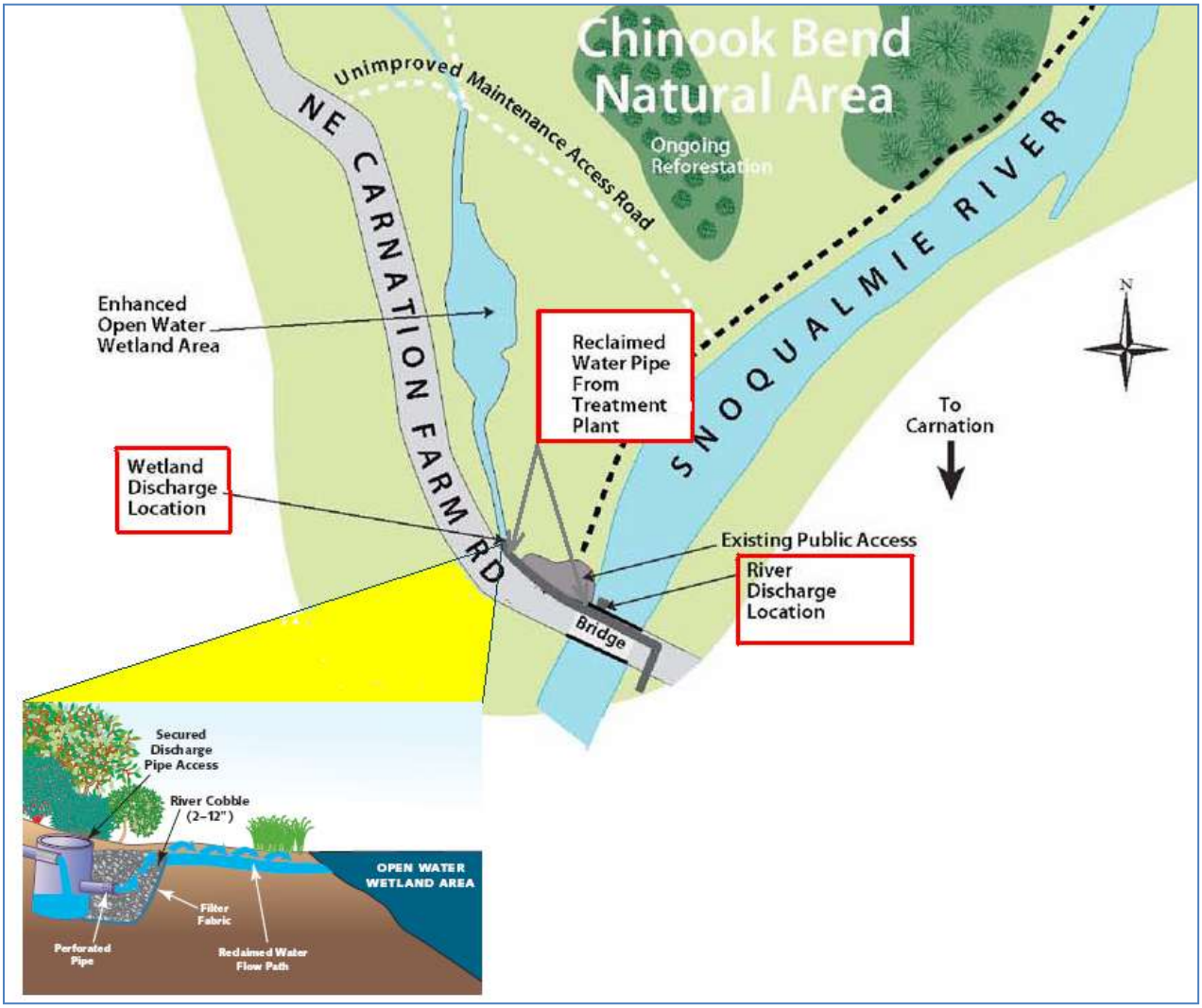

Figure 2. Outfall locations.

Reclaimed water piping entering the Chinook Bend site is buried along the edge of the property until the pipe reaches the discharge point approximately 200 feet into the wetlands. The reclaimed water discharges through perforated pipe and upwells to the surface through a river cobble pad.

For the river discharge, wastewater flows from the diversion valve to a duckbill diffuser check valve located two feet above the riverbed.

B. Description of the receiving water

The Carnation WWTF discharges to the Snoqualmie River which is designated as a Core Summer Salmonid Habitat in the vicinity of the outfall. Table 2 summarizes ambient background data in this area. King County provided the ambient temperature data with their permit application. Ecology obtained the 7Q10 flow data from the 2004 Outfall mixing evaluation conducted by Cosmopolitan Engineers. The remaining data were found online at Ecology's River and Stream Water Quality Monitoring website: http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html. The monitoring station (#07D070) is located in the Snoqualmie River at the Carnation Farm Road Bridge. This is the same bridge in which the outfall is located. Ecology used DO, ammonia, phosphorus, and coliform data collected from this site from 1976 to 1992.

Other point source outfalls in the vicinity include the City of Duvall WWTP, the City of Snoqualmie WWTP, the City of North Bend WWTP, and the Tokul Creek Hatchery. Significant nearby non-point sources of pollutants include silvicultural and agricultural activities.

Table 2. Ambient Background Data

Parameter	Value
Flow – 7Q10 Low Flow	443 cfs
Temperature: July 1 – Sept 14 (90% Confidence level 7-DADMax)	21.2˚C
Temperature: Sept 15 - July 1 (90% Confidence level 7-DADMax)	16.7˚C
Temperature: Nov - July (10% Confidence level)	3.2˚C
Temperature: Nov - July (90% Confidence level)	12.2˚C
pH (high - 90% Confidence level)	7.4
pH (low - 10% Confidence level)	6.9
Dissolved Oxygen (10% Confidence level)	9.7 mg/L
Total Ammonia-N (90% Confidence level)	0.03 mg/L
Fecal Coliform (90% Confidence level)	57/100 mL

Water quality impairments

The *Snoqualmie River Total Maximum Daily Load (TMDL) Study* (1994) limits ammonia, BOD_5 and fecal coliform bacteria discharges to the Snoqualmie River during the low flow months of August, September, and October. The TMDL study evaluated options which included wastewater discharges at Fall City and Carnation, in addition to the existing plants (in 1994) at North Bend, Snoqualmie, and Duvall. The proposed permit is based on the 5- plant scenario. (Refer to Appendix E, Table E-2, TMDL Allocation for 5-plant scenario.) The Carnation treatment facility allocation for BOD_5 is 25 lb/day and the allocation for ammonia is 8.4 lb/day during the months of August, September, and October. Compliance with the technology-based standards for fecal coliform will meet the requirements of the TMDL.

The *Snoqualmie River Basin Temperature TMDL* (2011) includes temperature waste load allocations for the wastewater treatment plants at North Bend, Snoqualmie, Carnation, and Duvall, as well as load allocations for stream shading throughout the watershed. The TMDL temperature allocation for the Carnation facility limits effluent temperature to an increase of 0.3 °C above the temperature criterion of 16 °C at the edge of the chronic mixing zone. The specific temperature

allocation depends on effluent dilution factors and must be calculated each permit cycle. This allocation applies during the months of June through September. See Section III-E for additional discussion on temperature.

C. Influent characterization

King County reported the concentration of influent pollutants in discharge monitoring reports. The influent wastewater is characterized as shown in Table 3.

Table 3. Wastewater Influent Characterization

Parameter	Units	# of Samples	Average Monthly Average	Maximum Monthly Average
BOD_5	mg/L	≈500	286 mg/L	363 mg/L
	lbs/day	≈500	267 mg/L	375 mg/L
TSS	mg/L	≈500	257 mg/L	364 mg/L
	lbs/day	≈500	238 mg/L	326 mg/L

D. Effluent and reclaimed water characterization

King County reported the concentrations of pollutants in the discharge in discharge monitoring reports and in the permit applications. Table 4 summarizes the treated wastewater effluent quality as discharged to the river, and Table 5 summarizes reclaimed water quality as provided to the wetlands between May 2008 and April 2013.

Table 4. Effluent Characterization – River Outfall*

Parameter	Units	# of Samples	Average Monthly Average	Maximum Monthly Average
BOD_5	mg/L	*≈200*	5	14
	lbs/day	*≈200*	3.5	6.3
TSS	mg/L	*≈200*	2	3
	lbs/day	*≈200*	1.5	2.1

	Units	# of Samples	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliform	cfu/100 mL	*≈200*	0	0

	Units	# of Samples	Minimum	Maximum
pH	Std Units	*continuous*	6.8	8.4

	Units	# of Samples	Value
Temperature - 7-DADMAX: July 1–Sept 14	°C	*continuous*	25.2
Temperature - 7-DADMAX: Sept 15–June 30	°C	*continuous*	22.5
** Data summarizes effluent quality as discharged from the NPDES river outfall only, does not include reclaimed water data taken during discharge to wetlands.*			

E. Reclaimed water distribution system

The reclaimed water distribution system consists of on-site piping for process and irrigation uses and off-site piping for use at the wetlands. This permit covers off-site use only since the Reclaimed Water Standards exempt the on-site use of effluent for normal wastewater treatment practices from permitting requirements. The off-site distribution system is composed of a purple pipe underground system to the off-site use point at Chinook Bend Natural Area. Figure 2 shows the wetland discharge location.

King County requested a waiver to the chlorine residual requirement for the conveyance system from the facility to the wetlands discharge. Ecology and DOH granted this waiver for the protection of biota in the wetlands. Accordingly, Ecology included a chlorine limit in the permit that requires King County to divert any water with chlorine levels greater than 6.9 µg/L to the river outfall. To alleviate concerns over regrowth of biological 'slimes' in the outfall pipeline, King County describes their plan to maintain and control possible regrowth as part of *Amendment 1* of the *Wastewater Facilities Plan for the Carnation Wastewater Treatment Facility.*

Table 5. Reclaimed Water Characterization

Parameter	Units	# of Samples	Average Monthly Average	Maximum Monthly Average
BOD_5	mg/L	*≈400*	4	5
	lbs/day	*≈400*	3	4.4
TSS	mg/L	*≈400*	2	3

	Units	# of Samples	Max 7-day Median	Maximum
Total Coliform	cfu/100 mL	*≈1400*	0	1

	Units	# of Samples	Minimum	Maximum
pH	Std Units	*continuous*	6.7	8.0
Dissolved Oxygen	mg/L	*≈250*	4.1	--

	Units	# of Samples	Average Monthly Average	Maximum
Turbidity	NTU	*continuous*	0.08	0.73
Ammonia	mg/L as N	*≈48*	--	1.0
Nitrogen, total	mg/L as N	*≈279*	13.3	31
Phosphorus, total	mg/L as P	*≈251*	4.41	7.3

F. Reclaimed water use area – Chinook Bend Wetland

The Nestlé Company donated the Chinook Bend Wetland Enhancement project site to King County in 2000. The County designated the property as an open space and habitat protection area. The King County Department of Natural Resources and Parks manages the Chinook Bend Natural Area (Chinook Bend) for the protection of ecological values and, where appropriate, public access. The King County Water and Land Division is restoring the area to a forested wetland ecosystem, as described in the *Chinook Bend Natural Area Wetland Restoration Plan* (May, 2007). Specific project goals include: 1) conserve and enhance ecological value, and 2) accommodate appropriate public uses that do not harm ecological resources.

The County defined the wetlands as Category IV in their *Amendment 1 to the Wastewater Facilities Plan* (April 2007). The wetland design focuses on enhancing native plantings and controlling reed canary grass in the existing degraded wetland through the use of a water control structure, which allows for moist soil management as well as fish passage. The new water control structure restores natural overland flow and connectivity to the Snoqualmie River. Restoring hydrologic connectivity to the river can benefit spawning and rearing salmonids, particularly Coho salmon. Blocking outflow from the culvert provides a back channel refuge environment for salmon. Expansion of the wetlands also improves terrestrial and amphibian habitat.

The project increases the size of the wetland from approximately three acres to nearly four acres; the overall wetland area including buffers is 10 acres. Enhancements provide environmental improvements for the wetlands, the river, salmon, and other species that rely on this critical natural resource. Hydrologically, the wetland is fed from many sources including groundwater seeps and stormwater. The reclaimed water system provides an additional 0.0893 MGD of Class A water to the wetland.

The impacted area is within the traditional hunter-fisher-gatherer territory of the Snoqualmie and Tulalip Tribes. Environmental improvements to the wetlands and river that result from the restoration project benefit tribal members by enhancing wildlife habitat in the area.

The Wastewater Treatment Division and the Water and Land Resources Division (WLRD) of the King County Department of Natural Resources and Parks have signed a Special Use Permit which serves as a Use Area Contract as required by the Water Reuse regulations. WLRD manages the wetland site and assumes responsibility for the maintenance, monitoring, and success of the wetland restoration effort.

G. Water rights impairment analysis

Chapter 90.46.130 RCW prohibits facilities that reclaim water from impairing existing downstream water rights without compensation or mitigation. King County prepared an impairment analysis in 2007 (the *Carnation Wastewater Treatment Facility Reclaimed Water – Water Rights Impairment Analysis)* that identified a regulatory-based instream resource flow protection limit as the only existing water right within the Carnation WWTF study area. The 2007 analysis also provided the following information:

- Wastewater baseline flows were estimated at 150,000 gpd based on estimated potable water use (238 gallons/connection/day and 632 connections);
- Evaporation and transpiration (ET) losses from a wetlands sized 6 acres or less will be less than ET losses from historical on-site treatment on an annual basis;
- Removal of historic septic discharges will cause impairment of the instream flow right between river miles (RM) 24.5 and 22; and environmental benefits of the project will be adequate compensation for the impairment;
- Downstream of RM 22 it is assumed that ~139,200 gpd reached the river from historical septic systems (139,200 gpd [0.215 cfs] is 150,000 gpd minus estimated ET).

Ecology's Water Resource Program reviewed the impairment analysis and concluded that, although the project may impair the State's existing instream flow protection water right, the benefits of the wetland enhancement project provided sufficient compensation for the impairment. Ecology agreed that the size of the wetland should be limited to 6 acres so that ET losses would not impair the river flow. Ecology also agreed that the facility would compensate for the reduction

in groundwater recharge that occurred with the removal of the septic tanks by sending a set amount of flow to the river or wetlands year-round.

Based on data from the initial five years of treatment plant operation, Ecology agrees with King County's assessment (see Steve Hershey's email to Jacque Klug dated October 29, 2013) that this baseline flow is 0.0893 mgd assessed on an annual average basis.

H. Groundwater

The proposed permit requires no groundwater monitoring for this facility. The Class A reclaimed water meets stringent requirements; Ecology expects that water of this quality will not degrade groundwater when applied as supplemental water to the wetlands. No drinking water wells should be impacted by the wetlands since the groundwater in the vicinity flows towards the river (King County 2007, *Amendment 1 to the Wastewater Facilities Plan for Carnation*).

I. Summary of compliance with previous permits

The previous NPDES permit placed effluent limits on BOD_5, TSS, fecal coliform, pH, ammonia, and chlorine. The previous Reclaimed Water permit placed effluent limits on BOD_5, TSS, turbidity, total coliform, pH, ammonia, and chlorine. King County complied with the effluent limits and permit conditions of the permits except as listed in Table 6 and Table 7. Ecology assessed compliance based on its review of the facility's information in Ecology's Permitting and Reporting Information System (PARIS), Discharge Monitoring Reports (DMRs), and on inspections.

Table 6. Compliance Summary - NPDES

Date	Violation	Parameter	Units	Value	Limit
5/1/2008	Numeric Effluent Violation	pH	Std Units	5.7	6
12/1/2009	Late DMR Submittal	-	-	-	-
8/1/2010	Late DMR Submittal	-	-	-	-
9/1/2012	Late DMR Submittal	-	-	-	-

Table 7. Compliance Summary – Reclaimed Water

Date	Violation	Parameter	Units	Value	Limit
8/1/2010	Late DMR Submittal	-	-	-	-
3/1/2011	Numeric Effluent Violation	Turbidity	NTU	0.73	0.5
9/1/2012	Late DMR Submittal	-	-	-	-

J. State environmental policy act (SEPA) compliance

State law exempts the issuance, reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

III. Proposed 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 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), Ground Water Standards (chapter 173-200 WAC), Sediment Quality Standards (chapter 173-204 WAC), or 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 Reclaimed Water Act, Chapter 90.46 RCW requires that reclaimed water be adequately and reliably treated prior to distribution and beneficial use. State regulations require that limits set forth in a permit issued under Chapter 90.46 and 90.48 RCW must be either technology- or water quality-based. Municipal wastewater must also be treated using all known, available, and reasonable treatment (AKART) and not pollute the waters of the State. The minimum criteria to demonstrate compliance with these requirements are derived from the *Water Reclamation and Reuse Standards* and Chapter 173-221 WAC.

Limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.) Ecology evaluated the permit applications and determined the limits needed to comply with the rules adopted by the state of Washington. 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.

Ecology does not usually develop limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. During the five-year permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. Until Ecology modifies the permit to reflect additional discharge of pollutants, a permitted facility could be violating its permit.

A. Design criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Ecology approved design criteria, shown in Table 8, for this facility in the *Carnation Wastewater Treatment Facility Plans & Specifications* prepared by Carollo Engineers, Inc.

Table 8. Design Criteria for Carnation Wastewater Treatment Facility

Parameter	Design Quantity
Maximum Average Month Flow	0.48 MGD
BOD_5 influent loading (at max month flow)	1,669 lb/day
TSS influent loading (at max month flow)	1,669 lb/day

B. Technology-based effluent limits

Federal and state regulations define technology-based effluent limits for municipal wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). These regulations are performance standards that constitute all known, available, and reasonable methods of prevention, control, and treatment (AKART) for municipal wastewater.

Table 9 identifies technology-based limits for pH, fecal coliform, BOD_5, and TSS, as listed in chapter 173-221 WAC. Section III.C discusses water quality-based limits.

Table 9. Technology-based Limits

Parameter	Average Monthly Limit	Average Weekly Limit
BOD_5 (concentration)	30 mg/L	45 mg/L
	In addition, the BOD_5 effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	
TSS (concentration)	30 mg/L	45 mg/L
	In addition, the TSS effluent concentration must not exceed fifteen percent (15%) of the average influent concentration.	
Chlorine	0.5 mg/L	0.75 mg/L
Parameter	**Monthly Geometric Mean Limit**	**Weekly Geometric Mean Limit**
Fecal Coliform	200 organisms/100 mL	400 organisms/100 mL
Parameter	**Daily Minimum**	**Daily Maximum**
pH	6.0 standard units	9.0 standard units

The Carnation WWTF uses UV for disinfection; however, chlorine is onsite for membrane cleaning and disinfection of the outfall line, and also for back-up disinfection of the effluent. Ecology derived the technology-based monthly average limit for chlorine from standard operating practices. The Water Pollution Control Federation's *Chlorination of Wastewater* (1976) states that a properly designed and maintained wastewater treatment facility can achieve adequate disinfection if a 0.5 mg/L chlorine residual is maintained after fifteen minutes of contact time. See also Metcalf and Eddy, *Wastewater Engineering, Treatment, Disposal and Reuse*, Third Edition, 1991. A treatment facility that provides adequate chlorination contact time can meet the 0.5 mg/L chlorine limit on a monthly average basis. According to WAC 173-221-030(11)(b), the corresponding weekly average is 0.75 mg/L. A water quality-based limit was also calculated (see Table E-4 in Appendix E). Since the water quality-based limit is more stringent than the technology-based limit, the water quality-based limit was used in the proposed permit.

Proposed limits for TSS, BOD_5, and fecal coliform for the high-flow months (November through July) are technology-based, as shown in Table 9. During the low-flow months (August through October), these technology-based limits will still apply, however, Ecology proposes additional TMDL-based limits for BOD_5 and ammonia based on the TMDL study completed by Ecology in 1994.

Technology-based mass limits, shown in Table 10, are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b). Ecology calculated the monthly and weekly average mass limits for BOD_5 and Total Suspended Solids as follows:

Mass Limit = CL x DF x CF
where:
CL = Technology-based concentration limits
DF = Maximum Monthly Average Design flow (MGD)
CF = Conversion factor of 8.34

Table 10. Technology-based Mass Limits

Parameter	Concentration Limit (mg/L)	Mass Limit (lbs/day)
BOD_5 Monthly Average	30	120
BOD_5 Weekly Average	45	180
TSS Monthly Average	30	120
TSS Weekly Average	45	180

C. Surface water quality-based effluent limits

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

Numerical criteria for the protection of aquatic life and recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. 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.

Numerical criteria for the protection of human health

The U.S. EPA has published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State (EPA, 1992). These criteria are designed to protect humans 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.

Narrative criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1); 2006) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2006) and of all marine waters (WAC 173-201A-210, 2006) in the state of Washington.

Antidegradation

Description--The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2006) 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 have an impact on 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).
- Apply three tiers of protection (described below) for surface waters of the state.

Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities. Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

A facility must prepare a Tier II analysis when all three of the following conditions are met:

- The facility is planning a new or expanded action.
- Ecology regulates or authorizes the action.
- The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

Facility Specific Requirements--This facility must meet Tier I requirements.

- Dischargers must maintain and protect existing and designated uses. Ecology 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.
- For waters that do not meet assigned criteria, or protect existing or designated uses, Ecology will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.
- Whenever the natural conditions of a water body are of a lower quality than the assigned criteria, the natural conditions constitute the water quality criteria. 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.

Ecology’s analysis described in this section of the fact sheet demonstrates that 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 port(s), where wastewater mixes with receiving water. Within mixing zones the pollutant concentrations may exceed water quality numeric standards, so long as the discharge doesn't interfere with designated uses of the receiving water body (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.

State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already receive all known, available, and reasonable methods of prevention, control, and treatment (AKART). Mixing zones typically require compliance with water quality criteria within a specified distance from the point of discharge and must not use more than 25% of the available width of the water body for dilution [WAC 173-201A-400 (7)(a)(ii-iii)].

Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derives any necessary effluent limits. Steady-state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur (see Ecology's *Permit Writer's Manual*). Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term "reasonable worst-case" applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 10 means the effluent is 10% and the receiving water is 90% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits. Water quality standards include both aquatic life-based criteria and human health-based criteria. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Each aquatic life *acute* criterion is based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years. Each aquatic life *chronic* criterion is based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic). The human health-based water quality criteria incorporate several exposure and risk assumptions. These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two liters/day for drinking water.
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

1. *Ecology must specify both the allowed size and location in a permit.*

   The proposed permit specifies the size and location of the allowed mixing zone (as specified below).

2. *The facility must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.*

   Ecology has determined that the treatment provided at the Carnation WWTF meets the requirements of AKART (see *Technology-based Limits*).

3. *Ecology must consider critical discharge conditions.*

   Surface water quality-based limits are derived for the water body's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-specific.

   Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Ecology's *Permit Writer's Manual* describes additional guidance on criteria/design conditions for determining dilution factors. The manual can be obtained from Ecology's website at: http://www.ecy.wa.gov/biblio/92109.html.

   Ecology used several sources to obtain mixing model input values for ambient critical conditions in the vicinity of the outfall, including a preliminary outfall mixing study performed by Carollo Engineers and Cosmopolitan in 2003 and Ecology's EIM database. King County provided facility flow data in monthly DMRs and their NPDES and reclaimed water permit applications. Table 11 lists the parameters Ecology used in the model.

4. *Supporting information must clearly indicate the mixing zone would not:*
   - Have a reasonable potential to cause the loss of sensitive or important habitat.
   - Substantially interfere with the existing or characteristic uses.
   - Result in damage to the ecosystem.
   - Adversely affect public health.

   Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms and set the criteria to generally protect the species tested and to fully protect all commercially and recreationally important species.

   EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of discharge.

Table 11. Critical Conditions Used to Model the Discharge

Critical Condition	Value	Source
The seven-day-average low river flow with a recurrence interval of ten years (7Q10)	443 cfs	*Carollo/Cosmopolitan Tech Memo No. 12: Outfall Evaluation 2003*
The thirty-day low river flow with a recurrence interval of five years (30Q5)	620 cfs	1.4 x 7Q10 flow
Harmonic river flow	1329 cfs	3 x 7Q10 flow
River depth at the 7Q10 period	5.0 feet	*Carollo/Cosmopolitan Tech Memo No. 12: Outfall Evaluation 2003 & 2003 Snoqualmie River Temperature TMDL Study*
River velocity	0.4 - 0.7 ft per second	Calculated from flow, river depth and width: Vel = Flow / (depth x width)
Slope	0.00097 ft/ft	*Carollo/Cosmopolitan Tech Memo No. 12: Outfall Evaluation 2003*
Channel width	200 feet	*Carollo/Cosmopolitan Tech Memo No. 12: Outfall Evaluation 2003 & 2003 Snoqualmie River Temperature TMDL Study*
Maximum average monthly effluent flow for past 3 years (chronic and human health non-carcinogen)	0.12 MGD	Carnation WWTF DMR data
Annual average flow for past 3 years (human health carcinogen)	0.096 MGD	Carnation WWTF DMR data
Maximum daily flow for past 3 years (acute)	0.15 MGD	Carnation WWTF DMR data

The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away. Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the effluent will not exceed 33 degrees C for more than two seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration. Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

Because this is a domestic wastewater discharge, the effluent contains fecal coliform bacteria. Ecology developed the water quality criteria for fecal coliforms (discussed below) to assure that people swimming (primary contact recreation) in water meeting the criteria would not develop gastro enteric illnesses. The water quality criteria for primary contact recreation waterbodies is 100 colonies/100 mL. Ecology has authorized a mixing zone for this discharge and a technology-based fecal coliform permit limit of 400 colonies/100 mL. Accounting for mixing with the receiving water and assuming 400 colonies/100 mL in the effluent, fecal coliforms will increase by 1 colony/100 mL at the boundary of the chronic mixing zone, 57 feet downstream of the discharge.

Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics, and the discharge location. Based on this review, Ecology concluded that the discharge does not have a reasonable potential to

cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in damage to the ecosystem, or adversely affect public health if the permit limits are met.

5. *The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone.*

   Ecology conducted a reasonable potential analysis, using procedures established by the EPA and by Ecology, for each pollutant and concluded the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

6. *The size of the mixing zone and the concentrations of the pollutants must be minimized.*

   At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. The plume mixes as it rises through the water column therefore much of the receiving water volume at lower depths in the mixing zone is not mixed with discharge. Ecology determined it is impractical to specify in the permit the actual, much more limited volume in which the dilution occurs as the plume rises and moves with the current.

   Ecology minimizes the size of mixing zones by requiring dischargers to install diffusers when they are appropriate to the discharge and the specific receiving waterbody. When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time. Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95th percentile pollutant concentration, the 90th percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

   Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

7. *Maximum size of mixing zone.*

   The authorized mixing zone does not exceed the maximum size restriction.

8. *Acute mixing zone: The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable* - Ecology determined the acute criteria will be met at 10% of the volume fraction of the chronic mixing zone at the ten year low flow.

   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 - As described above, the toxicity of any pollutant depends upon the exposure, the pollutant concentration, and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent).

   *The acute mixing zone must comply with size restrictions***.** - The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.

9. Overlap of mixing zones.

This mixing zone does not overlap another mixing zone.

D. Designated uses and surface water quality criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. In addition, the U.S. EPA set human health criteria for toxic pollutants (EPA 1992). The tables included below summarize the criteria applicable to the receiving water's designated uses.

- *Aquatic Life Uses* are designated based on the presence of, or the intent to provide protection for the key uses. All indigenous fish and non-fish aquatic species must be protected in waters of the state in addition to the key species. The aquatic life uses and associated criteria for this receiving water are identified in Table 12.

Table 12. Freshwater Aquatic Life Uses and Associated Criteria

Core Summer Salmonid Habitat	
Temperature Criteria – Highest 7-DAD MAX	16°C (60.8°F)
Dissolved Oxygen Criteria	9.5 mg/L
Turbidity Criteria	• 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
pH Criteria	The pH must measure within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units.
Salmon and Trout Spawning (Applies Sept 15 – May 15 as described in Ecology Publication 06-10-038)	
Temperature Criteria – Highest 7-DAD MAX	13°C (55.4°F)

- The *Recreational Uses* for this receiving water are identified in Table 13.

Table 13. Recreational Uses and Associated Criteria

Recreational Use	Criteria
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL.

- The *Water Supply Uses* are domestic, agricultural, industrial, and stock watering.
- The M*iscellaneous Freshwater Uses* are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

E. Evaluation of surface water quality-based effluent limits for numeric criteria

Pollutants in an effluent may affect the aquatic environment near the point of discharge (near-field) or at a considerable distance from the point of discharge (far-field). Toxic pollutants, for example, are near-field pollutants; their adverse effects diminish rapidly with mixing in the receiving water. Conversely, a pollutant such as biochemical oxygen demand (BOD_5) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

Chronic Mixing Zone--WAC 173-201A-400(7)(a) specifies that mixing zones must not extend in a downstream direction from the discharge ports for a distance greater than 300 feet plus the depth of water over the discharge ports or extend upstream for a distance of over 100 feet, not utilize greater than 25% of the flow, and not occupy greater than 25% of the width of the water body. The river width restriction resulted in a smaller chronic dilution factor than the distance downstream restriction; therefore Ecology used the river width restriction approach to determine the dilution factor shown in Table 14.

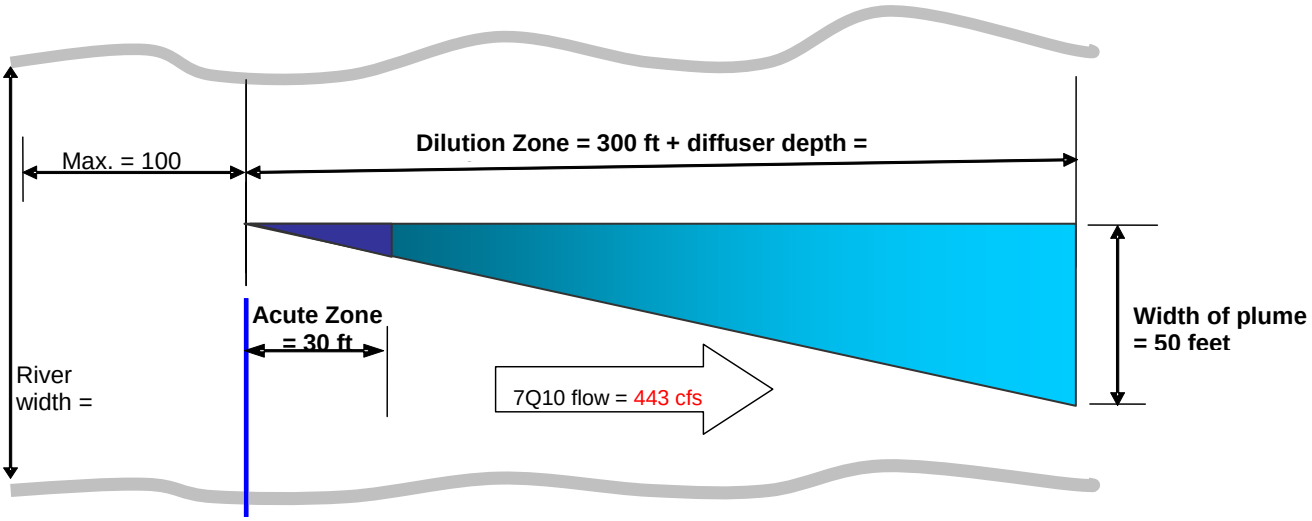

Figure 3. Mixing Zone Diagram.

Acute Mixing Zone--WAC 173-201A-400(8)(a) specifies that in rivers and streams a zone where acute toxics criteria may be exceeded must not extend beyond 10% of the distance towards the upstream and downstream boundaries of the chronic zone, not use greater than 2.5% of the flow and not occupy greater than 25% of the width of the water body. The flow volume restriction resulted in a smaller acute dilution factor than the distance downstream restriction, therefore Ecology used the volume restriction approach to determine the dilution factor shown below.

Appendix D summarizes the methodology used and the assumptions made to calculate dilution factors for the river discharge; the results are listed in Table 14. Ecology proposes less stringent dilution factors than those issued in the previous permit. Federal anti-backsliding regulation provides anti-backsliding exceptions (CFR 122.44(l)(2)(i)B)(1)) when *information is available which was not available at the time of [previous] permit issuance.*

Table 14. Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	49	378
Human Health, Carcinogen		1454
Human Health, Non-carcinogen		521

Ecology used recent facility flow data to calculate the proposed dilution factors; flow data was not available when the previous permit was issued because the facility was not yet in operation. Since facility flow data was not available, Ecology calculated the previous dilution factors using *design flow criteria* which resulted in more stringent dilution factors. See Appendix D for more information on dilution factor derivation.

Ecology determined the impacts of dissolved oxygen deficiency, nutrients, pH, fecal coliform, turbidity, toxics, and temperature as described below, using the dilution factors in Table 14. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

In accordance with NPDES regulations at 40 CFR 122.45(d), all permit limits must be expressed, unless impracticable, as both average monthly (AML) and maximum daily (MDL) values. Both Ecology guidance (*Permit Writer's Manual*, p. VI-26) and EPA Guidance (*Technical Support Document for Water Quality-based Toxic Control*, p. 99) provide the basis for calculating an average monthly limit (AML) from waste load allocation or maximum daily limit (MDL) based on the inherent variability of the data set and the number of samples expected per month.

Dissolved Oxygen, BOD_5 and Ammonia: Natural decomposition of organic material in wastewater effluent impacts dissolved oxygen in the receiving water at distances far outside of the regulated mixing zone. The 5-day Biochemical Oxygen Demand (BOD_5) of an effluent sample indicates the amount of biodegradable material in the wastewater and estimates the magnitude of oxygen consumption the wastewater will generate in the receiving water. The amount of ammonia-based nitrogen in the wastewater also provides an indication of oxygen demand potential in the receiving water.

High-Flow Season (November – July)

Ecology modeled the impact of CBOD and NBOD on the receiving water during the high-flow season using the Streeter-Phelps analysis at the critical condition. Calculations show that when the effluent is well mixed with the river and BOD decay and reaeration rates are taken into consideration, the resulting DO will be approximately 10.2 mg/L during these high flow conditions. This is greater than the 9.5 mg/L dissolved oxygen criteria; therefore the technology-based limits are protective of the water quality standards. The calculations used to assess dissolved oxygen impacts are shown in Table E-5 in Appendix E.

River Low-Flow Season (August – October)

Ecology completed a dissolved oxygen TMDL (*Snoqualmie River Total Maximum Daily Load Study* (1994)) and established waste load allocations (WLAs) for BOD_5 and ammonia. The proposed permit includes effluent limits for BOD_5 and ammonia derived from the completed TMDL. The TMDL waste load allocations for Carnation during the months of August through October are:

- BOD_5: 25 lbs/day
- Ammonia: 8.4 lbs/day (N)

The WLA is the maximum daily limit (MDL). According to federal NPDES regulations, all permit limits must be expressed as both average monthly and maximum daily limits. Ecology calculated the average monthly limit (AML) using recent data, and according to the method in EPA's *Technical Support Document for Water Quality-based Toxics Control* (1991).

- BOD_5: MDL = WLA = 25 lb/day
  AML = 12 lb/day
- Ammonia: MDL = WLA = 8.4 lb/day
  AML = 4.4 lb/day

These limits apply to both the river and wetlands discharges. See Appendix E, Table E-6, for detailed calculations.

Phosphorus: The TMDL does not require a waste load allocation for soluble reactive phosphorus (SRP), however it includes a recommended goal of 3 lb/day for this discharge. Ecology does not enforce recommended waste load allocation goals as permit limits. Additionally, Washington has not yet adopted numeric criteria for phosphorus. Therefore this permit does not include a phosphorus limit. The permit continues to require phosphorus monitoring to assess potential compliance measures in the future.

pH: Ecology modeled the impact of the effluent pH on the receiving water using the calculations from EPA, 1988, and the chronic dilution factor of 378. Model results are included in Appendix E, Table E-7. Ecology predicts no violation of the pH criteria under critical conditions, therefore the proposed permit includes technology-based effluent limits for pH.

Fecal coliform: Ecology calculated the numbers of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 ml and a dilution factor of 378. Under these conditions, the calculation predicts no reasonable potential to exceed the water quality criterion for fecal coliform (Table E-1 in Appendix E). Therefore, the proposed permit includes technology-based effluent limits for fecal coliform bacteria throughout the year.

For the low-flow season (August – October), the TMDL allocates a maximum daily fecal coliform limit of 3.1E+09 cfu/day (see Table E-6 in Appendix E). This value is based on an assumed effluent concentration of 400 cfu/100 mL at a facility flow of 0.2 MGD. The TMDL document states that the fecal coliform load to the river system from the wastewater treatment plants is 'inconsequential' compared to the non-point sources as long as the technology-based limit of 400 cfu/100mL was met. For this reason, the mass limits contained in the previous permit were removed and the proposed permit requires the facility to meet the technology-based fecal coliform limits throughout the year.

Turbidity: Ecology evaluated the impact of turbidity based on reclaimed water turbidity data. The maximum turbidity level reported during the previous four years was 0.73 NTU. Ecology expects no violations of the turbidity criteria outside the designated mixing zone as long as the facility continues to operate as designed.

Toxic Pollutants: Federal regulations (40 CFR 122.44) require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

Monitoring during the previous permit term indentified the following toxic pollutants in the discharge: chlorine (when using chlorine for back-up disinfection and line cleaning), ammonia, heavy metals, and other priority pollutants. Ecology conducted a reasonable potential analysis (Table E-3, Appendix E) on these parameters to assess whether effluent limits would be required. If valid ambient background data were not available for a particular pollutant Ecology used zero for background. Valid ambient background data were available for ammonia. Ecology used all applicable data to evaluate if there is a reasonable potential for this discharge to cause a violation of water quality standards.

Ammonia: Ammonia's toxicity depends on the portion available in the unionized form in the receiving water, which changes based on ambient temperature and pH. To evaluate ammonia toxicity, Ecology calculated the total ammonia concentration that correlates with the unionized

criteria under the known receiving water conditions (Table E-8, Appendix E). This total ammonia was then compared to existing effluent ammonia data to determine if there is a reasonable potential for this discharge to exceed the criteria (Table E-3, Appendix E). Under these conditions, the calculation predicts no violation of the water quality criterion for ammonia. Therefore, the proposed permit includes no limit for ammonia during these high-flow months.

Residual chlorine, heavy metals, priority pollutants: Ecology determined that none of these toxic chemicals pose a reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991 (Table E-3, Appendix E) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

Temperature: The Snoqualmie River is impaired for temperature in the vicinity of the Carnation outfall. King County conducted receiving water temperature monitoring throughout the previous permit term and measured a maximum 7DADMax of 23°C in the river immediately upstream of the outfall. Ecology completed the *Snoqualmie River Basin Temperature TMDL* study in 2011 and concluded that the Carnation WWTF will meet its temperature TMDL waste load allocation as long as the temperature criteria are met at the chronic mixing zone boundary. In addition, the state temperature standards [WAC 173-201A-200-210 and 600-612] include several elements:

- Annual summer maximum threshold criteria (June 15 to September 15).
- Supplemental spawning and rearing season criteria (September 15 to May 15).
- Incremental warming restrictions.
- Protections against acute effects.

Ecology evaluates each criterion independently to assess reasonable potential and to derive permit limits if needed. Ecology calculated the reasonable potential for these criteria (Table E-9, Appendix E) and concluded that no reasonable potential exists since this discharge does not increase the river temperature by more than 0.3°C at the chronic mixing zone boundary.

F. Human health

Washington's water quality standards include 91 numeric human health-based criteria that Ecology must consider when writing NPDES permits. These criteria were established in 1992 by the U.S. EPA in its National Toxics Rule (40 CFR 131.36). The National Toxics Rule allows states to use mixing zones to evaluate whether discharges comply with human health criteria.

Ecology evaluated the discharge's potential to violate the water quality standards by following the procedures published in the *Technical Support Document for Water Quality-Based Toxics Control* (EPA/505/2-90-001) and Ecology's *Permit Writer's Manual.* The reasonable potential evaluation (Table E-3, Appendix E) showed that the discharge has no reasonable potential to cause a violation of water quality standards; no effluent limits are needed.

G. Evaluation of reclaimed water limits

All reclaimed water permits must assure that the effluent has been adequately and reliably treated so that as a result of that treatment, it is suitable for a beneficial use or controlled use that would not otherwise occur and is no longer considered a wastewater [(RCW 90.46.010(15)]. The authority and duties for reclaimed water use are in addition to those already provided in law with regard to sewage and wastewater collection, treatment, and disposal for the protection of public health and the safety of the state's waters.

The *Water Reclamation and Reuse Standards*, 1997, define the requirements for the level of treatment technology as well as water quality limits necessary for public health protection during the use of reclaimed water. The standards provide four classes of reclaimed water, Classes A, B, C, and D. The state's reclaimed water standards include a section that specifically pertains to wetlands applications. Facilities must meet Class A reclaimed water standards where natural and constructed beneficial use wetlands receiving reclaimed water provide potential human contact recreational or educational beneficial uses.

The Carnation WWTF produces Class A reclaimed water which is the highest quality of reclaimed water and therefore provides the broadest range of reuse opportunities. Class A reclaimed water also requires the most stringent treatment and water quality limits. The technology and water quality requirements for the production of Class A reclaimed water are as follows: *Class A Reclaimed Water is reclaimed water that had been adequately and reliably treated and, at a minimum is, at all times, an oxidized, coagulated, filtered, and disinfected wastewater.*

1. Oxidized is defined as wastewater in which the organic matter has been stabilized such that the 5-day biochemical oxygen demand (BOD_5) does not exceed 30 mg/L and total suspended solids (TSS) does not exceed 30 mg/L, is non-putrescible, and contains dissolved oxygen.
2. Coagulated wastewater is defined as an oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated prior to filtration by the addition of chemicals or by an equally effective method. The coagulation requirement is not strictly enforced for membrane bioreactor facilities because these facilities perform well without coagulation, and coagulates add unnecessary costs and use of chemicals.
3. Filtered wastewater is defined as an oxidized, coagulated wastewater which has been passed through natural undisturbed soils or filter media, such as sand, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 nephelometric turbidity units (NTU), determined monthly, and does not exceed 5 NTU at any time. For MBR facilities, the average monthly turbidity limit is 0.2 NTU and the maximum limit is 0.5 NTU.
4. Adequate disinfection is defined as the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample.
5. The requirement for 0.5 mg/L chlorine residual during reclaimed water conveyance was waived for this situation since chlorine would harm biota in the wetlands. The facility disinfects the water with ultraviolet instead of chlorine.

BOD_5 & TSS: The *1997 Reclaimed Water Standards* limit wetland discharge concentrations of BOD_5 and TSS to 20 mg/L on an average annual basis. Ecology applied these limits as monthly average limits in the existing permit. The facility complied with these limits throughout the permit term therefore Ecology included the same limits in the proposed permit. The permit also includes seasonal mass limits for BOD_5 based on the Snoqualmie 1994 TMDL.

Turbidity: Washington State's Class A reclaimed water standards require the facility to filter Class A water at all times. The definition of *filtered water* states that turbidity must not exceed an average operating turbidity of 2 NTU, determined monthly, and 5 NTU at any time.

Reclaimed water at this facility is produced using membrane bioreactor (MBR) treatment. Turbidity limits for MBRs are set to be equivalent to the current regulations adopted by the State of California for the production of recycled water at 0.2 NTU daily average, with no more than 5% of the turbidity reading exceeding 0.5 NTU. The more stringent limits are based on the operational capability of the filter. Experience and extensive testing have confirmed that turbidity levels greater than these are indicative of significant membrane damage that can result in reduced virus and pathogen removal.

Total Coliform: The proposed permit includes total coliform limits according to Class A reclaimed water standards. The standards require that the 7-day median does not exceed 2.2/100 mL and that no sample exceeds 23/100 mL.

Fecal Coliform: The 1994 Snoqualmie River TMDL set a total maximum daily load for fecal coliform. The TMDL restricts the mass loading of fecal coliform to levels that equate to concentrations of 68 and 171 colonies/100ml for average month and max daily, respectively, at full design flow (0.48 MGD). However, the applied Reclaimed Water Standards for total coliform are far stricter than the TMDL requirements (2.2 and 23 colonies/100mL), so the proposed permit does not include a fecal coliform limit.

pH: Ecology set pH limits according to technology-based limits for municipal wastewater treatment facilities. These limits will protect wetland uses.

Residual Chlorine: To protect the wetland flora and fauna, Ecology calculated a residual chlorine limit for the wetlands discharge assuming no mixing zone. This results in a very stringent chlorine limit. Since the facility disinfects with ultraviolet and since Ecology and DOH waived the residual chlorine requirement in distribution systems for this discharge, the County does not use chlorine on a daily basis and should easily meet the chlorine limits during normal operation. However, the proposed permit requires the County to disinfect the outfall line after any total coliform exceedance occurs. The County must follow the procedures detailed in Section R4 of the permit to minimize chlorine discharge to the wetlands.

Nutrients: Nutrient uptake in wetlands varies seasonally and will likely change as the vegetation matures over time. Overloading the wetlands with nutrients can lead to eutrophication and can degrade the Snoqulamie River's DO levels. The proposed permit requires the County to calculate a nutrient balance to monitor the nutrient contribution from the reclaimed water, and to analyze wetland vegetation assimilation. Ecology and the County will use this information to determine the impacts of nutrients on the wetlands and the Snoqualmie River.

Nitrogen– The *1997 Reclaimed Water Standards* require Total Kjeldahl Nitrogen (TKN) concentrations to not exceed 3 mg/L on an annual average basis for wetland discharges, unless net environmental benefits are provided. The maximum average annual TKN concentration for this facility from 2009 to 2012 was 2 mg/L. In lieu of a TKN limit for the wetland discharge, a net environment benefit study is required and included as a reclaimed water permit condition.

The seasonal ammonia TMDL limit applies because the waters of the wetlands and Snoqualmie River are hydraulically connected.

Phosphorus – The *1997 Reclaimed Water Standards* require Total Phosphorus (TP) concentrations to not exceed 1 mg/L on an annual average basis for wetland discharges, unless net environmental benefits are demonstrated. The maximum average annual TP concentration for this facility from 2009 to 2012 was 5 mg/L. The permit requires the County to provide a net environmental benefit evaluation and a nutrient analysis with the next permit application. Ecology will assess TP compliance with the next permit issuance.

The TMDL does not require a waste load allocation for phosphorus, however it includes a recommended goal of 3 lb/day soluble reactive phosphorus (SRP) for this discharge. Ecology does not enforce recommended waste load allocation goals as permit limits. Additionally, Washington has not yet adopted numeric criteria for phosphorus. Therefore this permit does not include a phosphorus limit. The permit continues to require phosphorus monitoring to assess potential compliance measures in the future.

Metals: Data collected during the previous permit term indicate that copper exceeds water quality standards at the end of pipe (see Table E-10 in Appendix E). The *1997 Reclaimed Water Standards* allow for metal exceedances in wetlands if an absence of toxicity can be demonstrated with acute WET testing for daphnids. The WET results shown in Table F-2 (Appendix F) show that the Carnation effluent demonstrates no toxicity to daphnids. Therefore, the proposed permit does not include a copper limit. Since toxicity is not expected to change for this facility (i.e., MBR treatment and no industrial users), no additional WET testing is proposed. However, in order to assess continued compliance with the *1997 Reclaimed Water Standards* for metals, a net environmental benefit is required in lieu of a copper limit or acute WET testing.

Temperature: Ecology considered the temperature impacts from the reclaimed water on the Snoqualmie River as water discharges from the wetlands to the river. Water temperature will likely increase after exposure to the shallow wetlands environment. Water from the wetlands will overflow the weir to the river during high run-off conditions, likely during winter and spring months. During these months there is no reasonable potential to exceed the temperature standards in the river. Additionally, water from the wetlands contributes to the hyporheic zone circulation, which is recognized as an important factor in keeping surface waters cool as well as enhancing fish spawning and other important processes.

Hydraulic Loading: Ecology calculated the hydraulic loading to wetlands as 2.3 cm/day assuming an annual average flow of 0.1 MGD and a wetland area of 4 acres. This meets the *1997 Reclaimed Water Standards* maximum loading limit of 3 cm/day.

H. Sediment quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website.
http://www.ecy.wa.gov/programs/tcp/smu/sediment.html

Through a review of the discharger characteristics and of the effluent characteristics, Ecology determined that this discharge has no reasonable potential to violate the sediment management standards.

I. 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 detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

- *Acute toxicity tests measure mortality as the significant* response to the toxicity of the effluent. Dischargers who monitor their wastewater using acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.
- *Chronic toxicity tests measure various sublethal toxic responses*, such as reduced growth or reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

WET testing conducted during the previous permit term showed the facility's effluent has no reasonable potential to cause chronic or acute toxicity in the receiving water. Using the screening criteria in chapter 173-205-040 WAC, Ecology determined that toxic effects caused by unidentified pollutants in the effluent are unlikely. 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 this effluent.

J. Comparison of effluent limits with the previous permit

Table 15 and Table 17 and summarize the changes to effluent limits proposed with the new permit for the river and wetlands discharges, respectively. BOD_5 and TSS mass limits were added for the TMDL season and for the wetlands discharge; this provides consistency with the NPDES river discharge limits and reporting requirements. The TMDL-based mass limits for BOD_5 and ammonia changed slightly based on calculations using recent data; the previous limits were set prior to plant operation. The TMDL-based mass limit for fecal coliform was removed, and chlorine limits were changed from technology-based limits to more stringent water quality-based limits.

Table 15. Comparison of Previous and Proposed Effluent Limits – River outfall

	Previous Effluent Limits			Proposed Effluent Limits		
Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Basis of Limit**	**Average Monthly**	**Average Weekly**
BOD_5 (August–Oct)	Technology	no limit	no limit	Technology	120 lb/day	180 lb/day
	Basis of Limit	**Average Monthly**	**Maximum Daily**	**Basis of Limit**	**Average Monthly**	**Maximum Daily**
BOD_5 (August–Oct)	TMDL	12.5 lb/day	25 lb/day	TMDL	12 lb/day	no change
Ammonia, as N (August–Oct)	TMDL	4.2 lb/day	8.4 lb/day	TMDL	4.4 lb/day	no change
Fecal Coliform (August–Oct)	TMDL	1.55+E09 cfu/day	3.1+E09 cfu/day	--	no limit	no limit
	Basis of Limit	**Average Monthly**	**Average Weekly**	**Basis of Limit**	**Average Monthly**	**Maximum Daily**
Total Residual Chlorine	Technology	0.5 mg/L	0.75 mg/L	WQ	354 µg/L	926 µg/L

Table 16. Comparison of Previous and Proposed Effluent Limits – Reclaimed water wetlands discharge

	Previous Effluent Limits			Proposed Effluent Limits		
Parameter	**Basis of Limit**	**Average Monthly**	**Average Weekly**	**Basis of Limit**	**Average Monthly**	**Average Weekly**
BOD_5	Technology	no limit	no limit	Technology	80 lb/day	120 lb/day
TSS	Technology	no limit	no limit	Technology	80 lb/day	120 lb/day
	Basis of Limit	**Average Monthly**	**Maximum Daily**	**Basis of Limit**	**Average Monthly**	**Maximum Daily**
BOD_5 (August–Oct)	TMDL	12.5 lb/day	25 lb/day	TMDL	12 lb/day	no change
Ammonia, as N (August–Oct)	TMDL	4.2 lb/day	8.4 lb/day	TMDL	4.4 lb/day	no change

IV. 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.

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, DL, and QL on the discharge monitoring report or in the required report.

A. Influent and effluent monitoring

The monitoring schedule is detailed in the proposed permit under Special Condition S2 and Reclaimed Water Condition R2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (Publication Number 92-09) for activated sludge facilities with less that 2.0 MGD average design flow.

As a delegated pretreatment facility, King County is required to sample influent, final effluent, and sludge for toxic pollutants in order to characterize the industrial input. However, since no significant industrial users discharge to the Carnation collection system, WET testing and sampling for toxic pollutants is not required, except as necessary to assess compliance with water quality standards.

B. Lab accreditation

Ecology requires that facilities must 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). Ecology accredited the Carnation laboratory for the parameters listed in Table 17. King County analyzes additional parameters such as nutrients at their South Plant WWTP laboratory. The South Plant laboratory is accredited for the parameters listed in
Table 18.

King County's environmental lab at W. Ewing Street is additionally accredited for trace metals by ICP-OES and ICP-MS, mercury, inorganics, organics by GC and GC-MS, bioassays, and microbiology in matrices, including liquids, sediments, and tissues.

Table 17. Carnation Facility Lab Accreditation Parameters (Accreditation #M927-12)

Parameter Name	Method
Solids, Total Suspended	SM 2540 D-97
Chlorine (Residual), Total	SM 4500-Cl G-00
pH	SM 4500-H+ B-00
Biochemical Oxygen Demand (BOD)	SM 5210 B-01
Chemical Oxygen Demand (COD)	SM 5220 D-97
Total coliforms-count	SM 9222 B (M-endo)-97
Fecal coliform-count	SM 9222 D (m-FC)-97

Table 18. South Plant Lab Accreditation Parameters (Accreditation #M687-13)

Parameter Name	Method	Parameter Name	Method
Alkalinity, Total	2320 B(4a)	Orthophosphate	4500-P E
Ammonia	4500-NH3 F	pH	4500-H
Biochemical Oxygen Demand, BOD/CBOD	5210 B	Phosphorus, Total Persulfate	4500-P E
Chemical Oxygen Demand (COD)	5220 D	Solids, Total	2540 B
Chloride	4500-Cl- C	Solids, Total Dissolved	2540 C
Chlorine Residual, Total	4500-Cl G	Solids, Total Suspended	2540 D
Dissolved Oxygen	4500-O C	Solids, Total Volatile	2540 E
Hardness, Total (as CaCO3)	2340 C	Specific Conductance	2510 B
Magnesium	3500-Mg D	Sulfate	4500-SO4 E
Nitrate	4500-NO3 E	Turbidity	2130 B
Nitrate + Nitrite	4500-NO3 E	Fecal Coliform - count	9222 D
Nitrite	4500-NO2 B	Total Coliform - count MF	9222 B2,5,6
Nitrogen, Total Kjeldahl	4500-Norg B		

V. Other Permit Conditions

A. Reporting and record keeping

Ecology based Special Condition S3 and Reclaimed Water Condition R3 on its authority to specify any appropriate reporting and record keeping requirements to prevent and control waste discharges (WAC 173-220-210).

B. Prevention of facility overloading

Overloading of the treatment facility is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-220-150 require King County to:

- Take the actions detailed in proposed permit Special Condition S.4.
- Design and construct expansions or modifications before the treatment facility reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

Special Condition S.4 restricts the amount of flow.

If a municipality intends to apply for Ecology-administered funding for the design or construction of a facility project, the plan must meet the standard of a *Facility Plan*, as defined in WAC 173-98-030. A complete *Facility Plan* includes all elements of an *Engineering Report* along with State Environmental Review Process (SERP) documentation to demonstrate compliance with 40 CFR 35.3140 and 40 CFR 35.3145, and a cost effectiveness analysis as required by WAC 173-98-730. The municipality should contact Ecology's regional office as early as practical before planning a project that may include Ecology-administered funding.

C. Operation and maintenance

The proposed permit contains Special Condition S.5 as authorized under RCW 90.48.110, WAC 173-220-150, chapter 173-230 WAC, and WAC 173-240-080. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that King County takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

D. Reclaimed water distribution and use

These permit requirements are based on the *Water Reclamation and Reuse Standards* authorized in Chapter 90.46 RCW. The standards contain requirements to assure that distribution and use of reclaimed water are protective of public health and the environment at all times. These include prohibitions on bypass, alarms and alternative disposal of substandard water, maintenance of operational records, cross connection control, use area restrictions and enforceable contracts, and a local reclaimed water use ordinance.

E. Net Environmental Benefit Report

Recent data show that the total phosphorus loadings to the wetlands exceed the *1997 Water Reuse Standards* limit of 1 mg/L. The standards allow for phosphorus exceedances if the Permittee demonstrates that net environmental benefits (NEBs) are provided with the use of reclaimed water. The proposed permit requires the County to submit a report that demonstrates whether or not the use of reclaimed water provides an NEB. The County can use existing wetland monitoring data to make this determination if it is available. Consider evaluating the potential of reclaimed water having a cooling effect on Snoqualmie River temperatures as a result of enhanced hyporheic exchange.

F. Pretreatment

To provide more direct and effective control of pollutants, Ecology has delegated permitting, monitoring and enforcement authority to King County for industrial users discharging to their treatment systems. Ecology oversees the delegated Industrial Pretreatment Program to assure compliance with federal pretreatment regulations (40 CFR Part 403) and categorical standards and state regulations (Chapter 90.48 RCW and Chapter 173-216 WAC).

Duty to enforce discharge prohibitions **-** This provision prohibits the publicly owned treatment works (POTW) from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes “pass-through” or “interference”. This general prohibition is from 40 CFR §403.5(a). Appendix C of this fact sheet defines these terms.
- The second section reinforces a number of specific state and federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:
    a. Are prohibited due to dangerous waste rules.
    b. Are explosive or flammable.
    c. Have too high or low of a pH (too corrosive, acidic or basic).
    d. May cause a blockage such as grease, sand, rocks, or viscous materials.
    e. Are hot enough to cause a problem.
    f. Are of sufficient strength or volume to interfere with treatment.
    g. Contain too much petroleum-based oils, mineral oil, or cutting fluid.
    h. Create noxious or toxic gases at any point.

40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology. These discharges include:
  a. Cooling water in significant volumes.
  b. Stormwater and other direct inflow sources.
  c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

G. Solid wastes

To prevent water quality problems the facility is required in permit Special Condition S7 to store and handle all residual solids (grit, screenings, scum, sludge, and other solid waste) in accordance with the requirements of RCW 90.48.080 and state water quality standards.

The final use and disposal of sewage sludge from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under chapter 70.95J RCW, chapter 173-308 WAC *Biosolids Management*, and chapter 173-350 WAC *Solid Waste Handling Standards*. The disposal of other solid waste is under the jurisdiction of the King County Health Department.

H. General conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual domestic wastewater NPDES permits issued by Ecology.

VI. Permit Issuance Procedures

A. Permit modifications

Ecology may modify this permit to impose numerical limits, if necessary, to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for groundwaters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

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

B. Proposed permit issuance

This proposed permit meets 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 proposes to issue this permit for a term of 5 years.

VII. References for Text and Appendices

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Water Pollution Control Federation, *Chlorination of Wastewater*, 1976.

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Appendix A - Public Involvement Information

Ecology proposes to reissue a permit to King County's Carnation WWTF. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Draft on November 6, 2013, in *Snoqualmie Valley Record* to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Told where copies of the draft permit and fact sheet were available for public evaluation (a local public library, the closest regional or field office, posted on our website).
- Offered to provide the documents in an alternate format to accommodate special needs.
- Asked people to tell us how well the proposed permit would protect the receiving water.
- Invited people to suggest fairer conditions, limits, and requirements for the permit.
- Invited comments on Ecology's determination of compliance with antidegradation rules.
- Urged people to submit their comments, in writing, before the end of the comment period.
- Told how to request a public hearing about the proposed NPDES permit.
- Explained the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting*, which is available on our website at http://www.ecy.wa.gov/biblio/0307023.html.

You may obtain further information from Ecology by telephone, 425-649-7201, or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008-5452

The primary author of this permit and fact sheet is Alison Evans, PE.

Appendix B - Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt 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.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608
Pollution Control Hearings Board 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Appendix C - Glossary

1-DMax or 1-day maximum temperature -- The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-day average of the daily maximum temperatures -- The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

Acute toxicity -- The lethal effect of a compound on an organism that occurs in a short time period, usually 48 to 96 hours.

AKART -- The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance -- An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An "early warning value" must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ambient water quality -- The existing environmental condition of the water in a receiving water body.

Ammonia -- Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Average monthly discharge limit -- The average of the measured values obtained over a calendar month's time.

Background water quality -- The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time upgradient of an activity that has not been affected by that activity, [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best management practices (BMPs) -- 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 include treatment systems, operating procedures, and practices to control: facility site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5 -- Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass -- The intentional diversion of waste streams from any portion of a treatment facility.

Chlorine -- A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic toxicity -- The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean water act (CWA) -- The federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Composite sample -- A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Continuous monitoring -- Uninterrupted, unless otherwise noted in the permit.

Critical condition -- The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Date of receipt – This is defined in RCW 43.21B.001(2) as 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 forty-five days from the date of mailing.

Detection limit -- The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Dilution factor (DF) -- A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Engineering report -- A document that thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal coliform bacteria -- Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab sample -- A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Industrial user -- A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial wastewater -- Water or liquid-carried waste 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 storm water and, also, leachate from solid waste facilities.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local limits -- Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

Maximum daily discharge limit -- The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Maximum day design flow (MDDF) -- The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum month design flow (MMDF) -- The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum week design flow (MWDF) -- The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method detection level (MDL) -- See Method Detection Level.

Mixing zone -- An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National pollutant discharge elimination system (NPDES) -- The NPDES (Section 402 of the Clean Water Act) is the federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the state of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both state and federal laws.

pH -- The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Point of compliance -- The location in the groundwater where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential significant industrial user (PSIU) --A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment facility design capacity criteria and discharges <25,000 gallons per day; or

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation level (QL) -- Also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

Reasonable potential -- A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible corporate officer -- A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Significant industrial user (SIU) --

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment facility; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

   Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation 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.

   *The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug discharge -- Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW’s regulations and local limits.

Solid waste -- All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

State waters -- Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater – That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit -- A permit limit based on the ability of a treatment method to reduce the pollutant.

Total coliform bacteria -- A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total dissolved solids -- That portion of total solids in water or wastewater that passes through a specific filter.

Total maximum daily load (TMDL) -- A determination of the amount of pollutant that a water body can receive and still meet water quality standards.

Total suspended solids (TSS) -- Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset -- An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water quality-based effluent limit -- A limit imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D - Dilution Factor Derivation

Carollo Engineers and Cosmopolitan Engineering Group, Inc originally presented dilution factor calculations in their *Technical Memorandum No.12: Outfall Evaluation,* dated May 2003. Ecology considered the calculations as preliminary since the facility flow design criteria had not yet been determined. When issuing the previous permit, Ecology used RIVPLUM5 to recalculate the dilution factors using the actual design flow criteria. Ecology's *Permit Writer's Manual* recommends using existing flow data, as opposed to design criteria, to calculate dilution factors. Ecology could not use actual data for the previous permit since the Carnation WWTF was not yet in operation. Ecology recalculated the dilution factors for this permit using the updated RiverPlume6 model and facility flow data from the past three years as recommended in Ecology's *Permit Writer's Manual*.

River flows

Acute and chronic dilution factors are calculated using the 7Q10 river flow. The 7Q10 flow is a statistical estimate of the lowest 7-day average flow that can be expected to occur once every ten years on average. The 7Q10 flow is commonly used to represent the critical flow condition in a water body and is typically calculated from long-term flow data. The Carollo/Cosmopolitan (2003) study used a 7Q10 flow value of 443 cfs for the Snoqualmie River at Carnation. This is consistent with 7Q10 valued assessed in the *Snoqualmie River Basin Temperature TMDL (June 2011)* which used 442 cfs based on records from 1929-2008 from the USGS gauging Station 12149000.

Human Health carcinogen and non-carcinogen dilution factors are calculated using the harmonic mean and 30Q5 river flows, respectively. Ecology estimated these flows using the known 7Q10 flow.

Effluent flows

Ecology calculated critical effluent flows from DMR data from 2010-2013 according to Ecology's *Permit Writer's Manual.*

Channel geometry

The RiverPlume6 dilution model uses stream depth, width, velocity, and slope to predict dilution. In the previous permit, Ecology used channel geometry based on the Carollo/Cosmopolitan (2003) study. The study used 5.4 feet as the river depth, 200 feet as the river width, 0.61 ft/sec for velocity, and 0.00097 for slope. These values are consistent with, or slightly more conservative than, field measurements taken as part of the 2011 temperature TMDL as shown in Table D-1.

Table D-1. Snoqualmie River parameters (from 2001 Temperature TMDL study)

Site	Name	RM	Date	Time	Width (ft)	Avg. Vel (ft/sec)	Avg. Depth (ft)	Q (CFS)
07SNO24.9	Snoqualmie R. abv Tolt River	24.9	7/26/2006	715	218	0.45	8.00	762
07SNO22.8	Snoqualmie R. @ Farm Rd.	22.8	7/26/2006	1105	227	0.86	5.00	965

Ecology adjusted the depth to 5.0 feet to meet the more conservative depth measured in the field. Also, to be consistent with the 7Q10 flow, Ecology calculated the river velocity based on the following equation: Q(flow) = (depth) x (width) x (velocity). A velocity of 0.443 ft/s makes the flow volume match the 7Q10 and is consistent with the velocities measured in the field [5.0 ft x 200 ft x 0.443 ft/s = 443 cfs]. To calculate dilution factors for human health carcinogen and non-carcinogen,

the values for river depth, width, and velocity were adjusted in proportion to the corresponding river flows for those conditions.

Dilution Factors

According to the RiverPlume6 spreadsheet, the plume width at 300 feet downstream of the outfall is wider than 25% of the river width. Since regulation requires plume width to be 25% of the river width or less, Ecology reduced the *Distance Downstream to Point of Interest* until the calculated plume width equaled 25% of the river width. For three of the scenarios evaluated (chronic, human health non-carcinogen and human health carcinogen) the effluent plume width equaled 25% of the river width 45-58 ft downstream of the outfall. For the acute case, using 2.5% of the river volumetric flow resulted in the most restrictive dilution factor. Ecology selected the most restrictive dilution factors for each condition. Final dilution factors are shown in Table D-2 and the RiverPlume6 spreadsheet is shown in Table D-3.

Table D-2. Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	49	378
Human Health, Carcinogen		1454
Human Health, Non-carcinogen		521

Table D-3. RiverPlume6 - Dilution Factor Calculations

Spread of a Plume from a Point Source in a River with Boundary Effects from the Shoreline

Based on the method of Fischer et al. (1979) with correction for the effective origin of effluent.

	Cosmo-politan Study Chronic	Cosmo-politan Study Acute	Previous Permit-Design Flows Chronic	Previous Permit-Design Flows Acute	Chronic	Acute	HH Non-Carcin-ogen	HH Carcin-ogen
INPUT								
1. Effluent Discharge Rate (MGD)	0.62	0.93	0.48	0.77	0.12	0.15	0.12	0.09
or, Effluent Discharge Rate (cfs)	0.96	1.44	0.74	1.19	0.19	0.23	0.19	0.14
2. Receiving Water Characteristics Downstream from Discharge:								
Stream Depth (ft)	5.4	5.4	5.4	5.4	5.0	5.0	5.8	9.0
Stream Flow (cfs) (7Q10 chronic & acute, 30Q5 for non-carc, harm. mean for carc)	443	443	443	443	443	443	620	1329
% of stream flow allowed for DF (e.g., 25% for chronic & 2.5% for acute)	25	2.5	25	2.5	25	2.5	25	25
Stream Velocity (fps)	0.61	0.61	0.61	0.61	0.44	0.44	0.52	0.69
Channel Width (ft)	200	200	200	200	200	200	205	215
Stream Slope (ft/ft) or Manning roughness "n"	0.00097	0.00097	0.00097	0.00097	0.00097	0.00097	0.00097	0.00097
0 if slope or 1 if Manning "n" in previous cell	0	0	0	0	0	0	0	0
3. Discharge Distance from Nearest Shoreline (ft)	15	15	15	15	15	15	15	15
4. Location of Point of Interest to Estimate Dilution:								
Distance Downstream to Point of Interest (ft)	305	30.5	305	30.5	**57**	**30.5**	**58**	**45**
Distance From Nearest Shoreline (ft)	0	0	0	0	0	0	0	0
5. Transverse Mixing Coefficient Constant (usually 0.6):	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
6. Original Fischer Method (enter 0) or Effective Origin Modification (1)	0	0	0	0	0	0	0	0
7. Is the Plume bounded by the shoreline?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OUTPUT								
1. Source Conservative Mass Input Rate:								
Concentration of Conservative Substance (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Source Conservative Mass Input Rate (cfs*%)	95.93	143.90	74.27	119.14	18.57	23.21	18.57	13.93
2. Shear Velocity based on slope (ft/sec)	0.411	0.411	0.411	0.411	0.395	0.395	0.426	0.530
Shear Velocity based on Manning "n" (using Prasuhn equations 8-26 and 8-54 assuming hydraulic radius equals depth for wide channel):								
Selected Shear Velocity for next step (ft/sec)	0.411	0.411	0.411	0.411	0.395	0.395	0.426	0.530
3. Transverse Mixing Coefficient (ft2/sec)	1.331	1.331	1.331	1.331	1.186	1.186	1.481	2.863
4. Plume Characteristics Accounting for Shoreline Effect (Fischer et al., 1979):								
Co	1.46E-01	2.18E-01	1.13E-01	1.81E-01	4.19E-02	5.24E-02	2.99E-02	1.05E-02
x'	3.23E-03	3.23E-03	1.66E-02	1.66E-03	3.81E-03	2.04E-03	3.89E-03	4.06E-03
y'o	7.50E-02	7.50E-02	7.50E-02	7.50E-02	7.50E-02	7.50E-02	7.32E-02	6.98E-02
y' at point of interest	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Solution using superposition equation (Fischer eqn 5.9):								
Term for n= -2	0.00E+00	0.00E+00	2.74E-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Term for n= -1	2.75E-125	2.75E-125	6.47E-25	1.28E-242	3.16E-106	6.84E-198	1.77E-104	2.07E-100
Term for n= 0	1.29E+00	1.29E+00	1.84E+00	8.59E-01	1.38E+00	1.00E+00	1.42E+00	1.48E+00
Term for n= 1	2.75E-125	2.75E-125	6.47E-25	1.28E-242	3.16E-106	6.84E-198	1.77E-104	2.07E-100
Term for n= 2	0.00E+00	0.00E+00	2.74E-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Effective Distance Downstream from Effluent to Point of Interest (ft)	305.0	30.5	305.0	30.5	57.0	30.5	57.5	45.0
x' Adjusted for Effective Origin	1.66E-02	1.66E-03	1.66E-02	1.66E-03	3.81E-03	2.04E-03	3.89E-03	4.06E-03
C/Co (dimensionless)	2.83E+00	8.95E+00	4.02E+00	5.94E+00	6.32E+00	6.27E+00	6.41E+00	6.56E+00
Concentration at Point of Interest (Fischer Eqn 5.9)	4.12E-01	1.96E+00	4.53E-01	1.07E+00	2.65E-01	3.28E-01	1.92E-01	6.88E-02
Unbounded Plume half-width (ft)	73.0	23.1	73.0	23.1	34.9	25.6	36.1	38.7
Distance from near shore to discharge point (ft)	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Distance from far shore to discharge point (ft)	185.0	185.0	185.0	185.0	185.0	185.0	190.0	200.0
RESULTS								
W, Plume width bounded by shoreline (ft)	88.0	38.1	88.0	38.1	**49.9**	**40.6**	**51.1**	**53.7**
W, Unbounded Plume Width at Point of Interest (ft)	145.9	46.1	145.9	46.1	69.9	51.1	72.3	77.5
Approximate Downstream Distance to Complete Mix (ft)	6,276	6,276	6,276	6,276	5,115	5,115	5,085	3,838
Theoretical Dilution Factor at Complete Mix	687	458	887	553	2,386	1,909	3,340	9,543
Calculated Flux-Average DF Across Entire Plume Width	302	87	390	105	596	387	833	2,385
Calculated Dilution Factor at Point of Interest	243	51	221	93	**378**	**304**	**521**	**1,454**

Regulatory Max Plume Widths and Dilution Factors

Wmax, Regulatory Max Plume Width (ft)	50.0	50.0	50.0	50.0	50.0	50.0	51.3	53.8
Regulatory Max Dilution Factor (e.g, effluent well-mixed with 25% of 7Q10 flow)	116	9	150	10	597	49	836	2387
Most Restrictive Dilution Factor	**116**	**9**	**150**	**10**	**378**	**49**	**521**	**1454**

Appendix E - Technical Calculations

Several of the Excel® spreadsheet tools used to evaluate a discharger's ability to meet Washington State water quality standards can be found on Ecology's homepage at http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html.

Simple Mixing:

Ecology uses simple mixing calculations to assess the impacts of certain conservative pollutants, such as the expected increase in fecal coliform bacteria at the edge of the chronic mixing zone boundary. Simple mixing uses a mass balance approach to proportionally distribute a pollutant load from a discharge into the authorized mixing zone. The approach assumes no decay or generation of the pollutant of concern within the mixing zone. The predicted concentration at the edge of a mixing zone (MC) is based on the following calculation:

$$MC = [EC + (AC \times DF)]/(1 + DF)$$

where:

EC = Effluent Concentration
AC = Ambient Concentration
DF = Dilution Factor

Reasonable Potential Analysis:

The process and formulas for determining reasonable potential and effluent limits are taken directly from the *Technical Support Document for Water Quality-based Toxics Control*, (EPA 505/2-90-001). The adjustment for autocorrelation is from EPA (1996a), and EPA (1996b).

Calculation of Water Quality-Based Effluent Limits:

Water quality-based effluent limits are calculated by the two-value wasteload allocation process as described on page 100 of the TSD (EPA, 1991) and shown below.

1. Calculate the acute wasteload allocation WLA_a by multiplying the acute criteria by the acute dilution factor and subtracting the background factor. Calculate the chronic wasteload allocation (WLA_c) by multiplying the chronic criteria by the chronic dilution factor and subtracting the background factor.

$$WLA_a = (\text{acute criteria} \times DF_a) - [(\text{background conc.} \times (DF_a - 1)]$$
$$WLA_c = (\text{chronic criteria} \times DF_c) - [(\text{background conc.} \times (DF_c - 1)]$$

where: DF_a = Acute Dilution Factor
DF_c = Chronic Dilution Factor

2. Calculate the long term averages (LTA_a and LTA_c) which will comply with the wasteload allocations WLA_a and WLA_c.

$$LTA_a = WLA_a \times e^{[0.5\sigma^2 - z\sigma]}$$

where: $\sigma^2 = \ln[CV^2 + 1]$
$z = 2.326$
CV = coefficient of variation = std. dev./mean

$$LTA_c = WLA_c \times e^{[0.5\sigma^2 - z\sigma]}$$

where: $\sigma^2 = \ln[(CV^2 \div 4) + 1]$
$z = 2.326$

3. Use the smallest LTA of the LTA_a or LTA_c to calculate the maximum daily effluent limit and the monthly average effluent limit.

Maximum Daily Limit = MDL

$MDL = LTA \times e^{[Z\sigma - 0.5\sigma^2]}$ where: $\sigma^2 = \ln[CV^2 + 1]$

$z = 2.326$ (99^{th} percentile occurrence)

LTA = Limiting long term average

Average Monthly Limit = AML

$AML = LTA \times e^{[Z\sigma_n - 0.5\sigma_n^2]}$ where: $\sigma_n^2 = \ln[(CV^2 \div n) + 1]$

n = number of samples/month

$z = 1.645$ (95^{th} percentile occurrence)

LTA = Limiting long term average

Table E-1. Simple Mixing Calculations for Fecal Coliform

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	378
Receiving Water Fecal Coliform, #/100 ml (90th %)	57
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*100*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**58**
Difference between mixed and ambient, #/100 ml	1

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for fecal coliform.

Table E-2. 1994 TMDL Allocations for BOD_5, SRP, Fecal Coliform, and Ammonia for 5-Plant Scenario
(The following table is an excerpt from the Department of Ecology's Snoqualmie River Total Maximum Daily Load Study, May 1994, p. 31.)

Waste Load Allocations used to calculate AML and MDL for BOD_5, fecal coliform, and Ammonia.

Table 8. Summary of estimated contaminant loads to the Snoqualmie River during critical low flow: August, September, and October (units of lbs/day).
Expansion to five municipal wastewater treatment plant (WWTP) to projected seasonal capacity and nonpoint sources are evaluated. Recommended controls are outlined.

	PROJECTED WWTP EXPANSION WITH CONTROLS - NO NPS CONTROLS								WWTP AND NPS CONTROLS							
	Concentrations					Loads			Concentrations					Loads		
	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform	Flow (cfs)	BOD5 (mg/L)	NH3-N (mg/L)	SRP (mg/L)	Fecal* Coliform	BOD5 (lbs/d)	NH3-N (lbs/d)	SRP (lbs/d)	Fecal* Coliform
POINT SOURCES																		
North Bend	2.16	15	5	0.2	400	175	58.2	2	2.1E+10	2.16	15	9	0.22	400	175	104.8	3	2.1E+10
Weyerhaeuser	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06	0.01	4.7	0.08	0.03	6	0.25	0.004	0.002	1.5E+06
Snoqualmie	2.55	15	5	1.05	400	206	68.7	14	2.5E+10	2.55	15	9	1.05	400	206	123.7	14	2.5E+10
Fall City	0.31	15	5	1.4	400	25	8.4	2	3.1E+09	0.31	15	9	2.5	400	25	15.0	4	3.1E+09
Carnation	0.31	15	5	2	400	25	8.4	3	3.1E+09	0.31	15	9	2.5	400	25	15.0	4	3.1E+09
Duvall	1.16	15	5	1.2	400	94	31.3	8	1.1E+10	1.16	15	8	2	400	94	30.0	13	1.1E+10
Point Source Loads						825	175	36	6.4E+10						825	309	38	6.4E+10
MAINSTEM NONPOINT SOURCES																		
Three forks area	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11	0.02	60	1.5	1.4	3E+05	6	0.2	0.2	1.5E+11
Below Fall City	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11	0.075	60	15	1.4	3E+05	24	6.1	0.6	5.5E+11
Below Patterson Cr.	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11	0.07	60	15	1.4	3E+05	23	5.7	0.5	5.2E+11
Novelty Hill Bridge	0.3	60	15	1.4	3E+05	97	24.3	2.3	2.2E+12	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Cherry Creek area	0.15	60	15	1.4	3E+05	49	12.1	1.1	1.1E+12	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
High Bridge area	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11	0.1	60	15	1.4	3E+05	32	8.1	0.8	7.4E+11
Mainstem Nonpoint Loads						249	61	6	5.7E+12	Mainstem Nonpoint Loads					150	36	4	3.4E+12
BACKGROUND & TRIBUTARIES																		
S.F. Background	81	0.6	0.012	0.005	27	262	5.2	2.0	5.4E+10	81	0.6	0.012	0.0045	27	262	5.2	2.0	5.4E+10
Middle Fork	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10	187	0.6	0.011	0.002	21	605	11.1	2.0	9.7E+10
North Fork	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10	73	0.6	0.011	0.002	21	236	4.3	0.8	3.8E+10
Kimball Cr.	0.95	1.4	0.018	0.008	1448	7	0.1	0.04	3.4E+10	0.95	1.4	0.018	0.008	80	7	0.1	0.04	1.9E+10
Tokul Cr.	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09	16.6	0.6	0.041	0.02	10	54	3.7	1.8	4.1E+09
Raging R.	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09	8	1.4	0.015	0.005	31	60	0.6	0.2	6.1E+09
Patterson Cr.	7.4	2	0.03	0.05	207	80	1.2	2.0	3.8E+10	7.4	1.4	0.03	0.02	80	56	1.2	0.8	1.5E+10
Griffin Cr.	1.75	1.4	0.031	0.008	238	13	0.3	0.1	1.0E+10	1.75	1.4	0.031	0.008	80	13	0.3	0.1	3.4E+09
Tolt R.	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10	66	0.6	0.014	0.002	15	213	5.0	0.7	2.4E+10
Harris Cr.	1.46	1.4	0.016	0.015	50	11	0.1	0.1	1.8E+09	1.46	1.4	0.02	0.015	50	11	0.2	0.1	1.8E+09
Ames-Sikes Cr.	2.1	3	0.19	0.3	6550	34	2.2	3.4	3.4E+11	2.1	2	0.03	0.02	80	23	0.3	0.2	4.1E+09
Tuck Cr.	0.34	1.4	0.051	0.067	74	3	0.1	0.1	6.2E+08	0.34	1.4	0.03	0.02	74	3	0.1	0.04	6.2E+08
Cherry Cr.	5	1.4	0.041	0.013	530	38	1.1	0.4	6.5E+10	5	1.4	0.03	0.013	80	38	0.8	0.4	9.8E+09
Tributary and Background Loads						1616	35	14	7.1E+11	Tributary and Background Loads					1586	33	9	2.6E+11
Total Loads						2390	271	49	6.5E+12	Total Loads					2254	378	50	3.7E+12

Table E-3. Reasonable Potential Analysis – River Outfall

Reasonable Potential Calculation - River Discharge - Page 1

Facility	Carnation WWTP
Water Body Type	Freshwater
Rec. Water Hardness	23 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	49	378
Human Health Carcinogenic		1454
Human Health Non-Carcinogenic		521

Pollutant, CAS No. & NPDES Application Ref. No.		**AMMONIA, Criteria as Total NH3**	**ARSENIC (dissolved) 7440382 2M**	**ANTIMONY (INORGANIC) 7440036 1M**	**CADMIUM - 7440439 4M Hardness dependent**	**CHROMIUM(TRI) -16065831 5M Hardness dependent**	**COPPER - 744058 6M Hardness dependent**	**LEAD - 7439921 7M Dependent on hardness**	**MERCURY 7439976 8M**	**NICKEL - 7440020 9M - Dependent on hardness**	**SILVER - 7740224 11M dependent on hardness.**	**ZINC- 7440666 13M hardness dependent**
Effluent Data	# of Samples (n)	287	25	3	25	25	25	25	25	25	25	25
	Detected?	y	y	y	y	y	y	y	y	y	y	y
	Coeff of Variation (Cv)	1.33	0.1	0.6	0.3	0.1	0.2	0.2	0.2	0.4	0.1	0.1
	Effluent Concentration, ug/L (Max. or 95th Percentile)	900	1.222	0.5	0.0946	0.46	21.58	0.228	0.0008	2.13	0.05	73.24
	Calculated 50th percentile Effluent Conc. (when n>10)						17.7		0.0005	0.984		
Receiving Water Data	90th Percentile Conc., ug/L	30	0		0	0	0	0	0	0	0	0
	Geo Mean, ug/L			0			0		0	0		
Water Quality Criteria	Aquatic Life Criteria, ug/L — Acute	15,341	360	-	0.7515	164.67	4.2607	12.637	2.1	408.23	0.2754	32.946
	Aquatic Life Criteria, ug/L — Chronic	2,159	190	-	0.3472	53.418	3.2332	0.4924	0.012	45.337	-	30.084
	WQ Criteria for Protection of Human Health, ug/L	-	-	14	-	-	1300	-	0.14	610	-	-
	Metal Criteria Translator, decimal — Acute	-	1	-	0.943	-	1	0.466	0.85	0.998	0.85	1
	Metal Criteria Translator, decimal — Chronic	-	1	-	0.943	-	1	0.466	-	0.997	-	1
	Carcinogen?	N	Y	N	N	N	N	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value	0.950	0.950		0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
s $s^2=\ln(CV^2+1)$	1.009	0.100		0.294	0.100	0.198	0.198	0.198	0.385	0.100	0.100
Pn $Pn=(1\text{-confidence level})^{1/n}$	0.990	0.887		0.887	0.887	0.887	0.887	0.887	0.887	0.887	0.887
Multiplier	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max concentration (ug/L) at edge of… Acute	48	0.025		0.002	0.009	0.443	0.002	0.000	0.044	0.001	1.503
Max concentration (ug/L) at edge of… Chronic	32	0.003		0.000	0.001	0.057	0.000	0.000	0.006	0.000	0.194
Reasonable Potential? Limit Required?	**NO**	**NO**		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Human Health Reasonable Potential

s $s^2=\ln(CV^2+1)$		0.5545		0.198	0.198	0.3853
Pn $Pn=(1\text{-confidence level})1/n$		0.368		0.887	0.887	0.887
Multiplier		1.2049		0.7867	0.7867	0.6271
Dilution Factor		520.79		520.79	520.79	520.79
Max Conc. at edge of Chronic Zone, ug/L		0.0012		3.4E-02	1E-06	0.0019
Reasonable Potential? Limit Required?		**NO**		**NO**	**NO**	**NO**

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Table E-3. Reasonable Potential Analysis – River Outfall (continued)

Reasonable Potential Calculation - River Discharge - Page 2

Facility	Carnation WWTP
Water Body Type	Freshwater
Rec. Water Hardness	23 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	49	378
Human Health Carcinogenic		1454
Human Health Non-Carcinogenic		521

Pollutant, CAS No. & NPDES Application Ref. No.			BENZO(a)ANTHRACENE 56553 5B	BENZO(b)FLUORANTHENE 205992 7B	BENZO(k) FLUORANTHENE 207089 9B	BENZO(a)PYRENE 50328 6B	BIS(2-CHLOROETHYL)ETHER 111444 11B	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B	CHLOROFORM 67663 11V	CHRYSENE 218019 18B	INDENO(1,2,3-cd)PYRENE 193395 37B	1,4 DICHLOROBENZENE 106467 22B	DIETHYLPHTHALATE 84662 24B
Effluent Data	# of Samples (n)		25	24	1	22	3	25	3	28	22	25	25
	Detected?		y	y	y	y	y	y	y	y	y	y	y
	Coeff of Variation (Cv)		0.4	0.6	0.6	0.4	0.6	3.4	0.6	0.6	0.4	2.5	1
	Effluent Concentration, ug/L (Max. or 95th Percentile)				0.019		0.3		1.3				
	Calculated 50th percentile Effluent Conc. (when n>10)		0.0095	0.0143		0.019		0.5		0.0143	0.0143	0.0094	0.125
Receiving Water Data	90th Percentile Conc., ug/L												
	Geo Mean, ug/L		0	0	0	0	0	0	0	0	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	-	-	-	-	-	-	-	-	-	-	-
		Chronic	-	-	-	-	-	-	-	-	-	-	-
	WQ Criteria for Protection of Human Health, ug/L		0.0028	0.0028	0.0028	0.0028	0.031	1.8	5.7	0.0028	0.0028	400	23000
	Metal Criteria Translator, decimal	Acute	-	-	-	-	-	-	-	-	-	-	-
		Chronic	-	-	-	-	-	-	-	-	-	-	-
	Carcinogen?		Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N

Aquatic Life Reasonable Potential

Effluent percentile value													
s	$s^2=\ln(CV^2+1)$												
Pn	$Pn=(1\text{-confidence level})^{1/n}$												
Multiplier													
Max concentration (ug/L) at edge of…		Acute											
		Chronic											
Reasonable Potential? Limit Required?													

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.3853	0.5545	0.5545	0.3853	0.5545	1.5908	0.5545	0.5545	0.3853	1.4075	0.8326
Pn	Pn=(1-confidence level)1/n	0.887	0.883	0.050	0.873	0.368	0.887	0.368	0.899	0.873	0.887	0.887
Multiplier		0.6271	0.5174	2.4895	0.6448	1.2049	0.1456	1.2049	0.4936	0.6448	0.1818	0.3648
Dilution Factor		1454.3	1454.3	1454.3	1454.3	1454.3	1454.3	1454.3	1454.3	1454.3	520.79	520.79
Max Conc. at edge of Chronic Zone, ug/L		7E-06	1E-05	3E-05	1E-05	0.0002	3.4E-04	1.1E-03	1E-05	1E-05	2E-05	0.0002
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Table E-3. Reasonable Potential Analysis – River Outfall (continued)

Reasonable Potential Calculation - River Discharge - Page 3

Facility	Carnation WWTP
Water Body Type	Freshwater
Rec. Water Hardness	23 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	49	378
Human Health Carcinogenic		1454
Human Health Non-Carcinogenic		521

Pollutant, CAS No. & NPDES Application Ref. No.		DI-n-BUTYL PHTHALATE 84742 26B	FLUORANTHENE 206440 31B	MANGANESE 7439965	PHENOL 108952 10A	PYRENE 129000 45B	ANTHRACENE 120127 3B	ACENAPTHENE 83329 1B	DIBENZO(a,h)ANTHRACENE 53703 19B	DIMETHYLPHTHALATE 131113 25B	BUTYLBENZYL PHTHALATE 8568 15B	BENZENE 71432 3V
Effluent Data	# of Samples (n)	25	25	1	25	25	25	25	22	25	25	3
	Detected?	y	y	y	y	y	n	n	n	n	n	n
	Coeff of Variation (Cv)	0.8	1.1	0.6	0.9	0.9	0.4	1.7	0.4	0.3	0.3	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)			3.12					5			1
	Calculated 50th percentile Effluent Conc. (when n>10)	0.494	0.0155		0.048	0.017	0.0095	0.0095	0.0095	0.024	0.087	
Receiving Water Data	90th Percentile Conc., ug/L											
	Geo Mean, ug/L	0	0	0	0	0	0	0	0	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L Acute	-	-	-	-	-	-	-	-	-	-	-
	Aquatic Life Criteria, ug/L Chronic	-	-	-	-	-	-	-	-	-	-	-
	WQ Criteria for Protection of Human Health, ug/L	2700	300	50	21000	960	9600	670	0.0028	313000	1500	1.2
	Metal Criteria Translator, decimal Acute	-	-	-	-	-	-	-	-	-	-	-
	Metal Criteria Translator, decimal Chronic	-	-	-	-	-	-	-	-	-	-	-
	Carcinogen?	N	N	N	N	N	N	N	Y	N	N	Y

Aquatic Life Reasonable Potential

Effluent percentile value												
s	$s^2=\ln(CV^2+1)$											
Pn	$Pn=(1\text{-confidence level})^{1/n}$											
Multiplier												
Max concentration (ug/L) at edge of…	Acute											
	Chronic											
Reasonable Potential? Limit Required?												

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.7033	0.8905	0.5545	0.7703	0.7703	0.3853	1.1655	0.3853	0.2936	0.2936	0.5545
Pn	Pn=(1-confidence level)1/n	0.887	0.887	0.050	0.887	0.887	0.887	0.887	0.873	0.887	0.887	0.368
Multiplier		0.4266	0.3401	2.4895	0.3934	0.3934	0.6271	0.2438	0.6448	0.7008	0.7008	1.2049
Dilution Factor		520.79	520.79	520.79	520.79	520.79	520.79	520.79	1454.3	520.79	520.79	1454.3
Max Conc. at edge of Chronic Zone, ug/L		0.0009	3E-05	0.0149	9E-05	3E-05	1.8E-05	1.8E-05	7E-06	5E-05	0.0002	0.0008
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Table E-4. Calculation Water-Quality-based chlorine limit - River and Wetlands Outfalls

Aquatic Life and Human Health Limits Calculations

Facility	Carnation WWTP
Water Body Type	Freshwater
Rec. Water Hardness	23 mg/L

Pollutant, CAS No. & NPDES Application Ref. No.			River Outfall: CHLORINE (Total Residual) 7782505	Reclaimed Water Wetland Outfall: CHLORINE (Total Residual) 7782505
Effluent Data	Coeff of Variation (Cv)		0.6	0.6
Receiving Water Data	90th Percentile Conc., ug/L		0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	19	19
		Chronic	11	11
	WQ Criteria for Protection of Human Health, ug/L		-	-
	Metal Criteria Translator, decimal	Acute	-	-
		Chronic	-	-
	Carcinogen?		N	N

Dilution Factors

Aquatic Life - Acute			49	1
Aquatic Life - Chronic			378	1
Human Health Carcinogenic			1454	1
Human Health Non-Carcinogenic			521	1

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month			30	30
LTA Coeff. Var. (CV), decimal			0.6	0.6
Permit Limit Coeff. Var. (CV), decimal			0.6	0.6
Waste Load Allocations, ug/L		Acute	926	19
		Chronic	4154	11
Long Term Averages, ug/L		Acute	297	6
		Chronic	2191	6
Limiting LTA, ug/L			297	6
Metal Translator or 1?			1.00	1.00
Average Monthly Limit (AML), ug/L			**354**	**6.9**
Maximum Daily Limit (MDL), ug/L			**926**	**18.1**

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Table E-5. Streeter-Phelps Analysis of Critical DO Sag – River Outfall (non-TMDL months)

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

(Nov - July)

INPUT			
1. EFFLUENT CHARACTERISTICS			
Discharge (cfs):			0.186
$CBOD_5$ (mg/L):			40
NBOD (mg/L):			5.8
Dissolved Oxygen (mg/L):			4.1
Temperature (deg C):			25
2. RECEIVING WATER CHARACTERISTICS			
Upstream Discharge (cfs):			443
Upstream $CBOD_5$ (mg/L):			1.0
Upstream NBOD (mg/L):			0.05
Upstream Dissolved Oxygen (mg/L):			10.56
Upstream Temperature (deg C):			12.2
Elevation (ft NGVD):			89
Downstream Average Channel Slope (ft/ft):			0.00097
Downstream Average Channel Depth (ft):			5
Downstream Average Channel Velocity (fps):			0.443
3. REAERATION RATE (Base e) at 20 deg C (day^-1):			0.77
	Applic.	Applic.	Suggested
Reference	Vel (fps)	Dep (ft)	Values
Churchill	1.5 - 6	2 - 50	0.36
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.77
Owens	0.1 - 6	1 - 2	0.64
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.78
4. BOD DECAY RATE (Base e) AT 20 deg C (day^-1):			0.52
(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value* -->			0.52

OUTPUT	
1. INITIAL MIXED RIVER CONDITION	
$CBOD_5$ (mg/L):	1.0
NBOD (mg/L):	0.0
Dissolved Oxygen (mg/L):	10.6
Temperature (deg C):	12.2
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)	
Reaeration (day^-1):	0.64
BOD Decay (day^-1):	0.36
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU	
Initial Mixed CBODU (mg/L):	1.5
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	1.5
4. INITIAL DISSOLVED OXYGEN DEFICIT	
Saturation Dissolved Oxygen (mg/L):	10.693
Initial Deficit (mg/L):	0.14
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	1.79
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	13.00
7. CRITICAL DO DEFICIT (mg/L):	0.46
8. CRITICAL DO CONCENTRATION (mg/L):	**10.2**

Table E-6. Calculation of AML for BOD_5 and Ammonia

Calculating Permit Limits Based on Wasteload Allocation

	Definition	Formula	BOD, lb/day	Ammonia, lb/day
Input				
MDL	Maximum Daily Limit	= Daily WLA	**25**	**8.4**
CV^1	Coefficient of Variation	= std. dev/mean	0.56	1.33
n	Number of samples per month		8	1
Variables				
σ	Standard Deviation	= sqrt{ln(CV^2+1)}	0.52	1.01
σ^2	Standard Deviation, squared	= ln(CV^2+1)	0.27	1.02
σ_n		= ln(CV/n+1)	0.20	1.01
σ^2_n		= ln(CV^2/n+1)	0.04	1.02
z (99th)	99th Percentile Occurrence		2.25	1.90
z (95th)	95th Percentile Occurrence		1.51	1.27
Output				
LTAc	Chronic Long-term average	MDL*exp($z_{99}\sigma$-0.5σ^2)	8.87	2.05
AML	Average Monthly Limit	LTAc*exp($z_{95}\sigma_n$-0.5σ_n^2)	**12**	**4.4**

Source: EPA Technical Support Document for Water Quality-based Toxics Control

Table E-7. Calculation of pH mixture – River Outfall

Calculation of pH of a Mixture of Two Flows

Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

INPUT		
	@ Acute Boundary	**@ Chronic Boundary**
1. Dilution Factor at Mixing Zone Boundary	49	378
2. Ambient/Upstream/Background Conditions		
Temperature, 10th percentile (deg C):	3.2	3.2
pH:	6.9	6.9
Alkalinity (mg CaCO3/L):	11.0	11.0
3. Effluent Characteristics		
Temperature[1], 10th percentile (deg C):	8.6	8.6
pH:	6.00	6.00
Alkalinity* (mg CaCO3/L):	200	200
OUTPUT		
1. Ionization Constants		
Upstream/Background pKa:	6.53	6.53
Effluent pKa:	6.48	6.48
2. Ionization Fractions		
Upstream/Background Ionization Fraction:	0.70	0.70
Effluent Ionization Fraction:	0.25	0.25
3. Total Inorganic Carbon		
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	16	16
Effluent Total Inorganic Carbon (mg CaCO3/L):	800	800
4. Condtions at Mixing Zone Boundary		
Temperature (deg C):	3.3	3.2
Alkalinity (mg CaCO3/L):	14.9	11.5
Total Inorganic Carbon (mg CaCO3/L):	31.8	17.8
pKa:	6.5	6.5
RESULTS		
pH at Mixing Zone Boundary:	**6.5**	**6.8**

**Alkalinity value is approximate based on typical wastewater treatment plant effluent: 50-200 (100 typical): http://www.cefns.nau.edu/Projects/WDP/resources/Characteristics.htm. Conservative value used.*

Table E-8. Freshwater Un-ionized Ammonia Criteria Calculation – River Outfall

Freshwater Un-ionized Ammonia Criteria Calculation

Based on Chapter 173-201A WAC, amended November 20, 2006

INPUT	
1. Receiving Water Temperature, 90th percentile (deg C):	12.2
2. Receiving Water pH:	7.4
3. Is salmonid habitat an existing or designated use?	Yes
4. Are non-salmonid early life stages present or absent?	Present
OUTPUT	
Ratio	20.202
FT	1.714
FPH	1.600
pKa	9.657
Unionized Fraction	0.006
Unionized ammonia NH3 criteria (mg/L as NH_3)	
Acute:	0.103
Chronic:	0.014
RESULTS	
Total ammonia nitrogen criteria (mg/L as N):	
Acute:	15.341
Chronic:	2.159

Table E-9. Freshwater Temperature Reasonable Potential Calculation – River Outfall

Freshwater Temperature Reasonable Potential and Limit Calculation

Based on WAC 173-201A-200(1)(c)(i)--(ii) and the Water Quality Program Guidance. All data inputs must meet WQ guidelines. The Water Quality temperature guidance document may be found at: https://fortress.wa.gov/ecy/publications/summarypages/0610100.html

	Core Summer Critera	Supplemental Criteria
INPUT	**May 16 -Sept 14**	**Sept 15-May 15**
1. Chronic Dilution Factor at Mixing Zone Boundary	378	378
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	21.2 °C	16.7 °C
3. 7DADMax Effluent Temperature (95th percentile)	25.2 °C	22.5 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	16.0 °C	13.0 °C
OUTPUT		
5. Temperature at Chronic Mixing Zone Boundary:	21.2 °C	16.7 °C
6. Incremental Temperature Increase or decrease:	0.0 °C	0.0 °C
7. Maximum Allowable Incremental Temperature Increase:	0.3 °C	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	21.5 °C	17.0 °C
A. If ambient temp is warmer than WQ criterion		
9. Does temp fall within this warmer temp range?	YES	YES
10. Temperature Limit if Required:	NO LIMIT	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 28/(T_{amb}+7) and within 0.3 °C of the criterion		
11. Does temp fall within this incremental temp. range?	---	---
12. Temp increase allowed at mixing zone boundary, if required:	---	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 28/(T_{amb}+7) of the criterion		
13. Does temp fall within this Incremental temp. range?	---	---
14. Temp increase allowed at mixing zone boundary, if required:	---	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))		
15. Does temp fall within this Incremental temp. range?	---	---
16. Temp increase allowed at mixing zone boundary, if required:	---	---
RESULTS		
17. Do any of the above cells show a temp increase?	**NO**	**NO**
18. Temperature Limit if Required?	**NO LIMIT**	**NO LIMIT**

Table E-10. Freshwater Temperature Reasonable Potential Calculation – Wetland Outfall

Reasonable Potential Calculation - Wetlands Discharge - Page 1

Facility	Carnation WWTP
Water Body Type	Freshwater
Rec. Water Hardness	108 mg/L*

Dilution Factors:	Acute	Chronic
Aquatic Life	1	1
Human Health Carcinogenic		1
Human Health Non-Carcinogenic		1

Pollutant, CAS No. & NPDES Application Ref. No.		AMMONIA, Criteria as Total NH3	ARSENIC (dissolved) 7440382 2M	ANTIMONY (INORGANIC) 744036 1M	CADMIUM - 7440439 4M Hardness dependent	CHROMIUM(TRI) -16065831 5M Hardness dependent	COPPER - 744058 6M Hardness dependent	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness	SILVER - 7740224 11M dependent on hardness.	ZINC- 7440666 13M hardness dependent
Effluent Data	# of Samples (n)	287	25	3	25	25	25	25	25	25	25	25
	Detected?	y	y	y	y	y	y	y	y	y	y	y
	Coeff of Variation (Cv)	1.33	0.1	0.6	0.3	0.1	0.2	0.2	0.2	0.4	0.1	0.1
	Effluent Concentration, ug/L (Max. or 95th Percentile)	900	1.222	0.5	0.0946	0.46	21.58	0.228	0.0008	2.13	0.05	73.24
	Calculated 50th percentile Effluent Conc. (when n>10)						17.7		0.0005	0.984		
Receiving Water Data	90th Percentile Conc., ug/L	30	0		0	0	0	0	0	0	0	0
	Geo Mean, ug/L			0			0		0	0		
Water Quality Criteria	Aquatic Life Criteria, ug/L Acute	15,341	360	-	4.0245	584.4	18.30	70.219	2.1	1511	3.9383	122.2
	Aquatic Life Criteria, ug/L Chronic	2,159	190	-	1.0914	189.6	12.12	2.7363	0.012	168	-	111.5
	WQ Criteria for Protection of Human Health, ug/L	-	-	14	-	-	1300	-	0.14	610	-	-
	Metal Criteria Translator, decimal Acute	-	1	-	0.943	-	1	0.466	0.85	0.998	0.85	1
	Metal Criteria Translator, decimal Chronic	-	1	-	0.943	-	1	0.466	-	0.997	-	1
	Carcinogen?	N	Y	N	N	N	N	N	N	N	N	N

Aquatic Life Reasonable Potential

Effluent percentile value		0.950	0.950		0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$	1.009	0.100		0.294	0.100	0.198	0.198	0.198	0.385	0.100	0.100
Pn	$Pn=(1\text{-confidence level})^{1/n}$	0.990	0.887		0.887	0.887	0.887	0.887	0.887	0.887	0.887	0.887
Multiplier		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max concentration (ug/L) at edge of…	Acute	900	1.222		0.089	0.460	21.6	0.106	0.001	2.126	0.043	73.2
	Chronic	900	1.222		0.089	0.460	21.6	0.106	0.001	2.124	0.050	73.2
Reasonable Potential? Limit Required?		**NO**	**NO**		**NO**	**NO**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.5545		0.198	0.198	0.3853
Pn	Pn=(1-confidence level)1/n	0.368		0.887	0.887	0.887
Multiplier		1.2049		0.7867	0.7867	0.6271
Dilution Factor		1		1	1	1
Max Conc. at edge of Chronic Zone, ug/L		0.6024		1.8E+01	0.0005	0.984
Reasonable Potential? Limit Required?		**NO**		**NO**	**NO**	**NO**

*Hardness value obtained from the *Carnation WWTP Facility Plan, Amendment 1* , dated April 2007 (Carollo Engineers).

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Appendix F - Effluent and Receiving Water Data

Table F-1. DMR Data – River outfall & Wetlands outfall

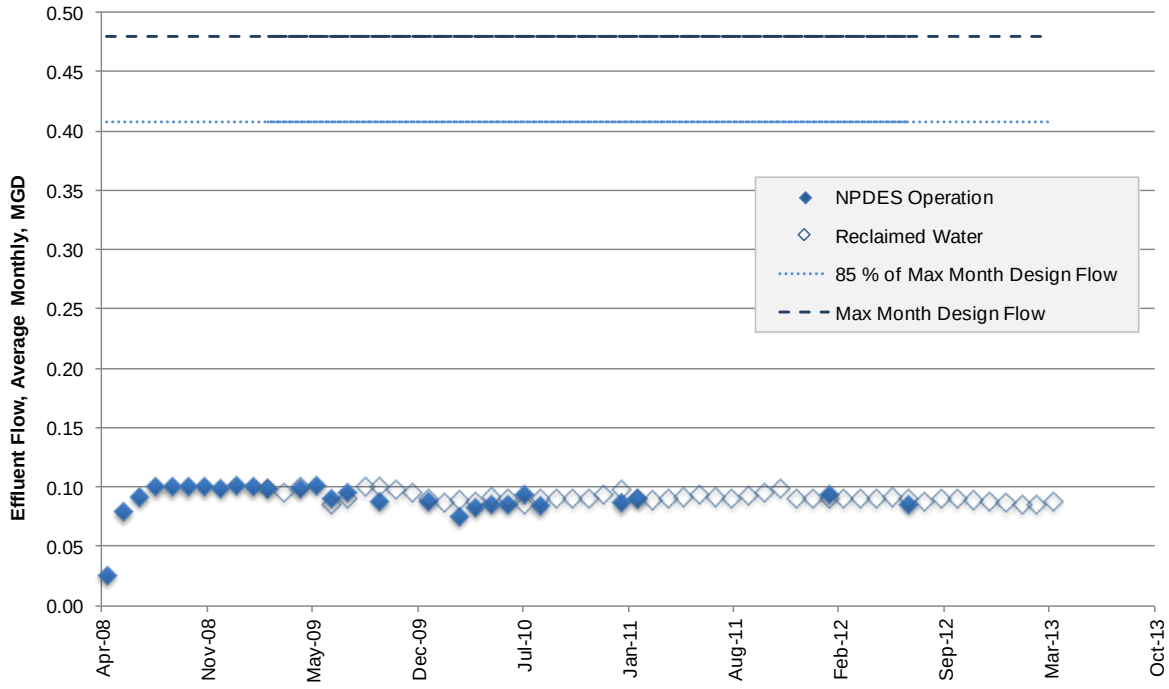
River Outfall	Influent										Effluent																												
	Flow, MGD	Flow, MGD	BOD, mg/L	BOD, mg/L	BOD, lbs/day	BOD, lbs/day	TSS, mg/L	TSS, mg/L	TSS, lbs/day	TSS, lbs/day	Flow, MGD	Flow, MGD	BOD, mg/L	BOD, mg/L	BOD, lbs/day	BOD, lbs/day	BOD, lbs/day - TMDL	BOD, % Removal	TSS, mg/L	TSS, mg/L	TSS, lbs/day	TSS, lbs/day	TSS, % Removal	PH	PH	Fecal Coliform, #/100 ml	Fecal Coliform, #/100 ml	Fecal Coliform, cfu/day	Fecal Coliform, cfu/day	Res. Chlorine, µg/L	Res. Chlorine, µg/L	Ammonia, mg/L	TKN, mg/L as N Nitrate+Nitrite, mg/L as N	Total Phos, mg/L as P	Temp, deg C			
	Ave	Max Day	Ave	Max Day	Ave	Max Day	Ave	Max Day	Ave	Max Day	Ave	Max Day	Mnth Ave	Wk Ave	Mnth Ave	Wkly Ave	Max Day	Ave	Mnth Ave	Wk Ave	Mnth Ave	Wk Ave	Ave	Min	Max	GEM	GM7	Ave	Max Day	Mnth Ave	Max Day	Max	Max	Max	Max			
1-May-08	0.03	0.06	213	431	59	93	176	556	48	131	0.03	0.07	13.9	25.0	6.3	12.9		92	2	2	0.8	1.1	100	5.7	7.3	0	0	0	0										
1-Jun-08	0.08	0.10	250	285	167	219	205	248	136	190	0.08	0.10	5.0	5.0	1.2	1.5		99	2	2	0.7	1.0	100	6.2	7.9	0	0	0	0	0.00	0.00							
1-Jul-08	0.09	0.11	265	307	204	243	254	356	195	285	0.09	0.11	5.0	7.0	2.4	4.7		99	2	4	1.5	3.0	99	7.0	7.6	0	0	0	0									23.2
1-Aug-08	0.10	0.14	283	370	241	341	238	352	200	269	0.10	0.12	5.0	5.0	4.2		5.1	98	2	3	1.8	2.2	99	6.8	7.5	0	0	0	0	0.00	0.00	0.08	1.2	7.1	5.8	23.7		
1-Sep-08	0.11	0.13	271	365	247	312	268	336	244	287	0.10	0.12	5.0	5.0	4.2		4.6	98	3	4	2.1	3.0	99	6.8	7.6	0	0	0	0			1.60	1.1	24	6.1	22.4		
1-Oct-08	0.11	0.13	337	387	302	360	283	396	253	379	0.10	0.12	5.0	5.0	4.0		4.3	99	2	3	1.6	2.3	99	7.0	7.6	0	0.3	0.3	0.3			0.05	1.2	28	7.0	20.9		
1-Nov-08	0.11	0.19	312	427	300	441	263	366	255	387	0.10	0.20	5.0	5.0	4.0	4.0		99	2	2	1.9	2.8	99	6.9	7.8	0	0	0	0									
1-Dec-08	0.11	0.13	346	468	308	429	272	366	242	344	0.10	0.12	5.0	5.0	3.9	3.9		99	2	2	1.6	1.6	99	6.6	7.8	0	0	0	0									
1-Jan-09	0.11	0.16	299	357	281	384	241	294	229	349	0.10	0.15	5.0	5.0	4.3	4.2		99	2	2	1.7	2.1	99	7.1	7.7	0	0											
1-Feb-09	0.11	0.13	321	405	296	367	244	280	226	276	0.10	0.12	5.0	5.0	4.2	4.2		99	2	2	1.8	2.0	99	6.6	7.8	0	0											
1-Mar-09	0.11	0.12	312	331	254	295	229	280	216	249	0.10	0.12	5.0	5.0	3.9	4.0		99	2	2	1.6	1.5	99	6.8	7.6	0	0	0	0									
1-May-09	0.11	0.12	359	417	320	383	296	338	263	302	0.10	0.12	5.0	5.0	4.1	4.3		99	2	2	1.7	1.8	99	7.1	8.3	0	0	0	0	0.10	0.20							
1-Jun-09	0.11	0.13	287	382	270	428	278	340	259	321	0.10	0.12	5.0	5.0	4.3	4.6		98	2	2	1.7	1.8	99	7.1	7.8	0	0	0	0									
1-Jul-09	0.11	0.15	312	526	277	493	272	312	263	271	0.09	0.13	8.7	34.2	5.0	16		99	2	2	1.3	1.3	100	7.0	8.4	0	0	0	0	0.12	0.56							25.5
1-Aug-09	0.12	0.13	211	211	196	196	187	250	173	230	0.10	0.11	5.0	5.0	3.4		3.4	99	2	2	1.5		99	7.1	7.4	0	0	0	0	0.01	0.01	0.01	1.3	13	5.1	26.0		
1-Oct-09	0.11	0.11	278	278	258	258	260	260	241	241	0.09	0.09	5.0	5.0	3.7		3.7	98	2	2	1.5	1.5	99	7.4	7.5	0	0	0	0			NR	NR	NR	NR	18.3		
1-Jan-10	0.11	0.11	323	323	282	282	298	298	261	261	0.09	0.09	5.0	5.0	3.7	3.7		98	2	2	1.5	1.5	99	7.2	7.4	0	0	0	0									
1-Mar-10	0.10	0.10	226	226	192	192	248	248	211	211	0.08	0.08	5.0	5.0	3.2	3.2		98	2	2	1.3	1.3	99	7.0	7.3	0	0	0	0									
1-Apr-10	0.10	0.10	344	344	293	293	238	238	203	203	0.08	0.08	5.0	5.0	3.5	3.5		98	2	2	1.4	1.4	99	7.0	7.3	0	0	0	0									
1-May-10	0.11	0.11	291	310	256	295	234	270	207	258	0.09	0.09	5.0	5.0	3.5	3.7		99	2	2	1.4	1.4	99	6.8	7.3	0	0	0	0									
1-Jun-10	0.10	0.11	335	424	288	372	320	534	276	469	0.09	0.09	5.0	5.0	3.5	3.6		99	2	2	1.5	1.6	99	6.9	7.2	0	0	0	0									
1-Jul-10	0.11	0.12	318	318	281	281	288	288	254	254	0.09	0.11	5.0	5.0	3.6	3.5		99	2	2	1.4	1.4	99	6.9	7.2	0	0	0	0									23.1
1-Aug-10	0.10	0.11	278	278	236	236	326	326	276	276	0.08	0.09	5.0	5.0	3.5		3.5	99	2	2	1.4	1.4	99	6.9	7.3	0	0	0	0			0.20	1.7	1.6	5.3	23.3		
1-Jan-11	0.10	0.11	266	266	206	206	214	214	257	257	0.09	0.09	5.0	5.0	3.6	3.6		98	2	2	1.4	1.4	100	6.6	7.0	0	0	0	0									
1-Feb-11	0.10	0.10	375	386	303	306	265	284	215	239	0.09	0.09	5.0	5.0	3.8	3.8		99	2	2	1.5	1.5	99	6.8	7.6	0	0	0	0									
1-Feb-12	0.10	0.10	338	339	279	280	277	296	229	244	0.09	0.10	1.5	1.5	1.2	1.5		100	2	2	1.6	1.6	99	6.8	7.1	0	0	0	0									
1-Jul-12	0.10	0.10	161	161	133	133	242	242	200	200	0.09	0.09	1.0	1.0	0.7	0.7		100	2	2	1.4	1.4	99	6.7	7.1	0	0	0	0									22.0
AVE:	0.10	0.12	293	345	249	301	256	317	223	273	0.09	0.11	5	7	3.6	4.5	4.1	98	2	2	1.5	1.7	99	6.8	7.5	0	0	0	0	0.04	0.15	0.39	1	15	5.86	22.8		
MIN:	0.03	0.06	161	161	59	93	176	214	48	131	0.03	0.07	1	1	0.7	0.7	3.4	92	2	2	0.7	1.0	99	5.7	7.0	0	0	0	0	0.00	0.00	0.01	1	2	5.10	18.3		
MAX:	0.12	0.19	375	526	320	493	326	556	276	469	0.10	0.20	14	34	6.3	16.3	5.1	100	3	4	2.1	3.0	100	7.4	8.4	0	0.3	0.3	0.3	0.12	0.56	1.60	2	28	7.00	26.0		
5%:																								6.3														
95%:																									8.2														
85%	0.41			1,419				1,419																														
Low Flow Limits (Aug-Oct):	0.48			1,669				1,669					30	45	12.5		25	85	30	45	120	180	85	6.0	9.0	200	400	1.55E+09	3.1E+09	500	750							
High Flow Limits (Nov-July):	0.48			1,669				1,669					30	45	120	180		85	30	45	120	180	85	6.0	9.0	200	400			500	750							

Wetland Outfall	Influent										Effluent																													
	Flow, MGD	Flow, MGD	BOD, mg/L	BOD, mg/L	BOD, lbs/day	BOD, lbs/day	TSS, mg/L	TSS, mg/L	TSS, lbs/day	TSS, lbs/day	Flow, MGD	Flow, MGD	BOD, mg/L	BOD, mg/L	BOD, lbs/day	BOD, lbs/day	BOD, lbs/day - TMDL	TSS, mg/L	TSS, mg/L	PH	PH	Total Coliform, #/100 ml	Total Coliform, #/100 ml	Turbidity, NTU	Turbidity, NTU	Res. Chlorine, µg/L	Res. Chlorine, µg/L	Ammonia, mg/L	Ammonia, lbs/day	Total Nitrogen, mg/L as N	Total Nitrogen, mg/L as N	Total Phos, mg/L as P	Total Phos, mg/L as P	DO, mg/L	DO, mg/L	Temp, deg C	UV Dosage, mJ/cm2
		Max		Max		Max		Max		Max		Max	Mnth	Wk	Mnth	Wkly	Max	Mnth	Wk			7-day		Mnth		Mnth	Max		Mnth									
	Ave	Day	Ave	Day	Ave	Day	Ave	Day	Ave	Day	Ave	Day	Ave	Ave	Ave	Ave	Day	Ave	Ave	Min	Max	Median	Max	Ave	Max	Ave	Day	Max	Ave	Ave	Max	Ave	Max	Ave	Min	Max	Min
1-Mar-09	0.11	0.12	324	375	288	325	254	318	225	286	0.10	0.12	5.0	5.0	4.0	4.0		2	2	7.0	7.6	0	0	0.05	0.10			0.00	0.00	25	26	4.5	4.6	9.1	8.3			185
1-Apr-09	0.10	0.11	357	468	307	424	291	340	250	273	0.10	0.11	5.0	5.0	4.0	4.2		2	2	7.0	7.8	0	0	0.07	0.13					23	25	4.8	5.2	8.7	8.1			189
1-May-09	0.11	0.12	363	383	342	350	276	318	258	277	0.10	0.11	5.0	5.0	4.4	4.3		2	2	7.1	7.7	0	0	0.04	0.08					22	23	5.6	5.9	8.4	8.0			162
1-Jul-09	0.11	0.12	314	380	282	349	337	548	303	503	0.09	0.10	5.0	5.0	3.5	3.6		2	2	7.1	7.5	0	0	0.08	0.14	4.10	8.00			15	16	5.1	5.4	7.5	7.3	22.6		101
1-Aug-09	0.11	0.13	272	340	250	319	245	288	226	271	0.09	0.12	5.0	5.0	3.7	3.8		2	2	6.8	7.4	0	0	0.08	0.15	3.20	6.00	0.07	0.03	17	19	4.5	5.1	7.2	6.9	24.5		83
1-Sep-09	0.11	0.14	238	323	222	311	243	300	228	295	0.10	0.11	5.0	5.0	3.9	4.2		2	2	6.9	7.4	0	0.7	0.07	0.16			0.05	0.02	15	18	5.0	5.4	7.3	6.6	23.1		81
1-Oct-09	0.12	0.13	240	318	231	305	241	306	232	301	0.10	0.12	5.0	5.0	3.9	4.0		2	2	6.9	7.6	0	0	0.07	0.15			0.29	0.08	13	21	5.2	6.2	S	S	20.3		97
1-Nov-09	0.12	0.13	237	318	230	299	239	278	231	281	0.10	0.11	5.0	5.0				2	2	6.9	7.4	0	0	0.07	0.13					14	18	5.1	6.2	8.2	7.6			106
1-Dec-09	0.11	0.12	265	333	244	298	251	364	235	368	0.10	0.11	5.0	5.0				2	2	6.8	7.4	0	0	0.06	0.13					23	31	4.8	5.2	8.9	8.3			101
1-Jan-10	0.11	0.12	257	352	223	312	260	318	226	274	0.09	0.10	5.0	5.0				2	2	6.8	7.4	0	0	0.07	0.15					20	30	5.1	6	8.6	7.6			103
1-Feb-10	0.11	0.12	279	372	241	330	279	380	241	337	0.09	0.10	5.0	5.0				2	2	7.0	7.4	0	0	0.05	0.22					12	16	5.1	5.4	8.6	8.1			99
1-Mar-10	0.11	0.12	259	379	223	333	260	294	224	261	0.09	0.11	5.0	5.0				2	2	7.0	7.6	0	0	0.07	0.49					13	15	5	5.5	8.4	7.8			99
1-Apr-10	0.11	0.12	248	311	217	279	254	304	222	274	0.09	0.11	5.0	5.0				2	2	6.9	7.3	0	0.3	0.06	0.28					16	22	4.5	5.2	8.2	7.2			63
1-May-10	0.11	0.12	319	339	281	304	251	290	221	262	0.09	0.11	5.0	5.0				2	2	6.0	7.3	0	0.3	0.06	0.33					7	14	4.3	4.8	7.7	7.5			92
1-Jun-10	0.11	0.13	283	321	244	271	278	322	240	277	0.09	0.11	5.0	5.0				2	2	6.9	7.3	0	0	0.06	0.39					7.6	12	5.2	6.1	7.1	6.4			81
1-Jul-10	0.11	0.11	295	409	254	341	268	376	230	314	0.09	0.10	5.0	5.0				2	2	6.9	7.3	0	0	0.07	0.34					4.8	5.2	5.2	5.7	7.0	6.1	23.0		91
1-Aug-10	0.11	0.12	291	333	254	292	268	326	235	276	0.09	0.10	5.0	5.0	3.6	3.7		2	2	6.8	7.3	0	0.3	0.08	0.42			0.90	0.29	4.8	6.1	5.8	6.7	6.3	4.4	24.1		92
1-Sep-10	0.11	0.13	285	332	254	311	291	334	260	343	0.09	0.11	5.0	5.0	3.8	3.9		3	4	6.7	7.1	0	0	0.06	0.29			0.15	0.09	13	17	6.1	7.3	6.9	6.4	22.2		83
1-Oct-10	0.10	0.15	285	319	231	345	248	290	200	272	0.09	0.14	5.0	5.0	3.8	4.3		2	2	6.5	8.0	0	0.3	0.04	0.40			0.09	0.09	18	25	5.0	5.5	6.9	3.8	21.0		84
1-Nov-10	0.09	0.11	320	450	249	338	278	372	217	293	0.09	0.11	5.0	5.0				2	2	6.6	7.0	0	0.3	0.08	0.49					20	23	3.9	4.7	8.0	6.8			76
1-Dec-10	0.10	0.13	300	403	243	319	233	464	189	368	0.09	0.12	5.0	5.0				2	2	6.6	7.1	0	0.3	0.05	0.42					12	14	2.5	3.1	8.4	7.9			101
1-Jan-11	0.10	0.13	282	314	242	318	237	286	203	303	0.10	0.13	5.0	5.0				2	2	6.6	7.0	0	0	0.07	0.46					14	17	2.6	3.4	7.9	6.0			110
1-Feb-11	0.10	0.12	310	366	242	290	237	272	185	209	0.09	0.12	5.0	5.0				2	2	6.6	7.0	0	0.3	0.11	0.44					16	23	2.9	3	8.0	6.3			67
1-Mar-11	0.10	0.11	308	414	243	328	269	376	211	282	0.09	0.10	5.0	5.0				2	2	6.1	7.1	0	0.3	0.10	0.73					14	19	3.1	3.3	7.6	6.3			93
1-Apr-11	0.10	0.11	320	632	258	548	263	330	210	269	0.09	0.10	5.0	5.0				2	2	6.6	7.3	0	0	0.08	0.46					8.9	12	3.4	3.5	7.1	5.4			117
1-May-11	0.10	0.12	306	379	254	310	264	304	220	267	0.09	0.11	5.0	5.0				2	2	6.9	7.2	0	1	0.13	0.40					4.9	6.3	3.5	4.1	5.5	2.9			124
1-Jun-11	0.10	0.11	314	407	265	333	298	446	252	409	0.09	0.11	5.0	5.0				2	2	6.9	7.3	0	0	0.13	0.45					4.4	5.5	3.6	4.2	5.1	4.0			95
1-Jul-11	0.10	0.11	300	377	243	296	282	440	231	345	0.09	0.11	5.0	5.0				2	3	6.8	7.3	0	0	0.10	0.45					7.1	11	4	4.5	5.9	5.2	21.8		89
1-Aug-11	0.09	0.11	323	381	262	327	348	514	282	407	0.09	0.10	5.0	5.0	3.7		3.9	2	2	6.7	7.7	0	0.7	0.08	0.45			0.55	0.38	7	8.4	4.4	4.5	6.5	6.0	23.9		98
1-Sep-11	0.10	0.12	342	457	290	401	361	552	308	502	0.09	0.11	1.2	1.6	0.9		1.3	2	2	6.8	7.3	0	0.3	0.06	0.42			1.00	0.68	6.3	9.9	4.9	5.4	7.0	6.1	22.9		8
1-Oct-11	0.10	0.12	321	463	276	429	364	504	314	413	0.10	0.12	2.1	5.0	1.6		3.8	2	2	6.5	7.3	0	0.3	0.07	0.46			0.54	0.27	13	14	4.3	4.5	7.2	6.5	20.9		80
1-Nov-11	0.10	0.12	286	331	244	295	263	340	225	285	0.10	0.12	1.4	2.1				2	2	6.8	7.2	0	0	0.07	0.43									6.7	5.7			89
1-Dec-11	0.10	0.11	320	394	243	342	261	316	198	274	0.09	0.11	1.3	1.5				2	2	6.9	7.2	0	0	0.07	0.47					4.9	6	3.4	3.6	7.2	5.5			80
1-Jan-12	0.10	0.12	343	429	284	382	280	324	233	305	0.09	0.12	1.4	1.5				2	2	6.8	7.1	0	0	0.08	0.42					7.2	10	3.7	4	7.4	5.3			107
1-Feb-12	0.10	0.11	340	403	272	338	304	382	242	290	0.09	0.10	1.2	1.5				2	2	6.7	7.1	0	0	0.09	0.42					16	25	3.7	3.8	8.6	6.8			90
1-Mar-12	0.09	0.11	361	456	288	411	296	350	236	285	0.09	0.11	1.2	1.4				2	2	6.7	7.3	0	0	0.07	0.48					28	29	3.7	4	9.3	8.7			92
1-Apr-12	0.09	0.11	358	508	281	398	270	352	211	273	0.09	0.11	1.6	1.4				2	3	6.7	7.1	0	0	0.07	0.42					27	31	4.1	4.4	9.1	8.5			80
1-May-12	0.10	0.11	340	587	274	455	252	332	204	279	0.09	0.14	1.2	2.8				2	2	6.1	7.2	0	0	0.08	0.48					22	25	4.5	5.1	8.3	6.5			80
1-Jun-12	0.10	0.10	299	379	237	310	232	312	185	255	0.09	0.10	1.2	1.4				2	2	6.6	7.2	0	0	0.08	0.41					22	26	4.6	5.2	8.3	7.7			82
1-Jul-12	0.09	0.10	308	600	244	455	257	342	202	260	0.09	0.10	1.1	1.3				2	2	6.4	7.8	0	0	0.10	0.45					10	19	4.7	5.1	7.3	5.3	22.7		82
1-Aug-12	0.09	0.12	314	370	244	334	282	338	219	282	0.09	0.10	1.3	2.6	0.9		2.0	2	3	6.4	8.0	0	0	0.09	0.49			0.16	0.10	5.7	7.5	5.3	5.5	7.1	5.2	24.2		80
1-Sep-12	0.09	0.11	275	368	221	299	279	516	223	405	0.09	0.11	1.1	1.4	0.8		1.1	2	4	6.8	7.7	0	0	0.07	0.43			0.09	0.08	8	11	4.7	5.2	7.5	7.1	23.3		81
1-Oct-12	0.09	0.10	291	386	228	315	252	302	198	247	0.09	0.11	1.4	4.8	1.0		3.6	2	3	7.0	7.5	0	0	0.08	0.43			0.26	0.17	9.3	14	4.6	5	7.7	7.2	21.2		80
1-Nov-12	0.09	0.10	351	614	272	451	340	974	262	715	0.09	0.11	1.1	1.1				2	2	6.5	7.6	0	0	0.07	0.41					7	11	4.2	4.6	7.3	5.5			80
1-Dec-12	0.09	0.10	339	430	262	349	286	434	222	351	0.09	0.10	1.1	1.3				2	2	6.7	7.3	0	0	0.07	0.39					9.2	15	3.8	4.2	7.7	7.2			83
1-Jan-13	0.09	0.11	326	465	254	388	271	464	211	387	0.09	0.11	1.1	1.2				2	3	6.7	7.2	0	0	0.08	0.27					13	17	4.2	4.3	8.2	7.1			80
1-Feb-13	0.09	0.10	330	377	247	289	289	370	216	284	0.09	0.10	1.4	1.7				2	3	6.9	7.4	0	0	0.08	0.33					8.4	13	4.4	5.5	7.4	5.8			82
1-Mar-13	0.09	0.10	312	426	227	327	262	474	196	364	0.09	0.10	2.3	2.8				2	2	6.9	7.3	0	0	0.07	0.42					9.7	19	4.4	5.1	7.4	6.7			80
1-Apr-13	0.09	0.11	354	471	273	393	278	318	212	252	0.09	0.11	1.5	3.2				2	2	6.6	7.3	0	0	0.09	0.42					19.5	26	4.8	5.6	8.0	7.1			88
AVE:	0.10	0.12	306	403	255	344	274	375	229	318	0.09	0.11	4	4	3.0	4.0	2.6	2	2	6.7	7.4	0.0	0.1	0.08	0.36	3.65	7.00	0.32	0.18	13.3	17.2	4.41	4.91	7.61	6.55	22.6		93
MIN:	0.09	0.10	237	311	217	271	232	272	185	209	0.09	0.10	1	1	0.8	3.6	1.1	2	2	6.0	7.0	0.0	0.0	0.04	0.08	3.20	6.00	0.00	0.00	4.4	5.2	2.50	3.00	5.08	2.90	20.3		8
MAX:	0.12	0.15	363	632	342	548	364	974	314	715	0.10	0.14	5	5	4.4	4.3	3.9	3	4	7.1	8.0	0.0	1.0	0.13	0.73	4.10	8.00	1.00	0.68	27.9	31.0	6.10	7.30	9.30	8.70	24.5		189
5%:																				6.2																		
95%:																					7.8																		
Limits:	0.48				1,669				1,669				20	30	**12.5**		**25**	20	30	6.0	9.0	2.2	23	0.2	0.5	6.90	18.1		**4.2**									

*Reclaimed water BOD and Ammonia mass limits apply August through October.

exceeds permit limits

Figure F-1. Effluent flow and pH (source: KC discharge monitoring report)



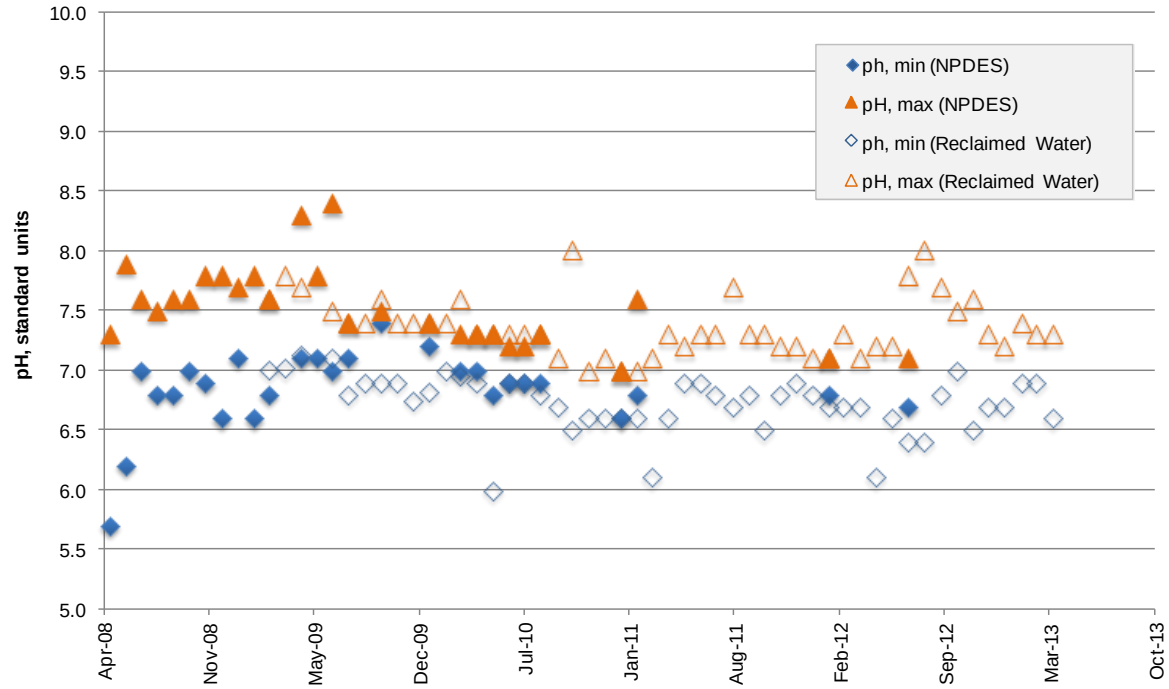
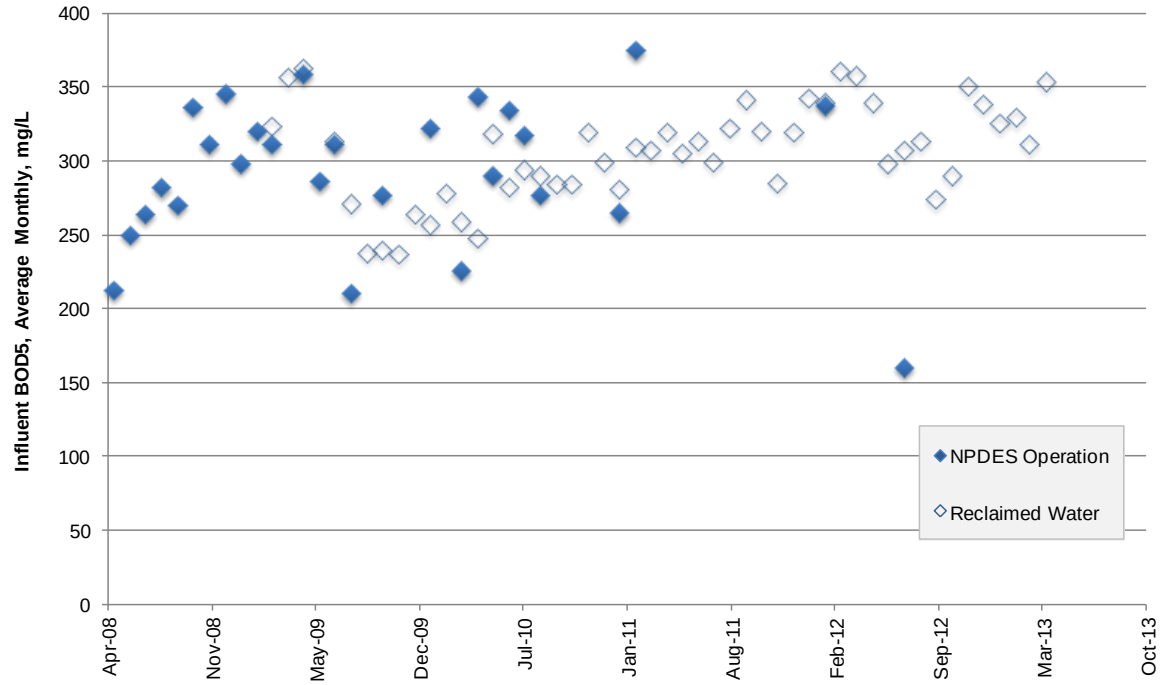


Figure F-2. Influent BOD_5 (source: KC discharge monitoring report)



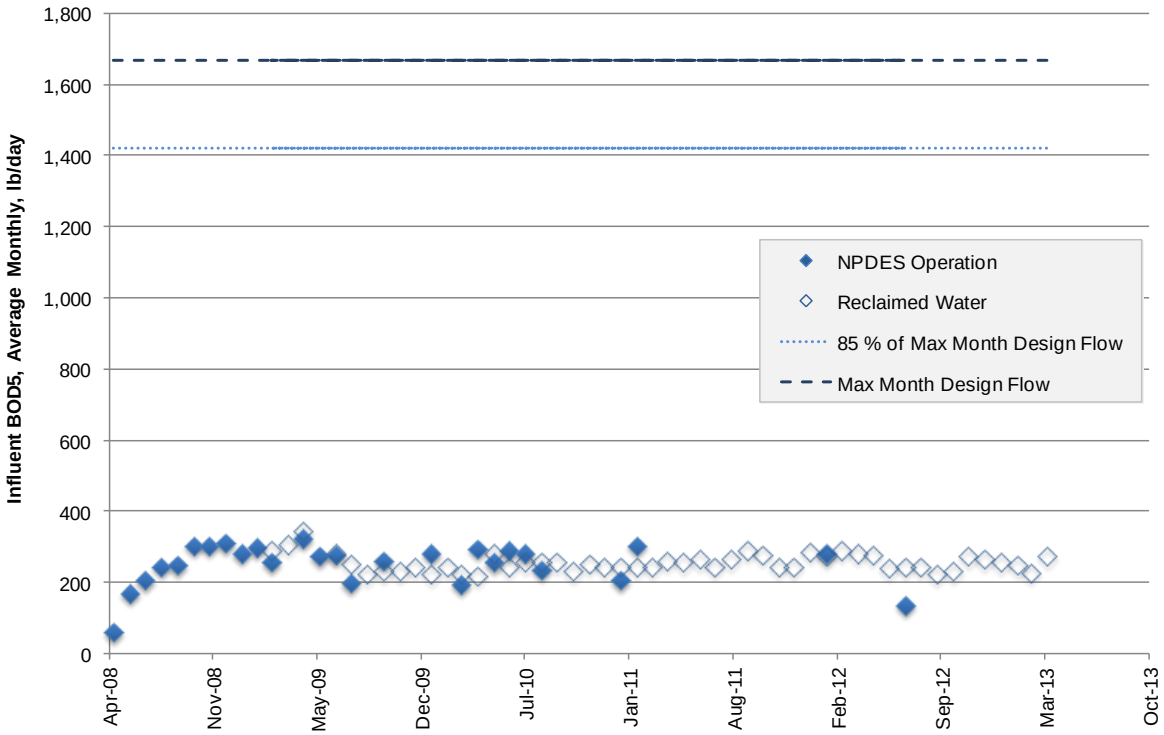


Figure F-3. Influent TSS (source: KC discharge monitoring report)

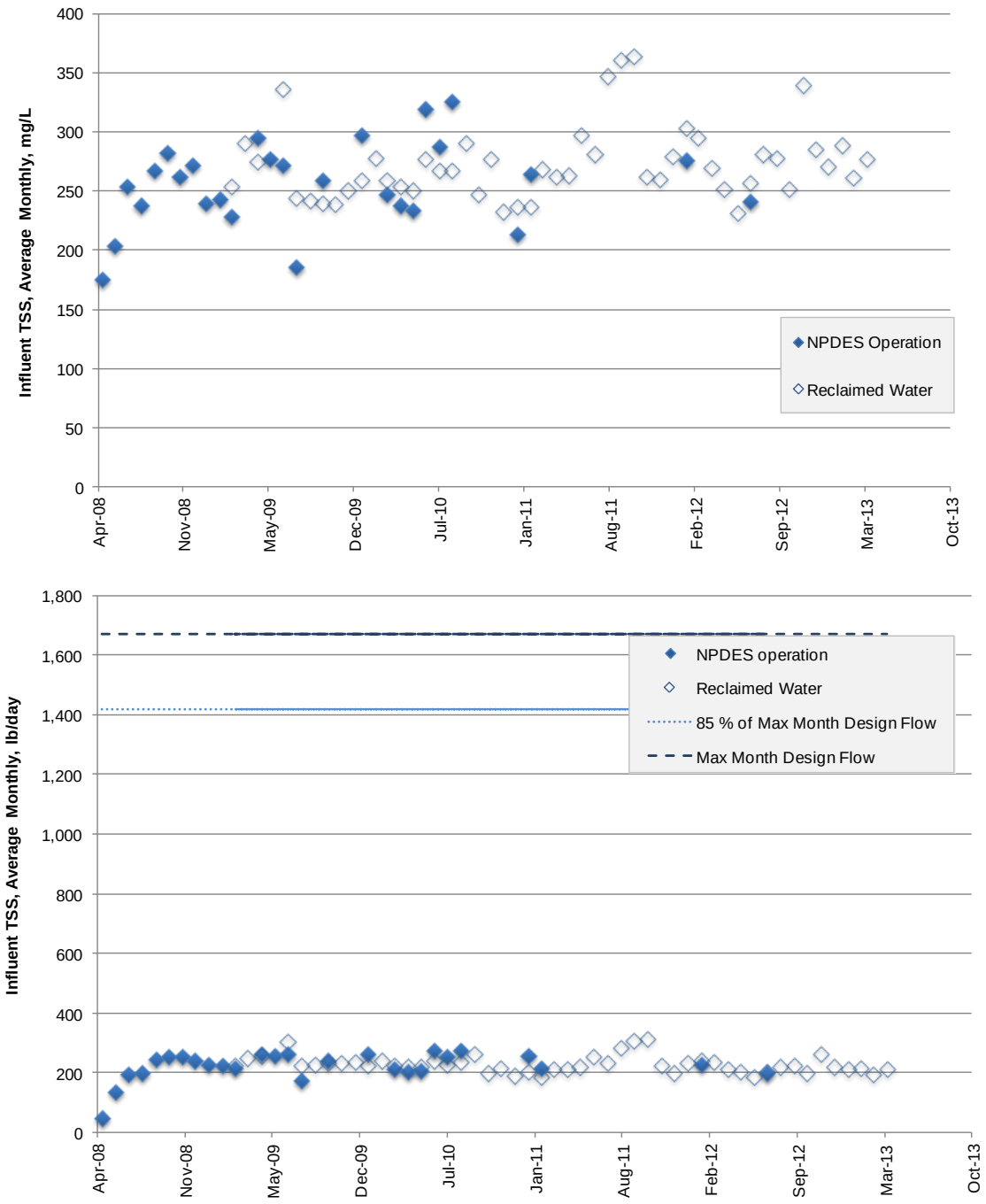
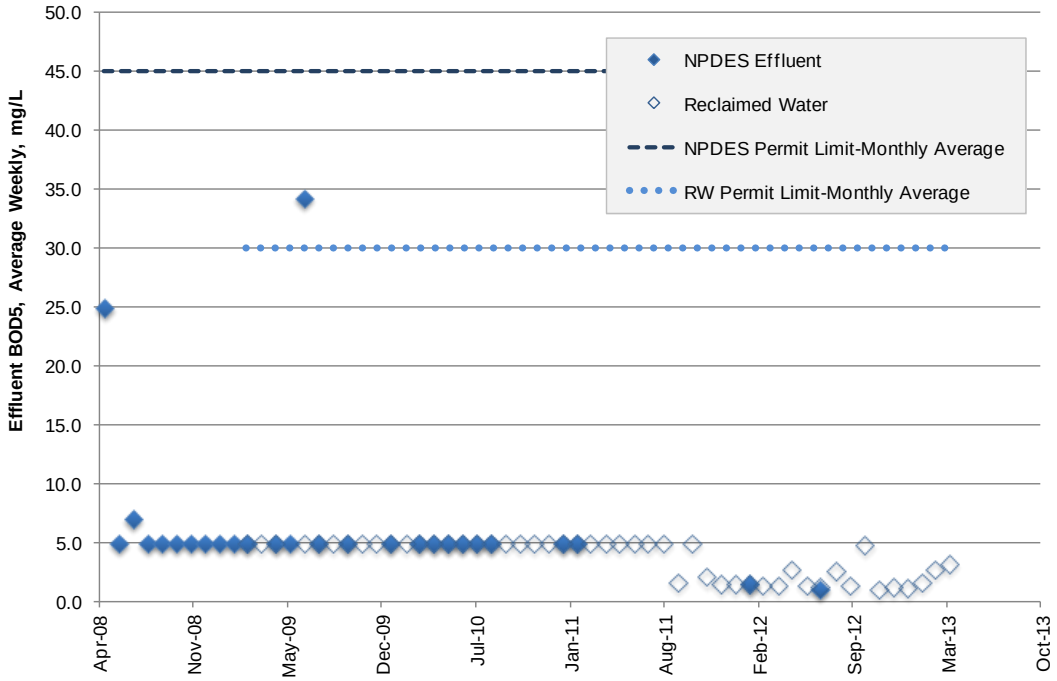


Figure F-4. Effluent BOD_5 (source: KC discharge monitoring report)



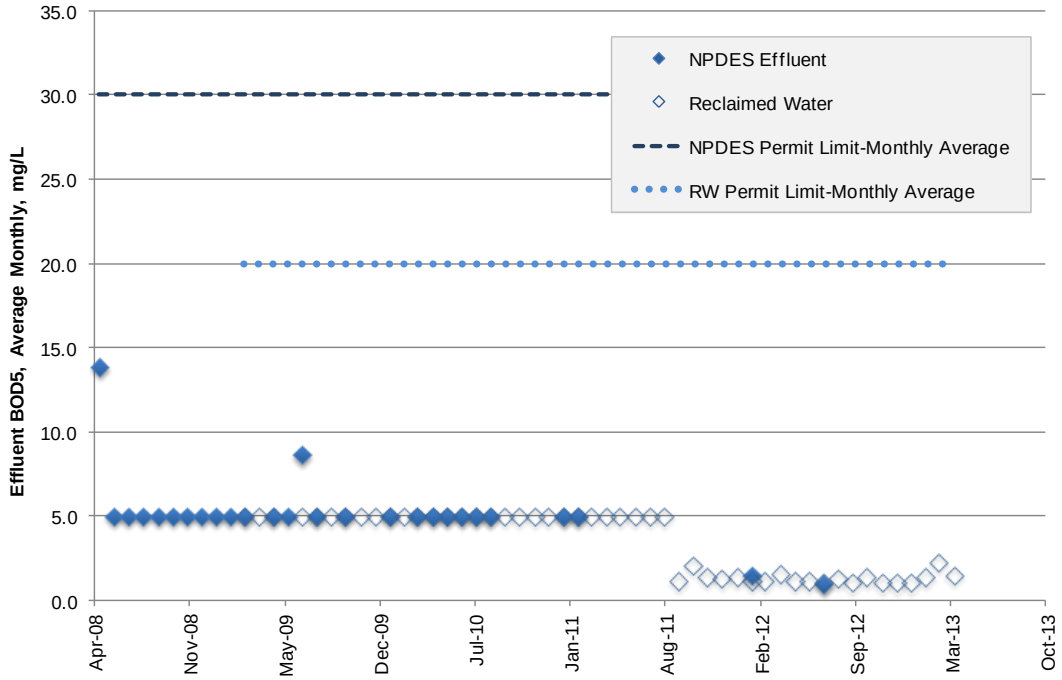


Figure F-5. Effluent TSS (source: KC discharge monitoring report)

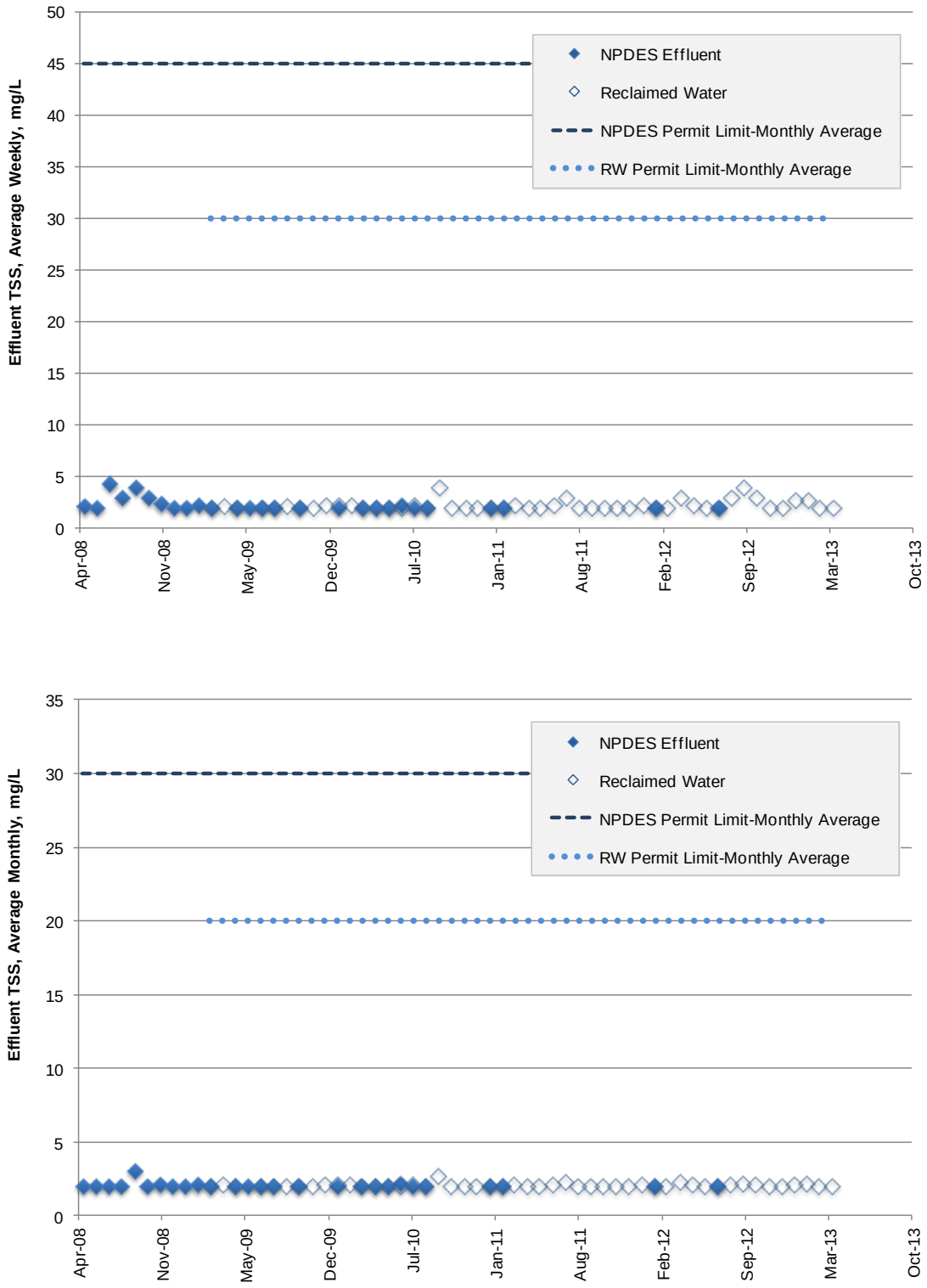
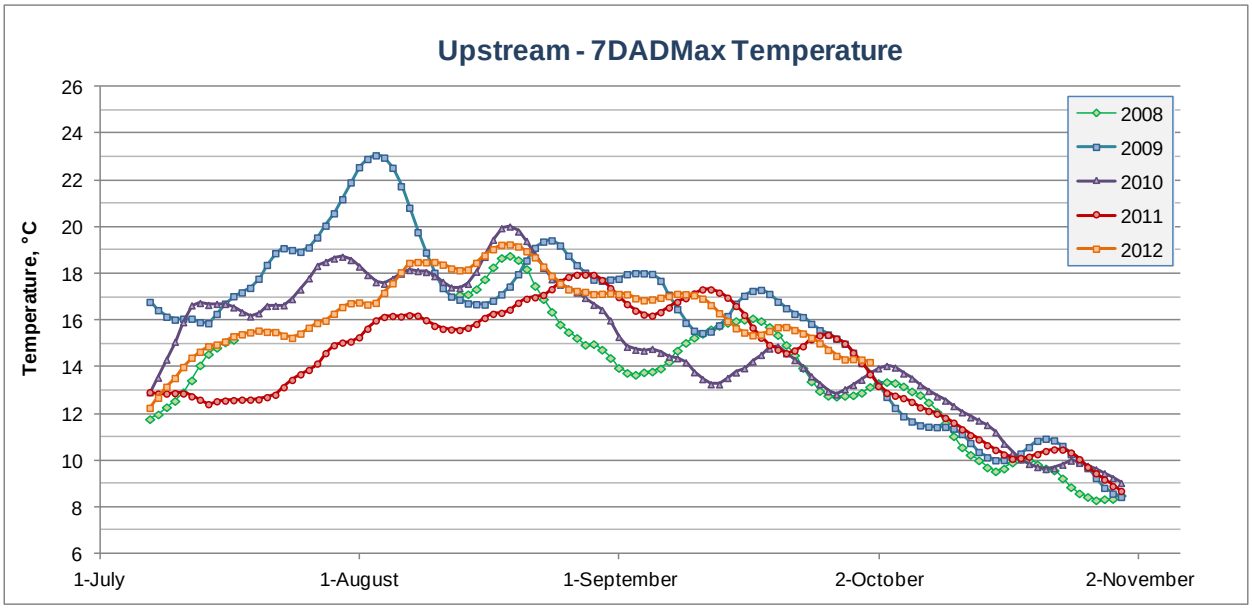


Figure F-6. Temperature Data - Receiving Water and Effluent (source: KC permit application)



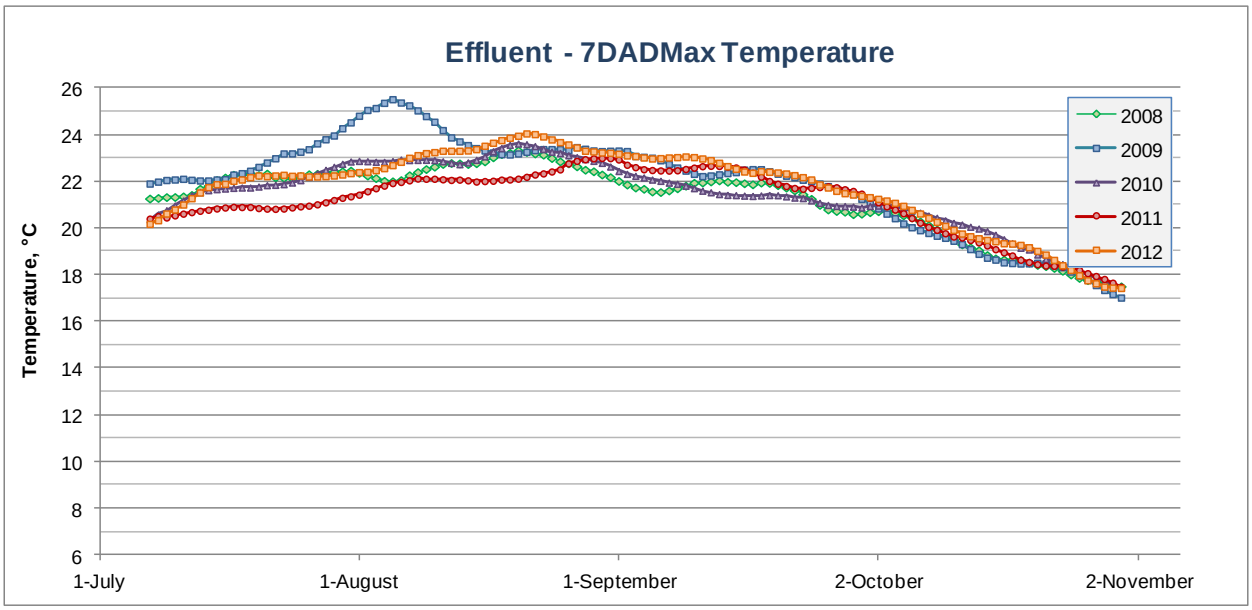


Table F-2. Whole Effluent Toxicity Testing Results

Acute Results

Date Collected	Start Date	Organism	Endpoint	NOEC	LOEC	PMSD	%Survival
8/12/2009	8/12/2009	*Daphnia pulex*	48-hour Survival	100	> 100	5.0%	100%
8/17/2009	8/17/2009	fathead minnow	96-hour Survival	100	> 100	4.6%	100%
9/8/2010	9/8/2010	*Daphnia pulex*	48-hour Survival	100	> 100	5.0%	100%
9/13/2010	9/13/2010	fathead minnow	96-hour Survival	100	> 100	10.9%	95%
7/13/2011	7/13/2011	*Daphnia pulex*	48-hour Survival	100	> 100	16.6%	100%
7/18/2011	7/18/2011	fathead minnow	96-hour Survival	100	> 100	13.1%	95%
8/8/2012	8/8/2012	*Daphnia pulex*	48-hour Survival	100	> 100	5.0%	100%
8/13/2012	8/13/2012	fathead minnow	96-hour Survival	100	> 100	10.7%	98%

Chronic Results

Date Collected	Start Date	Organism	Endpoint	NOEC	LOEC	PMSD
8/12/2009	8/12/2009	fathead minnow	7-day Survival	100	> 100	2.5%
			Biomass	100	> 100	13.2%
			Weight	100	> 100	13.2%
9/9/2009	9/9/2009	*Ceriodaphnia dubia*	7-day Survival	100	> 100	
			Reproduction	100	> 100	29.3%
9/8/2010	9/8/2010	fathead minnow	7-day Survival	100	> 100	2.5%
			Biomass	100	> 100	11.3%
			Weight	100	> 100	11.3%
9/29/2010	9/29/2010	*Ceriodaphnia dubia*	7-day Survival	100	> 100	
			Reproduction	100	> 100	13.2%
7/13/2011	7/13/2011	*Ceriodaphnia dubia*	7-day Survival	100	> 100	
			Reproduction	100	> 100	22.6%
7/13/2011	7/13/2011	fathead minnow	7-day Survival	100	> 100	4.9%
			Biomass	100	> 100	14.2%
			Weight	100	> 100	14.0%
8/8/2012	8/8/2012	fathead minnow	7-day Survival	100	> 100	2.5%
			Biomass	100	> 100	11.1%
			Weight	100	> 100	11.1%
9/12/2012	9/12/2012	*Ceriodaphnia dubia*	7-day Survival	100	> 100	
			Reproduction	50	100	31.5%

Carnation - Chinook Bend Wetlands Loadings

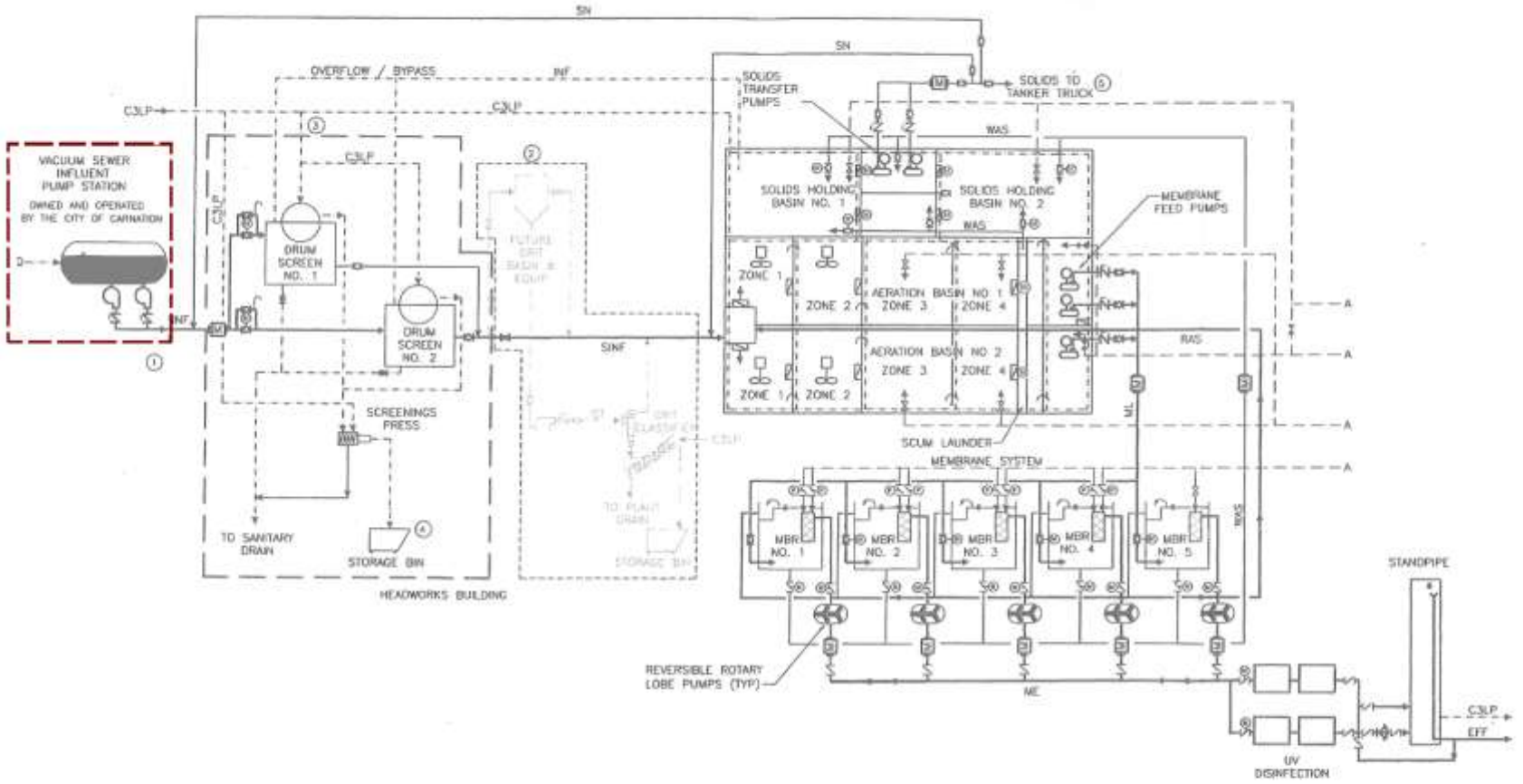
Facility Data[1]	Carnation WWTF	1997 Reuse Wetland Stds	Proposed RW Rule
Effluent P Conc, Annual Average[2], mg/L	5	1	1
Effluent TKN Conc, Annual Average[2], mg/L	2	3	3
Effluent TN Conc, Annual Average[2], mg/L	19.4	n/a	n/a
Effluent BOD5 Conc, Annual Average, mg/L	4	20	20
Effluent TSS Conc, Annual Average, mg/L	4	20	20
Effluent Flow, MGD	0.1		
Wetlands area, acre	4		

Loading Calcs	Carnation WWTF	1997 Reuse Wetland Stds	Proposed RW Rule
Wetland P Load, kg/day/hectare	1.2	0.2	none
Wetland TN Load, kg/day/hectare	4.5	1.2	none
Wetland BOD Load, kg/day/hectare	0.9	5	none
Wetland TSS Load, kg/day/hectare	0.9	9	none
Wetlands hydraulic loading, cm/day	2.3	5	3
Wetlands hydraulic loading, ft3/s	0.15	none	none

[1] *data source: DMR data, 2009-2013*

[2] *maximum average annual on record based on nutrient data from KC.*

Appendix G - WWTF Schematic



Appendix H - Response to Comments

King County Review Comments:

No.	Permit or Fact Sheet	Section, Paragraph No.	Page	Comment	Reviewer	Response
1	Permit	S1.A. Effluent Limits table 1	5	The pH section does not include any provision for a short duration of excursion above or below the max or min values listed. In past NPDES permit there was a provision, listed in a footnote for the pH limit, which stated "Indicates the range of permitted values. When ph is continuously monitored, excursions between 5.0 and 6.0, or 9.0 and 10.0 shall not be considered violations provided no single excursions exceeds 60 minutes in length and the total excursions do not exceed 7 hours and 30 minutes per month. Any excursions below 5.0 and above 10.0 are violations. The instantaneous maximum and minimum pH shall be reported monthly." We request that some type of excursion exemption, for cause, be included in the permit for pH.	Betsy Cooper	40 CFR 401.17(a) supports pH excursions when pH is monitored continuously. Additionally, EPA published a 1980 guidance document called "*Background Document for Modification of pH Effluent LImitations Guidelines and Standards for Point Sources Required by NPDES Permit to Monitor Continuously Effluent pH* ", which allows for pH excursions when monitoring continuously, citing EPA's requirement for compliance 99% of the time (1% =7 hrs 12 min each month); each excursion cannot last longer than 30 minutes. However, since the Carnation facility met the pH permit limits without incident during the current permit cycle, Ecology feels allowing for these excursions would be backsliding and therefore cannot allow them in the permit.
2	Permit	S1.A. Effluent Limits	5	The last paragraph discusses the TMDL requirements listed in Table 2 of the 1994 TMDL. Is this the most recent TMDL document? The 2008 document does not list such requirements.	Betsy Cooper	Ecology produced the *2008 TMDL Effectiveness Study* to document the water quality changes that have occurred in the Snoqualmie River since the issuance of the 1994 TMDL. The 2008 document recommends keeping the 1994 TMDL allocations in place for WWTPs.
3	Permit	S1.2.A Monitoring schedule - river outfall	6	For clarity we suggest modifying the first sentence to add "… with methods specified in..." after "Table 3". Appendix A discusses methodology, not monitoring requirements.	Betsy Cooper	Clarification added to Tables 3 and 6.
4	Permit	S2.3 Monitoring Schedule Table 3	7	Final Effluent Temperature monitoring requirement in 2016 - can you explain why the full year of data is needed? Is their a specific season you are interested in rather than the full year? Also why was 2016 chosen? Also would the data be collected in DMRs or in a separate annual report or single report at the end of the permit cycle with the permit renewal? If it stays in the DMR do we report the average or maximum reading for each day?	Betsy Cooper/Rick Butler/Pete Carter	This section of the Snoq River has additional Supplemental Spawning and Incubation Protection for Salmonid Species (13°C) from Sept. 15-May 15: (https://fortress.wa.gov/ecy/publications/publications/0610038.pdf). Effluent and receiving water temperatures were well characterized during the current permit term for July-Oct, not so much for Nov-May. One year of data was proposed to provide the information needed to assess compliance with the supplemental criteria. Ecology decreased the monitoring window to Aug 2014 through May 2015 since this will provide sufficient data to assess compliance.KC will enter max daily temperatures for each day on monthly DMRs.
5	Permit	S2.3 Monitoring Schedule Table 3 footnote g	7	Since chlorine is use for membrane cleaning purposes please consider revising this footnote to read "When not using chlorine *for disinfection or effluent pipe disinfection* …"	Betsy Cooper	Clarification added to Tables 3 and 6.
6	Permit	S2.A. Table 3	7	A 24-hour Composite is listed as the Sample Type for Phosphorus, ortho-, as P. This is a parameter that must be filtered (o.45µ pore-size) within 15 minutes of collection. Although the final effluent has in effect been filtered by the membrane bioreactor (nominal pore size of 0.1 µ), we do not have data to demonstrate that filtration taking place over a 24-hour period prior to preservation yields an uncompromised sample. We therefore request the Sample Type be changed to Grab for this parameter.	Lab/ Katherine Bourbonais	Sample types for ortho-P changed from 24-hour composite to Grab in Table 3.
7	Permit	S2.A. Table 3	7	A 24-hour Composite is listed as the Sample Type for Oil and Grease. This is a parameter that should be collected as a Grab or series of Grab samples. We therefore request the Sample Type be changed to Grab for this parameter.	Lab/ Katherine Bourbonais	Sample types for Oil & Grease changed from 24-hour composite to Grab in Table 3.
8	Permit	S2.B. Sampling and analytical procedures	8	This section contains a new requirement for representative sampling during "…maintenance-related conditions that may affect effluent quality." What does Ecology consider such maintenance related events?	Betsy Cooper	This requirement applies to any plant maintenance that has the potential to affect effluent quality (perhaps, but not necessarily: tank cleaning, membrane flushing, UV maintenance, …). This is standard language not necessarily written for Carnation and may be more applicable to facilitties that sample less frequently. However, Ecology feels it still applies and the language will remain.

No.	Permit or Fact Sheet	Section, Paragraph No.	Page	Comment	Reviewer	Response
9	Permit	S2.C. 3.	8	Can we use manufacturer's recommendation instead of weekly? (Most of our instruments are calibrated bi-weekly.)	Carter. Peter	Weekly calibration requirement removed. S2.C.2 requires calibration according to the manufacture's recommendation and industry standard.
10	Permit	S2.D.	9	Should Turbidimeters be added to the list of parameters exempted from this requirement	Carter. Peter	Turbidity added to list of parameters that do not require accreditation.
11	Permit	S3.E. 2.b Reporting Permit violations	11	b.4. - As mentioned earlier - if a pH limit is a short term excursion for cause why would that need to be called in rather than discussed in the monthly DMR?	Betsy Cooper	King County is ok with language as is with added pH excursion language.
12	Permit	S3.E. 2.c Reporting Permit violations	12	#5 should only be required if applicable to the particular incident on which we would be reporting.	Betsy Cooper	#5 refers to noncompliance prior to the treatment works. Since KC does not own and operate any equipment prior to the treatment works (operated by the City of Carnation), Ecology removed this requirement.
13	permit	S3.E. 2 e Reporting Permit violations	12	Here too, we suggest that 'if applicable' should be added in the second sentence after "…subpart c, above'…" since there would be times when not all components of subpart c would be relevant.	Betsy Cooper	No changes made.
14	Permit	S4.D.1.b Notification of new or altered sources	14	The City of Carnation has the General Sewer Plan for this area, not King County. Therefore KC would not be in a position to approved plans and specs. We suggest this section be removed from the KC permit.	Betsy Cooper	Ecology understands that the General Sewer Plan development falls under the City's pervue and not the County's, and therefore removed the requirement for general sewer plans updates.
15	Permit	S5C. Short term Reduction	15	We would like to discuss what Ecology considers Non-critical period water quality periods. Does the definition of these periods differ for RW maintenance operations?	Betsy Cooper	Ecology and King County discussed this issue, no changes were made.
16	Permit	S5.E. Prevent connection of inflow	15	This section is not applicable to KC because we do not have control over the sewers or sewer ordinance therefore we suggest it be deleted.	Betsy Cooper	Ecology understands that the collection system O&M falls under the City's pervue and not the County's, and therefore removed the requirement for prevention of inflow.
17	Permit	S5.F.2.b Bypass Procedures	16	Last bullet in b. has a duplicated portion - so suggest deleting "or preventative maintenance, or transport of untreated wastewater to another treatment facility." which comes after *Transport of untreated wastes to another treatment facility*	Betsy Cooper/ Pete Carter	Thanks, typo corrected.
18	Permit	S5.G.a.1 Operations and maintenance Manuals	17	a.1 includes requirement for O&M manual has to be updated when new equipment is installed - This does not mean ANY new equipment, but rather some equipment change that requires new procedures? Just concerned about triggering a manual revision when no substantive change has occurred.	Betsy Cooper	Changed update requirement to when 'significant' new equipment is installed.
19	Permit	S5.G.b.1 Operations and maintenance Manuals	17	b - discusses components of a manual. Since we have an existing approved manual must this section remain in our permit?	Betsy Cooper	Ecology and King County discussed this issue, and it is understood that these O&M manual requirements are in addition to those requirements listed in WAC 173-250-080, and should be added to the manual when any future modifications are made. KC has an approved O&M manual now, no changes are expected in the near future. No changes were made to the permit.
20	Permit	S6.A	18	Update language using the sections developed for West Point and South Plant permits. This is to make consistent with new KC code and recent streamlining amendments to federal regulations.	IW / Despina Strong	Language updated to be consistent with Brightwater permit.
21	Permit	S6.A.j. pretreatment - general requirements	18	j. discusses the need for binding agreement to implement the pretreatment program. We have such agreement in our contracts with the City of Carnation therefore, was has been done in this permit in the past and all our other permits we request you remove the last sentence in this section that requires an MOU be created.	Betsy Cooper	Language updated to be consistent with Brightwater permit.
22	Permit	R1. Table 4	21	Can we get some permissible time period for short pH excursions due to instrument issues (similar to turbidity and request above)?	Carter. Peter	See response to Question 1.

No.	Permit or Fact Sheet	Section, Paragraph No.	Page	Comment	Reviewer	Response
23	Permit	R5.C. Net Environmental Benefit Report	26	NEB – WTD would like a better description of the scope and geographic area to which the study applies. What criteria would Ecology use to assess the NEB approval, and what, if anything, would trigger the need for phosphorus removal at the treatment plant? Can Ecology provide an example of a NEB study already done? Please clarify what "full and uninterrupted protection of all significant beneficial uses that existed in the wetlands prior to the use of reclaimed water" means. Please clarify what Ecology means by "biological criteria.	Westbrook/Hirschey /Kaufman-Una	Ecology provided clarification in the permit that this study is to be conducted on the areas of the wetlands 'impacted by the reclaimed water'.The NEB study is required by the 1997 reclaimed water standards (and the proposed RW Rule) in response to the discharge of elevated phosphorus levels to the wetlands. Ecology will futher assess compliance at the next permit issuance. Phosphorus removal will likely not be required. If euthrophication occurs in the wetlands the first approach will likely be to discharge the reclaimed water to the river throughout the growing season, however this will be assessed as needed.
24	Permit	R5.D. Reclaimed Water Nutrient Analysis	26	Reclaimed water nutrient analysis: WTD's current model does not provide a daily loading by season. The model we are using, we developed from literature and other sources. Please explain why the level of modeling now is not sufficient and why we need to do seasonal average daily loadings. Please clarify what "calculation of loading to the Snoqualmie River" means? We currently provide loading estimates but do not include the long channel to the river. Is there a critical season? We are concerned that a requirement to assess loading to the Snoqualmie might create an obligation for the County to take care of the entire wetland, when WTD is only one of many discharges to the wetland. WTD is not responsible now for the quality in the wetland or the flow to the river. Please provide feedback on the existing reporting we have done.	Westbrook/Hirschey /Kaufman-Una	Current model is ok. Wording was revised to reflect this and to clarify that King County is responsible only for the reclaimed water portion of the wetlands water.
25	Permit	Reclaimed water right articulated in the permit or fact sheet		Combined permit -With the combined of the RW and NPDES Discharge permit, we request that the permit contain language to memorialize the reclaimed water right similar to other reclaimed water permits. The County would like to document a volume used to satisfy or ameliorate the original quantification of impairment to the State's instream flow right in the permit or fact sheet. The County desires that reclaimed water generated beyond that amount be available for other permitted uses. Can we explore the opportunity to use reclaimed water at the plant for outside irrigation instead of buying City potable water and to demonstrate the use as an education tool ?	Westbrook/Hirschey /Kaufman-Una	Provided additional language in fact sheet discussing King County's plans to submit a letter to Ecology's Water Resource Section requesting a baseline flow be established and commemorated.
26	Permit	Appendix A	34	Please change the Quantitation Level (QL) for Total Ammonia (as N) to 0.3 mg/L	Lab/ Katherine Bourbonais	Ecology made change as requested. A QL of 0.3 mg/L is sufficient for wastewater effluent analysis.
27	Permit	Appendix A	34	Please change the Detection Level (DL) and QL for Soluble Reactive Phosphorus (as P) to 100 for both entries.	Lab/ Katherine Bourbonais	Ecology made change as requested. A QL of 0.1 mg/L is sufficient for wastewater effluent analysis.
28	Permit	Appendix A	34	Please change the DL and QL for Phosphorus, Total (as P) to 100 for both entries.	Lab/ Katherine Bourbonais	Ecology made change as requested. A QL of 0.1 mg/L is sufficient for wastewater effluent analysis.
29	Permit	Appendix A	34	Our current quantification levels for BOD and TSS are 1 mg/L and 2mg/L respectively. As they are lower than the ones listed in the appendix this shouldn't be an issue, but do we need to note it somewhere?	Carter. Peter	No need to note it detection limits if they are lower than those in Appendix A.
30	Permit	Appendix A	34	Total Nitrogen and Total Dissolved Solids are not listed in Appendix A and yet are listed elsewhere in the permit. Total Nitrogen is listed in Table 3 on page 7 and in Table 6 on page 23. Total Dissolved Solids is listed in Table 3 on page 7.	Lab/ Katherine Bourbonais	Changes made.
31	Permit	WQWebDMR		I don't see columns for total coliform, average turbidity or maximum turbidity. Also should there be a column that identifies whether we are discharging to the wetland or the river?	Carter. Peter	See second worksheet for the reclaimed water DMR.
32	fact sheet	H. Groundwater	15	Could we revise the description of the discharge to the wetland as "adjacent to the wetland" since the application point is not actually in the wetland?	Betsy Cooper	Language left as is.
33	factsheet	I. Summary of complaince	15	We would like to confirm whether the Late DMRS listed were truly late.	Betsy Cooper	Changed DMR submittal dates and compliance based on postmark dates submitted by KC on 11/5/13.
34	factsheet	2nd and 3rd paragraph	26	These appear to be duplicates from previous pages.	Betsy Cooper	Duplicate language removed.

30-day Public Notice of Draft Review

Ecology received no comments from the public during the 30-day public notice of draft period. However, Ecology revised Section II.G of the fact sheet to provide updated information on the water rights impairment conditions for the facility.