Fact Sheet for NPDES Permit WA0000825
Inland Empire Paper Company

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 Inland Empire Paper Company.

This fact sheet complies with WAC 173-220-060, 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 30 days before issuing the final permit. Copies of the fact sheet and draft permit for Inland Empire Paper Company, NPDES permit WA0000825, are available for public review and comment from March 4, 2022 until April 18, 2022. For more details on preparing and filing comments about these documents, please see **Appendix A - Public Involvement Information**.

Inland Empire Paper Company reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, 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 F** - **Response to Comments**, and publish it when issuing the final NPDES permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

Summary

Inland Empire Paper Company (IEP) owns and operates a pulp and newsprint mill located in Millwood, Spokane County, Washington. The facility produces pulp by the groundwood thermo-mechanical pulp (TMP) process and the deink process using recycled newspapers, magazines, office paper, and other paper stock. The facility discharges treated process wastewater and non-contact cooling water to the Spokane River.

The permit extends the compliance schedule for meeting the final water quality-based effluent limits (WQBELs) for total phosphorus and carbonaceous biochemical oxygen demand ($CBOD_5$) from the Spokane River and Lake Spokane . Although the company has installed its next level of treatment consisting of ultra filtration membranes, the effluent data demonstrates that the Permittee will exceed the final WQBELs for total phosphorus and $CBOD_5$. The extended compliance schedule requires the preparation of an engineering report, a revised timeline to meet these WQBELs, and sets interim effluent limitations. The proposed permit also includes a water quality-based limit for polychlorinated biphenyls (PCBs), and the preparation and implementation of a Pollutant Minimization Plan (PMP) for PCBs.

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I. Introduction

The Federal Clean Water Act (CWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the 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 RCW (Revised Code of Washington).

- The following regulations apply to industrial NPDES permits:
- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC)
- Water quality criteria for ground waters (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 industrial 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 performance requirements imposed by the permit.

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 30-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 comment(s). Ecology will summarize the responses to comments and any changes to the permit in **Appendix F**.

II. Background Information

Table 1: Facility Information

Applicant	Inland Empire Paper Company
Facility Name and Address	Inland Empire Paper Company
Contact at Facility	Doug Krapas, Environmental Manager (509) 924-1911
Responsible Official	Kevin Rasler, President and General Manager 3320 N. Argonne Road, Spokane, WA 99212 (509) 924-1911 FAX #: (509) 927-8461
Industry Type	Pulp and Paper Mill
Categorical Industry	40 CFR Part 430, The Pulp, Paper, and Paperboard Point Source Category
Type of Treatment	Primary Clarification, Biological Treatment, Secondary Clarification, Membrane Filtration
SIC Codes	2611
NAIC Codes	322122
Facility Location (NAD83/WGS84 reference datum)	Latitude: 47.686635207364638 Longitude: -117.28164536807787
Discharge Waterbody Name and Location (NAD83/WGS84 reference datum)	Spokane River Latitude: 47.6891052410492 Longitude: -117.279231379965

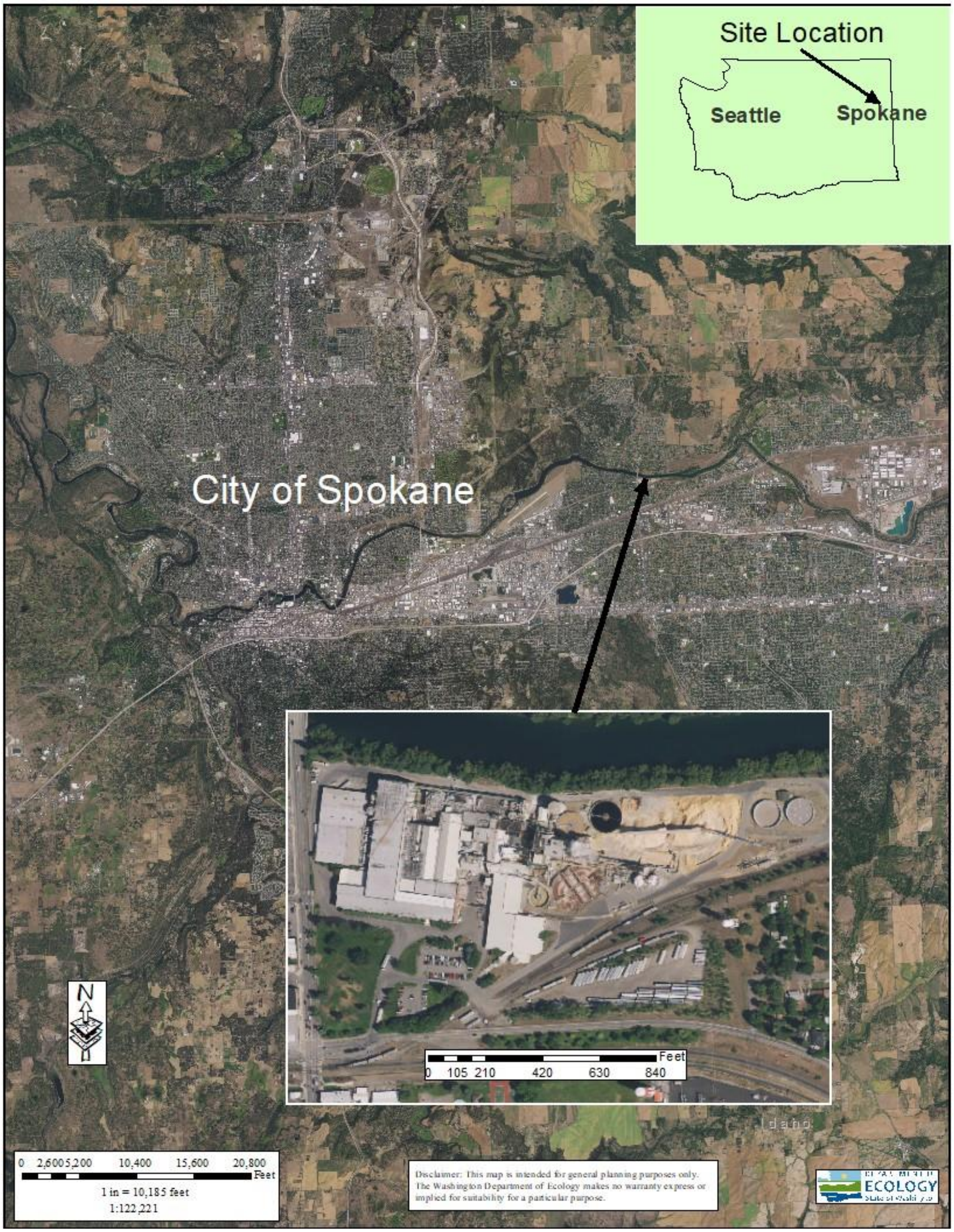
Table 2: Permit Status

Renewal Date of Previous Permit	November 1, 2011
Application for Permit Renewal Submittal Date	March 1, 2021
Date of Ecology Acceptance of Application	March 19, 2021

Table 3: Inspection Status

Date of Last Non-sampling Inspection Date	June 18, 2018

Figure 1: Facility Location Map



A. Facility description

History

The Permittee (IEP) owns and operates a pulp and newsprint mill located in Millwood, six miles east of Spokane (see Figure 1). The facility has been in operation since 1911. The facility produces pulp by the groundwood-thermo-mechanical pulp (TMP) process and the deink process using recycled newspapers, magazines, office paper, and other paper stock. IEP installed the newspaper recycle plant in 1991 with an original capacity of 120 tons per day (TPD). Current capacity of the newspaper recycle plant is 335 TPD. The company installed a new state-of-the-art TMP system with a capacity of 475 TPD of pulp in December 2009. The current average production capacity of IEP's paper machine is about 525 TPD.

Cooling Water Intakes

CWA § 316(b) requires the location, design, construction, and capacity of cooling water intake structures that reflect the best technology available for minimizing adverse environmental impact. Since July 2013, Ecology has required a supplemental application for all applicants using EPA Form 2-C. IEP does not have a cooling water intake associated with the facility.

Industrial Processes

IEP manufactures newsprint and specialty paper products from the groundwood-thermo-mechanical pulp (TMP) processing of raw wood chips and the deink processing of recycled newspapers, magazine, and office paper. IEP has also maintained older groundwood-refiner-mechanical pump (RMP) process equipment for potential expanded production. Typically, finished product contains 70 percent TMP pulp and 30 percent recycle content.

Wastewater Treatment processes

IEP has implemented numerous water conservation, reclamation, and reuse projects over the past several years that have resulted in an average process wastewater flow of about 3.0 million gallons per day (mgd) of process wastewater. Additionally, the facility discharges about 3.6 mgd of non-contact cooling water from equipment cooling to the launder ring of their secondary clarifier.

IEP's wastewater treatment system (WWTS) consists of flow and load equalization, super oxygenation, primary solids settling, activated sludge treatment, moving bed biofilm reactors, secondary solids settling, membrane filtration, and sludge dewatering.

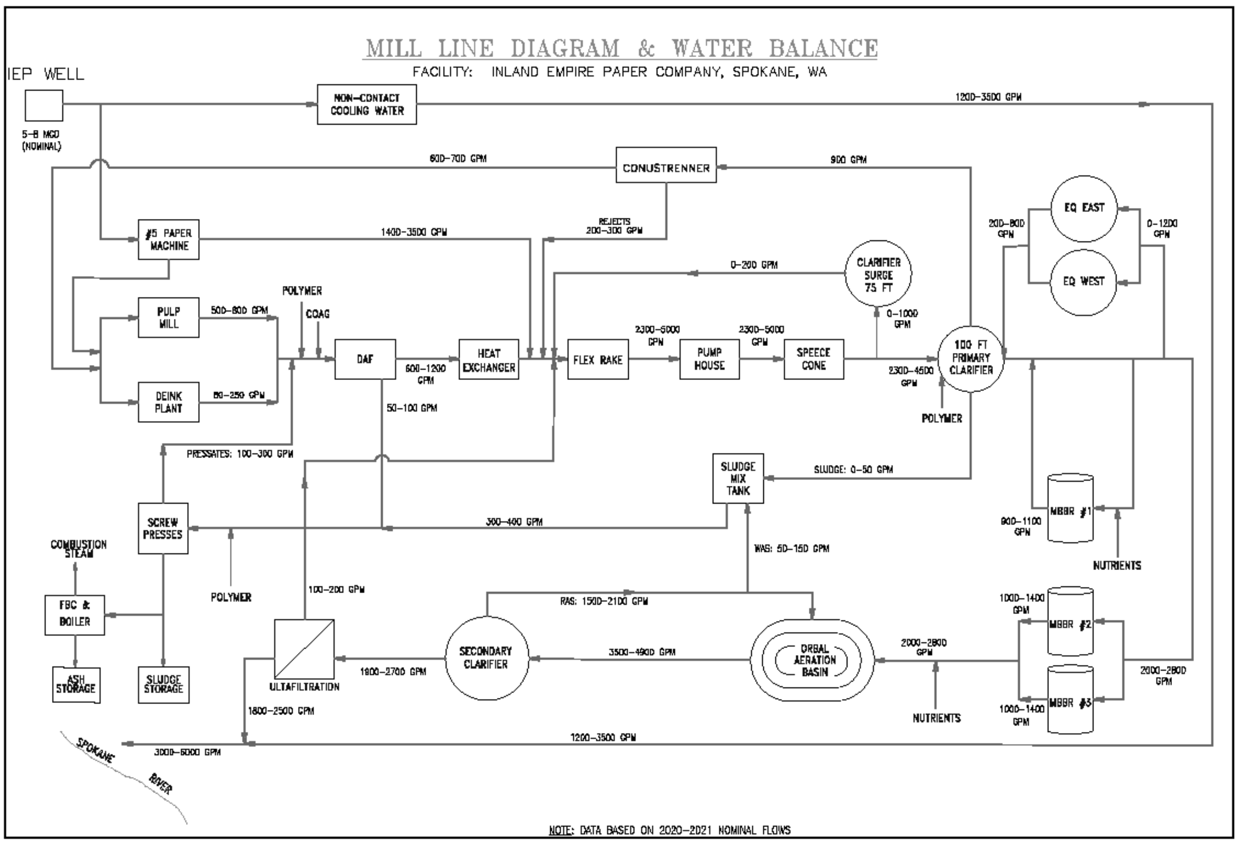
All process waters flow to a main sump where pumps transfer the wastewater to a Speece Cone system. The Speece Cone system super-oxygenates the water to approximately 50-60 mg/L of oxygen to mitigate odor and begin BOD_5 removal. The super-oxygenated water then enters the Primary Clarifier for solids settling. IEP diverts both high flow surges and anticipated heavy BOD_5 loadings to a 75-foot clarifier used as surge control. Once mill production returns to normal conditions, water in the 75-foot clarifier is metered back into the head works of the treatment system.

Primary clarifier effluent is split with a portion of wastewater flow sent to a Connustrenner with the remainder sent to dual equalization (EQ) tanks. The Connustrenner system recovers about 1.6 mgd of water for reuse within the mill. The dual equalization (EQ) tanks minimize hydraulic flow and BOD_5 load swings to the biological treatment processes. The EQ tanks deliver a set flow rate of effluent to three moving bed biofilm reactors (MBBRs) to begin the secondary biological treatment process. Following the MBBRs, the wastewater gravity flows into the Orbal oxidation ditch, into the secondary clarifier, then through the ultrafiltration (UF) membrane system. UF membrane reject is sent to the treatment system headworks while permeate mixes with non-contact cooling water (NCCW) prior to discharge to the Spokane River.

Fresh Water Sources

IEP obtains its supply water from an onsite groundwater production well.

Figure 2: Wastewater Treatment Process



Solid wastes

Solids withdrawn from the primary clarifiers, dissolved air floatation (DAF) system, and secondary clarifier are combined, thickened, and then dewatered. IEP uses the dewatered sludge as feed for a fluidized bed combustor that produces steam for use in the process. Ash can be beneficially reused as a cement additive or an agricultural soil amendment.

Discharge Outfall 001

IEP discharges treated effluent through Outfall 001 to the Spokane River through an 18-inch diameter, 70-foot outfall line with a 32-foot attached diffuser. The diffuser has nine openings consisting of eight ports, four feet apart, on 90 degree risers facing downstream with an open ended pipe at the end of the diffuser. The effluent line is oriented about 10 degrees downstream as measured from perpendicular to the shoreline.

The facility has two internal outfalls consisting of treated process wastewater (Outfall 003) and non-contact cooling water (Outfall 004).

B. Description of the receiving water

The Spokane River basin encompasses over 6,000 square miles in Idaho and Washington. The headwaters begin at the outlet of Lake Coeur d'Alene in Idaho. The river flows west 112 river miles to the Columbia River in Washington. It flows through the cities of Post Falls and Coeur d'Alene in Idaho, and through the large urban areas of City of Spokane Valley and City of Spokane in Washington.

The flow regime for the Spokane River is dictated largely by freezing temperatures in the winter followed by spring and early summer snowmelt. The annual harmonic mean flow is approximately 2,154 cubic feet per second (cfs) as the river crosses the Idaho border. Flow increases to 2,896 cfs downstream of Spokane as an overall net influx of groundwater through this reach.

In Idaho, other point source outfalls to the Spokane River include the City of Coeur d'Alene, Hayden Area Regional Sewer Board POTW, and the City of Post Falls POTW. In Washington, points sources include Liberty Lake Sewer & Water District and Kaiser Aluminum Washington (upstream from the Permittee); and Spokane County Regional Water Reclamation Facility and the City of Spokane Advanced Wastewater Treatment Plant (downstream from the Permittee).

Non-point sources of pollution to the Spokane River in Washington include the Little Spokane River, Hangman Creek, Coulee Creek, and the Lake Spokane watersheds; stormwater and combined sewer overflows from the City of Spokane; and groundwater.

Section III.D of this fact sheet describes the known receiving waterbody impairments. The ambient background data used for this permit includes data from Ecology's Environmental Information Management System (EIM) for upstream stations on the Spokane River from January 2011 to January 2021. The ambient background data also includes results from PCB surveys for the Spokane River at below Trent Bridge (Spokane River Regional Toxics Task Force, Station SR-7).

Table 4: Ambient Background Data

Parameter	Units	# of Samples	Value	Description
Temperature (1-DMax) – Summer Season	°C	354	19.2	90th Percentile
Temperature (1-DMax) – April 1 to June 15 Spawning Season	°C	152	17.37	90th Percentile
pH Maximum pH Minimum	standard units	237	8.0 7.2	90th Percentile 10th Percentile
Dissolved Oxygen	mg/L	176	12.6	90th Percentile
Total Ammonia-N	mg/L	111	0.028	90th Percentile
Turbidity	NTU	167	3.4	90th Percentile
Hardness	mg/L as $CaCO_3$	85	19.4	10th Percentile
Total Alkalinity	mg/L as $CaCO_3$	31	72.5 22.1	90th Percentile 10th Percentile
Aluminum, dissolved	µg/L	2	9.0	Maximum
Arsenic, total	µg/L	52	0.52 0.44	90th Percentile Geometric Mean
Cadmium, dissolved	µg/L	53	0.185	90th Percentile
Chromium, dissolved	µg/L	51	0.125	90th Percentile
Copper, dissolved	µg/L	53	0.576 0.527	90th Percentile Geometric Mean
Mercury, total	µg/L	52	0.00236 0.00116	90th Percentile Geometric Mean
Nickel, dissolved	µg/L	52	0.39 0.227	90th Percentile Geometric Mean
Total PCBs	pg/L	27	78	Geometric Mean
Lead, dissolved	µg/L	52	1.05	90th Percentile
Silver, dissolved	µg/L	54	0.01	90th Percentile
Zinc, dissolved	µg/L	53	54.0	90th Percentile

C. Wastewater characterization

IEP reported the concentration of pollutants in the discharge in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater effluent discharged from January 2020 through May 2021. IEP began operating their UF membrane system in the fall of 2019, although system optimization was ongoing through this time period.

The wastewater effluent is characterized as follows:

Table 5: Wastewater Characterization

Parameter	Units	# of Samples	Average Value	95^{th} Percentile	Maximum Value
Flow	million gallons per day (mgd)	517	5.73	7.13	8.43
Biochemical Oxygen Demand (BOD_5)	mg/L lbs/day	368	3.4 160.0	7.3 314.7	14.3 629
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L lbs/day	68	1.6 87.3	4.1 200.6	5.6 284
Total Suspended Solids (TSS)	mg/L lbs/day	507	1.7 78.3	5.1 236.1	15.5 715
Temperature	°F °C	517	72.7 22.6	77.0 25.0	79.0 26.1
Total Phosphorus (as P)	mg/L lbs/day	150	0.210 9.4	0.646 28.4	2.03 84.6
Total Reactive Phosphorus (as P)	mg/L lbs/day	150	0.173 7.8	0.560 24.8	1.28 47.1
Ammonia (as N)	mg/L lbs/day	122	0.280 12.3	1.76 71.5	4.22 168.2
Hardness, as $CaCO_3$	mg/L	17	158	209 (95%) 135.8 (10%)	213
Cadmium, Total	ug/L	17	0.5	0.5	0.5
Lead, Total	ug/L	17	0.84	1.45	1.57
Zinc, Total	ug/L	17	81.7	98.4	115
Total PCBs [a]	pg/L	5	1,460	1,930	1,970
Antimony, Total	ug/L	1	-	-	2.65

Parameter	Units	# of Samples	Average Value	95th Percentile	Maximum Value
Color	Color Units	1	-	-	250
Nitrate-Nitrite, as N	mg/L	1	-	-	0.306
Total Organic Nitrogen, as N	mg/L	1	-	-	2.81
Oil and Grease (HEM)	mg/L	1	-	-	14.4
Sulfate, as S	mg/L	1	-	-	96
Surfactants (MBAS)	mg/L	1	-	-	0.130
Aluminum, Total	ug/L	1	-	-	77.0
Barium, Total	ug/L	1	-	-	74.9
Boron, Total	ug/L	1	-	-	34.0
Iron, Total	ug/L	1	-	-	72.6
Magnesium, Total	mg/L	1	-	-	7.34
Molybdenum, Total	ug/L	1	-	-	2.25
Manganese, Total	mg/L	1	-	-	0.693
Alpha, Total	pCi/L	1	-	-	10.6
Beta, Total	pCi/L	1	-	-	12.5
Radium, Total	pCi/L	1	-	-	4.13
Arsenic, Total	ug/L	1	-	-	2.97
Copper, Total	ug/L	1	-	-	4.34
Mercury, Total	ng/L	8	-	-	5.67
Nickel, Total	ug/L	1	-	-	2.05
Chloroform	ug/L	1	-	-	1.06
Methyl Chloride	ug/L	1	-	-	1.56

Footnote for Table 5: Wastewater Characterization

[a] PCB results during the 2020 calendar year

Table 6: Wastewater Characterization

Parameter	Units	# of Samples	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliforms	MPN/100 mL	1	<1.8	<1.8

D. Summary of compliance with previous permit Issued

The previous permit placed numeric effluent limits on BOD_5, TSS, zinc, lead, cadmium, pH, and total phosphorus.

IEP has complied with the effluent limits and permit conditions throughout the duration of the permit issued over the past five years with the exceptions noted below. Ecology assessed compliance based on its review of the facility's information in the Ecology Permitting and Reporting Information System (PARIS), discharge monitoring reports (DMRs) and on inspections.

The following table summarizes these violations:

Table 7: Numeric Effluent Violations

Date	Parameter	Unit	Limit Type	Value	Limit
Mar 2019	BOD_5	lbs/day	Average Monthly	1,519	1,101
Apr 2019	Total Phosphorus	lbs/day	Average Monthly	28.9	24.7
Oct 22, 2018	BOD_5	lbs/day	Daily Maximum	1,823	1,555
Mar 03, 2019	BOD_5	lbs/day	Daily Maximum	2,842	1,555
Mar 03, 2019	TSS	lbs/day	Daily Maximum	11,826	8,450
Mar 10, 2019	BOD_5	lbs/day	Daily Maximum	1,802	1,555
Mar 11, 2019	BOD_5	lbs/day	Daily Maximum	2,544	1,555
Mar 12, 2019	BOD_5	lbs/day	Daily Maximum	3,202	1,555
Mar 13, 2019	BOD_5	lbs/day	Daily Maximum	2,296	1,555
Mar 14, 2019	BOD_5	lbs/day	Daily Maximum	3,563	1,555
Mar 24, 2019	BOD_5	lbs/day	Daily Maximum	1,915	1,555
Mar 25, 2019	BOD_5	lbs/day	Daily Maximum	1,711	1,555
Apr 03, 2019	BOD_5	lbs/day	Daily Maximum	1,890	1,555
Apr 17, 2019	Total Phosphorus	lbs/day	Daily Maximum	51.6	49.7

For the October 2018 BOD1$_5$ exceedence, the company had recently commissioned two new equalization tanks as an upgrade to their wastewater treatment system. However, several factors contributed to reduced BOD_5 removal through the treatment system. The Permittee made a number of process control changes that resulted in improved treatment system performance.

The BOD_5 and total phosphorus exceedences during March and April 2019 resulted from a temporary mill outage due to late winter season natural gas shortage. Upon restarting the mill, a treatment system upset occurred due, in part, to colder than normal temperatures.

IEP took several severe corrective measures, including chlorination of the secondary system to reduce a filamentous bacteria outbreak. This upset also resulted in permit exceedences into April.

The following table summarizes other violations and permit triggers that occurred during the last five years. Permit triggers are not violations but rather when triggered require the permit holder to take an action defined in the permit.

Table 8: Violations/Permit Triggers

Date	Violation	Number of Violations	Notes
May 2020	Analysis not Conducted	2	Composite sample not collected due to an oversight
November 2020	Late submittal of required report	3	Late submittals due to an oversight

E. 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 that 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 Federal Water Quality Criteria Applicable to Washington (40 CFR 131.45).

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

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.). Ecology evaluated the permit application 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, and 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. Technology-based effluent limits

The technology-based limits for both the groundwood-thermo-mechanical and deink pulping are based on New Source Performance Standards (NSPS) developed by the Environmental Protection Agency (EPA).

These limits are found in "Effluent Guidelines and Standards" in the Code of Federal Regulations (CFR), July 1, 2014 edition, as follows:

Table 9: Technology-based Subcategories

Subcategory	Technology
Mechanical Pulp (40 CFR 430, Subpart G)	NSPS for mechanical pulp facilities where the integrated production of pulp and coarse paper, molded pulp products, and newsprint at groundwood mills occurs (40 CFR 430.75)
Secondary Fiber Deink (40 CFR 430, Subpart I)	NSPS for facilities where newsprint is produced (40 CFR 430.95)

NSPS regulated pollutants include BOD_5, TSS, pH, pentachlorophenol, trichlorophenol, and zinc. The pentachlorophenol and trichlorophenol limitations are only applicable at facilities where chlorophenolic-containing biocides are used. Likewise, the zinc limitation is only applicable at facilities where zinc hydrosulfite is used as a bleaching agent [40 CFR Part 430.75]. The Permittee has previously certified that both chlorophenolic containing biocides and zinc hydrosulfite are not used in the facility.

Therefore, the proposed permit does not include the NSPS technology-based limits for pentachlorophenol, trichlorophenol, and zinc. Pollutant limits for BOD_5, TSS, and pH for these two categories are as follows:

Table 10: Mechanical Pulp

Pollutant	Average Monthly Limit	Maximum Daily Limit
BOD_5, lbs/1,000 lbs of product	2.5	4.6
TSS, lbs/1,000 lbs of product	3.8	7.3
	Daily Minimum	**Daily Maximum**
pH, standard units	5.0	9.0

Table 11: Secondary Fiber Deink

Pollutant	Average Monthly Limit	Maximum Daily Limit
BOD_5, lbs/1,000 lbs of product	3.2	6.0
TSS, lbs/1,000 lbs of product	6.3	12.0
	Daily Minimum	**Daily Maximum**
pH, standard units	5.0	9.0

Ecology examined total newsprint production from January 2016 through May 2021 to develop the proposed technology-based effluent limitations. During this time period, the highest 12 consecutive month average production occurred from September 2017 through August 2018 with a value of 555.1 tons per day. During this same time period, thermo-mechanical and deink production averaged 431.8 and 123.3 tons/day, respectively.

The resulting technology-based limits are shown below (**Appendix D** lists the calculation of these limits):

Table 12: Technology-based Limits

Parameter	Average Monthly Limit	Maximum Daily Limit
BOD_5, lbs/day	5,452	2,948
TSS, lbs/day	9,263	4,835
	Daily Minimum	**Daily Maximum**
pH, standard units	5.0	9.0

Ecology also determined case-by-case technology-based limits based on past performance of the treatment system. Ecology used BOD_5 and TSS data collected from April 1, 2017, through May 31, 2021. The time period included effluent data collected after the installation of the membrane treatment system. However, the system had not been fully optimized and Ecology chose to analyze the data prior to and after the installation of the membrane filters to determine these limits.

Ecology calculated case-by-case limits using its spreadsheet tools and assuming log normally distributed data.

Table 13: Case-by-Case Technology-based Limits

Parameter	Average Monthly Limit	Maximum Daily Limit
BOD_5, lbs/day	1,138	1,872
TSS, lbs/day	1,149	2,367

B. 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).

Numeric criteria for the protection of aquatic life and recreation

Numeric 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.

Numeric criteria for the protection of human health

Numeric water quality criteria for the protection of human health are promulgated in Chapter 173-201A WAC and 40 CFR 131.45. These criteria are designed to protect 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.

Ecology submitted a standards revision for 192 new human health criteria for 97 pollutants to EPA on August 1, 2016. In accordance with requirements of CWA section 303(c) (2) (B), EPA finalized 144 new and revised Washington specific human health criteria for priority pollutants, to apply to waters under Washington’s jurisdiction. EPA approved 45 human health criteria as submitted by Washington. The EPA took no action on Ecology submitted criteria for arsenic, dioxin, and thallium. The existing criteria for these three pollutants remain in effect and were included in 40 CFR 131.45, Revision of certain Federal water quality criteria applicable to Washington.

On May 13, 2020, EPA issued a final rule that withdrew the initial action on PCBs changing the criteria for PCBs from 7 parts per quadrillion (ppq) to 170 ppq. Recently (June 30, 2021), EPA filed a motion with the federal court that provides time for EPA to propose new human health criteria for Washington.

Specifically, EPA proposes to:

- Issue a proposed rule establishing protective federal human health criteria applicable to Washington's surface waters.
- Put that rule out for public comment.
- Finalize a rule for Washington in 18 months.

Until a new federal rule is in place, Ecology based the proposed permit on the current applicable human health criteria, which Ecology listed in WAC 173-201A-240, Toxic Substances Criteria. For PCBs, the current applicable human health criteria for PCBs is 170 ppq.

General condition G3 of the permit allows Ecology to modify, revoke, reissue, or terminate a permit under certain conditions. One of the conditions includes the promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision. When EPA finalizes its new rule, Ecology will evaluate the impact to the permit resulting from any changes to the criteria. Ecology will then take appropriate actions, which could include modifying the current permit or including new requirements in the next permit issuance.

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, 2016) and of all marine waters (WAC 173-201A-210, 2016) in the state of Washington.

Antidegradation

Description – The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2016) 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, https://apps.ecology.wa.gov/publications/documents/92109.pdf). 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 4 means the effluent is 25% and the receiving water is 75% 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 and four tenths (2.4) liters/day for drinking water (increased from two liters/day in the 2016 Water Quality Standards update).
- 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 IEP 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. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise. The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology's Permit Writers Manual describes additional guidance on criteria/design conditions for determining dilution factors. The manual can be obtained from Ecology's website at https://fortress.wa.gov/ecy/publications/documents/92109.pdf.

Ecology estimated the critical river flows at the Permittee's point of discharge based on data from the USGS gauging station for the Spokane River at Spokane (USGS 12422500). Ecology calculated critical river flows at this gage using data from 2009 to present. In June 2009, the Federal Energy Regulatory Commission reissued a license to Avista Utilities for their operation and maintenance of five hydroelectric projects on the Spokane River. The license requires Avista to maintain a minimum discharge of 600 cfs from the Post Falls dam in Idaho from June 7 until the Tuesday following Labor Day each year, and reduce the minimum discharge to 500 cfs if the water level in Lake Coeur d'Alene falls below 2,127.75 feet during the summer full-pool period. The FERC flow requirements have resulted in increased summertime flows in the Spokane River.

The following table shows critical flows for the Spokane River at Spokane gage (USGS 12422500):

Table 14: Critical Flows for the Spokane River at Spokane (USGS 12422500)

Critical Condition	Flow
Seven-day-average low river flow with a recurrence interval of ten years (7Q10)	749 cubic feet per second (cfs)
Thirty-day low river flow with a recurrence interval of five years (30Q5)	892 cfs
Harmonic mean river flow	2,728 cfs

Ecology then adjusted these critical flows based on measurements taken by Ecology at eleven river stations during August 2005 and 2006 (Covert, 2016). One of these stations included the Centennial Trail bridge below Plantes Ferry Park, about 1.4 miles upstream from the Permittee's outfall. The table below compares measured flows at the Centennial Trail Bridge below Plantes Ferry Park with flows at Spokane River at Spokane:

Table 15: River Flow Measurements at the Centennial Trail Bridge and the Spokane River at Spokane (USGS 12322500)

Date	Centennial Trail Bridge (cfs)	Spokane River at Spokane - USGS 12422500 (cfs)	Difference (cfs)
August 2005	492	613	-121
August 2006	579	750	-171

The August 2006 flows for the Spokane River at Spokane approximated the 7Q10 value of 749 cfs. Ecology used the difference of 171 cfs to estimate the critical 7Q10 and 30Q5 river flows at the point of discharge. Ecology did not have representative flows at the harmonic mean flowrate; therefore used the difference of 171 cfs for the adjustment.

Table 16: Critical Conditions Used to Model the Discharge at IEP

Critical Condition	Spokane River at Spokane (USGS 12422500)	Adjustment	Point of Discharge
Seven-day-average low river flow with a recurrence interval of ten years (7Q10), cfs	749	-171	578
Thirty-day low river flow with a recurrence interval of five years (30Q5), cfs	892	-171	721
Harmonic mean river flow, cfs	2,728	-171	2,557

Table 17: Critical Effluent Flowrates at IEP

Critical Condition	Effluent
Maximum average monthly effluent flow for chronic and human health non-carcinogen	7.67 million gallons per day (MGD)
Annual average flow for human health carcinogen	7.47 MGD
Maximum daily flow for acute mixing zone	8.49 MGD

Ecology obtained critical water quality ambient data from Ecology's EIM System for water quality monitoring stations for the Spokane River upstream of the discharge as listed in Table 4.

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.

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.

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. Similarly, because the discharge may stop rising at some depth due to density stratification, waters above that depth will not mix with the 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).

- 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.

C. 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 certain toxic pollutants in 40 CFR Part 131.45. The table included below summarizes the criteria applicable to this facility's discharge.

- **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 for this receiving water are identified below.

Freshwater Aquatic Life Uses and Associated Criteria

Table 18: Salmonid Spawning, Rearing, and Migration

Criteria	Value
Temperature Criteria – Highest 7-DAD MAX	17.5°C (63.5°F)
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	8.0 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.
Total Dissolved Gas Criteria	Total dissolved gas must not exceed 110 percent of saturation at any point of sample collection.
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 0.5 units.

- The **recreational uses** for this receiving water are identified below.

Table 19: Recreational Uses and Associated Criteria

Recreational Use	Criteria
Primary Contact Recreation	*E.coli* organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within the averaging period exceeding 320 CFU or MPN per 100 mL.

- The **water supply uses** are domestic, agricultural, industrial, and stock watering.
- The **miscellaneous freshwater uses** are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

An additional special condition applies to the Spokane River. From Nine Mile Bridge (river mile 58.0) to the Idaho Border (river mile 96.5), temperature shall not exceed a one day maximum (1-DMax) of 20.0°C due to human activities.

When natural condition exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases at any time exceed t=34/(T+9); "t" represents the maximum permissible temperature increase measured at a mixing zone boundary; and "T" represents the background temperature as measured at a point unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge.

D. Water quality impairments

Ecology routinely assesses available water quality data on a statewide basis. Ecology submits these results to the Environmental Protection Agency (EPA) as an "integrated report" to satisfy Sections 303(d) and 305(b) of the federal Clean Water Act. EPA recommends the listing of water quality for a particular location in one of five categories. Categories one through four represent the 305(b) Report which assesses the overall status of water quality in the State. Category 5 waters represents the 303(d) list which are known impaired waters in the State.

A total daily maximum load (TMDL) is required for each pollutant on the 303(d) list that EPA has determined is suitable for such a calculation. A TMDL is not required if other pollution control requirements result in compliance with the applicable water quality standard(s). A TMDL determines the amount of pollution a water body can receive while still meeting water quality standards. The TMDL sets maximum allowable pollution from various sources as either individual waste load allocations (WLAs) for point sources or load allocations (LAs) for nonpoint sources.

The candidate 2018 303(d) list contains multiple segments in the Spokane River. River segments are listed for temperature, dissolved oxygen, fecal coliform bacteria in water; and PCBs, dioxin, methylmercury, and polybrominated diphenyl ethers (PBDEs) in fish tissue. At the discharge location, listings include PCBs, methylmercury, and PBDEs in fish tissue.

Category 4a waters of the 305(b) report represent impaired waters that have an EPA-approved TMDL in place and are actively being implemented. In the Spokane River, this includes the Spokane River Metals TMDL addressing cadmium, lead, and zinc (Ecology, 1999); and the Spokane River Dissolved Oxygen TMDL for total phosphorus and dissolved oxygen (Ecology, 2010). Specific WLAs applicable to the Permittee are discussed in the next section below.

The previous permit issued on June 23, 2011, included a comprehensive approach toward addressing point and nonpoint sources of PCBs in the Spokane River. The permit required the Permittee to participate in the formation and funding of the Spokane River Regional Toxics Task Force (Task Force). The goal of the Task Force is to develop a comprehensive plan to bring the Spokane River into compliance with applicable water quality standards for PCBs. The previous permit included specific tasks for Permittee to work with the Task Force to accomplish, including completion of the comprehensive plan by December 2016.

Ecology developed criteria by which it could assess the measurable progress of the Task Force's efforts in meeting water quality criteria for PCBs, located online at http://srrttf.org/?attachment_id=6029.

Section H discusses specific Best Management Practices (BMPs) and Task Force milestones applicable to the Permittee for the discharge of PCBs.

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

Ecology must consider the narrative criteria described in WAC 173-201A-260 when it determines permit limits and conditions. Narrative water quality criteria limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge which have the potential to adversely affect designated uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

Ecology considers narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of treatment and prevention (AKART) as described above in the technology-based limits section. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

In addition, Ecology considers the toxicity of the wastewater discharge by requiring whole effluent toxicity (WET) testing when there is a reasonable potential for the discharge to contain toxics. Ecology's analysis of the need for WET testing for this discharge is described later in the fact sheet.

F. 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 biological 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.

Treated effluent is discharged to the Spokane River through an 18-inch diameter, 70-foot outfall line with a 32-foot attached diffuser. The diffuser has nine openings consisting of eight ports, four feet apart, on 90 degree risers facing downstream with an open ended pipe at the end of the diffuser. The effluent line is oriented about 10 degrees downstream as measured from perpendicular to the shoreline.

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 flow volume restriction resulted in a smaller chronic dilution factor than the distance downstream. The dilution factor below results from the volume restriction.

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. The dilution factor below results from the volume restriction.

Ecology determined the dilution factors that occur within these zones at the critical condition using the effluent/receiving water flow volume restrictions. The dilution factors are listed below.

Table 20: Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	2.4	16.8
Human Health, Non-Carcinogen	---	19.8
Human Health, Carcinogen	---	56.3

Ecology determined the impacts of pH, ammonia, metals, and other toxics, and temperature as described below, using the dilution factors in the above table. 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.

Federal regulations (CFR Part 122.44(d)) require that NPDES permits contain limits to control all pollutants or pollutant parameters (either conventional, nonconventional, or toxic pollutants) which Ecology determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality.

Dissolved Oxygen — **Total Phosphorus, Ammonia, and $CBOD_5$ Effects** — 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 carbonaceous biochemical oxygen demand ($CBOD_5$) 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 in the receiving water.

Ecology has completed a dissolved oxygen TMDL, referenced above, and established effluent limits for total phosphorus, ammonia, and carbonaceous biochemical oxygen demand ($CBOD_5$). The previous permit issued on June 23, 2011, contained a 10-year schedule of compliance for meeting final water quality based effluent limits for total phosphorus, $CBOD_5$, and ammonia derived from the waste load allocations from the TMDL:

Table 21: Waste Load Allocations

Parameter	Seasonal Average (March through October)
Ammonia, lbs/day	24.29
$CBOD_5$, lbs/day	123.2
Parameter	**Seasonal Average (February through October)**
Total Phosphorus, lbs/day	2.39

This compliance schedule required reductions in the total phosphorus, $CBOD_5$, and ammonia discharged to the Spokane River, through a combination of treatment technology and other target pursuit actions as incorporated into a delta elimination plan. IEP is currently meeting its wasteload allocation for ammonia, but has not been able to achieve the wasteload allocations for total phosphorus and $CBOD_5$.

Treatment Technology: After extensive research and testing, IEP identified that ultrafiltration in combination with flow equalization and additional biological treatment resulted in the most effective technologies for seasonally removing $CBOD_5$, ammonia, and phosphorus from their effluent. In late 2019, IEP completed installation of the ultrafiltration system and began testing and optimizing its operation.

Delta Elimination Plan: A discharger's Delta is the actual pounds of phosphorus, $CBOD_5$, or ammonia discharged per day after the implementation of treatment technology minus the WLA target pounds. The Delta Elimination Plan would include a planned and scheduled group of actions aimed at eliminating a discharger's Delta.

Depending on the discharger, the Delta Elimination Plan could include a range of other phosphorus, $CBOD_5$, and ammonia removal actions such as conservation, effluent re-use, source control through support of regional phosphorus, $CBOD_5$, and ammonia reduction efforts (such as limiting use of fertilizers and dishwasher detergents), and supporting regional non-point source control efforts to be established. The plan, in combination with the pollutant reduction from technology, provides reasonable assurance of meeting the permit holder's WLAs by the end of the ten year compliance schedule (by 2021).

For a discharger, or group of dischargers, Delta Elimination can also consist of additional toolbox items that allow the development of alternate waste load allocations and WQBELs, as long as the resulting DO is consistent with that defined in the TMDL. These toolbox items can include a range of concepts such as pollutant equivalency (the exchange of one pollutant for another) and bubble limits (sum of applicable wasteload allocations for multiple points sources becomes a cap or bubble).

The Permittee's Delta Elimination Plan includes the following:

1. River Water Offset for Total Phosphorus.

   IEP withdraws process water from a well located within a few hundred feet of the Spokane River. IEP uses a portion of the well water in their once-through, non-contact cooling water (NCCW) system. Therefore the Spokane River likely contributes a natural phosphorus load to the groundwater that IEP uses for its NCCW.

   During 2012-2013, Ecology collected surface water and groundwater data from 10 sites along the river and within the IEP facility (Ecology, 2016). Ecology analyzed these data to determine whether an allowance for phosphorus in the NCCW is appropriate. Ecology used a mixing model to calculate the volume fraction of river water pumped by IEP's supply well. The report concluded that an allowance addressing this fraction of river water phosphorus load is appropriate.

   Therefore, the proposed permit will contain an allowance (i.e. credit) for the fraction of river phosphorus loads in the NCCW. As concluded by the report, the allowance will be the lesser of these two loads; actual observed NCCW loads and 0.182 lbs/day which is the estimated fraction of river load (Table 13, Critical Season Average Estimated Fraction of River Load, Ecology, 2016).

2. Static Pollutant Equivalency for Ammonia and $CBOD_5$.

   IEP submitted a CE-QUAL-W2 model run for an alternate pollutant loading for ammonia and $CBOD_5$. The results of this model run indicate the following alternative loading scenario will result in substantially equal, or improved, dissolved oxygen levels in Lake Spokane as compared to the Spokane River DO TMDL's WLA scenario #1:

Table 22: March – October Alternative Pollutant Loading Scenario (4.1 MGD Effluent Flow)

Pollutant	Units	Current WLA	Alternate WLA
Ammonia	mg/L as N lbs/day [a]	0.71 24.29	0.071 2.43
$CBOD_5$, mg/L	mg/L lbs/day [a]	3.6 123.1	5.04 172.3

The evaluation of the results built upon the 2011 loading scenario which included:

Extending critical season for Idaho dischargers to the Spokane River (City of Coeur d'Alene, City of Post Falls, and Hayden Area Regional Sewer Board) and the Permittee to February through October.

Increasing the allowable total phosphorus levels for Idaho discharges and the Permittee, their load increasing from 1.23 lbs/day (0.036 mg/L at 4.1 mgd) to 2.39 lbs/day (0.070 mg/L at 4.1 mgd.

An equivalent dissolved oxygen loading for the proposed Spokane County wastewater treatment plant with reduced levels of carbonaceous biological oxygen demand ($CBOD_5$) and increased levels of total phosphorus.

Ecology and EPA developed guidelines to determine whether changes to permit limits complies with the WLAs and other requirements in the Spokane River DO TMDL (US EPA, 2011). These guidelines contain two parts:

1. Any revised effluent limits, considered cumulatively with the load allocations in Table 6 of the TMDL, and Avista's DO responsibility in Table 7 of the TMDL, must meet the State's DO criteria in WAC 173-201A-200(1)(d).
2. Any revised effluent limits must not further decrease the cumulative average DO levels of the shaded cells in Table 7 of the TMDL.

Part #1 allows for small DO deviations relative to the WLAs and Idaho modeling assumptions from the TMDL at times in individual lake segments, as long as the resulting DO levels, rounded to the nearest 0.1 mg/L, do not violate the State's DO water quality criteria. This part applies to the entire reservoir at all times during the year. In determining compliance with the 0.2 mg/L decrease from natural conditions allowed in WAC 173-201-200(1)(d)(ii), Avista's DO responsibility is added to the resulting DO levels from any revised discharge limits.

Part #2 ensures the cumulative DO change in cells where the TMDL assigns a DO responsibility to Avista (shaded cells in Table 7) will remain zero, or positive, relative to the previous TMDL model results. The guidelines do not allow rounding in these calculations, since the rounding then averaging may mask small but widespread decreases in Lake DO concentrations.

The results from this scenario meet part #2, where the average modeled DO level in shaded cells in Table 7 increases by a very small amount (0.0022 mg/L).

For part #1, the model results show a total of 9 of 448 cells where a change occurs to the 0.2 decrease below natural conditions allowed by the Water Quality Standards. In six cells, the modeled DO levels improve resulting in a 0.1 mg/L decrease. In the three remaining cells, the model predicts a slight decrease in DO rounding upward to 0.1 mg/L. A closer look at these cells reveals a small tolerance, where slight increases in DO concentrations (greater than 0.0008, 0.0006 and 0.0001 mg/L) would result in rounding upward to the next 0.1 mg/L.

Ecology believes the results of the modeled scenario are equivalent to the TMDL's WLAs and meets the State's Water Quality Standards because:

For the three cells where rounding upward occurred, Ecology considers the very small changes insignificant, especially considering the small tolerance for change within these cells.

The exceptions to the 0.2 mg/L decrease below natural conditions predicted occur infrequently (3 of 448 total cells) and fall within the precision of the model.

The TMDL modeling used conservative assumptions, making actual DO concentrations greater than those predicted by the model.

IEP has indicated that they do not wish to pursue the alternate loading scenario outlined in Table 22. The proposed permit will include the current waste load allocations for ammonia and $CBOD_5$.

3. Nutrient Bubble Limit with Kaiser Aluminum Washington

IEP and Kaiser Aluminum Washington (Kaiser) have pursued a nutrient bubble limit. Under a bubble limit, an individual discharger is not considered in violation of their WQBEL, as long as the collective bubble limit is met during the same reporting period. Bubble limits are a form of water quality offsets (https://apps.leg.wa.gov/wac/default.aspx?cite=173-201A-450). Ecology's Draft Water Quality Trading Framework discusses the concept of bubble allocations between point source dischargers.

EPA issued a draft test for "Compliance with Washington Water Quality Standards", which would allow the results of a given CE-QUAL-W2 simulation to be assessed in terms of whether its results were consistent with the TMDL. This test for compliance had three criteria, all of which must be met:

- The alternate scenario must not increase the spatial or temporal extent of Avista responsibilities, after results are rounded to 0.1 mg/L.
- The alternate scenario must not decrease the dissolved oxygen concentration averaged across all Avista-affected segments and times.
- The alternate scenario must not increase Avista's responsibility in any segment or time, after results are rounded to 0.1 mg/L.

The procedure for developing bubble limit for Kaiser and Inland Empire Paper included the following steps:

- Verify model predictions to ensure that results match those of the model used to develop the TMDL.
- Conduct loading sensitivity by varying pollutant loads for each discharger (e.g. 0, +/- 50%, +/- 100%)
- Calculate linear response function. Two slopes were calculated, one for each increasing load and another for decreasing loads relative to the TMDL WLA. To match results of the TMDL, each line segment included the point with the wasteload allocation and a dissolved oxygen change of zero.
- Calculate and incorporate safety factor. For increasing loads, the slope resulting in the largest incremental dissolved oxygen decrease was used. For decreasing loads, the slope resulting in the lowest incremental DO increase was used.
- Ensure the results were consistent with the TMDL by procedures from EPA's draft test for "Compliance with Washington Water Quality Standards". The results met all of the three criteria described above.

Appendix E contains bubble limit calculations for $CBOD_5$ (LimnoTech 2020a). The results show a trading ratio for $CBOD_5$ of 4.247 (a one pound increase in IEP $CBOD_5$ loading requires a 4.247 pound decrease in Kaiser $CBOD_5$ loading). The proposed permit will specify a final water quality based effluent limit for $CBOD_5$ as:

- A seasonal average individual limit for $CBOD_5$ as 123.2 lbs/day
- A seasonal average bubble (aggregate) limit for $CBOD_5$ as:

- 123.2 lbs/day, when the $CBOD_5$ seasonal average individual load from Kaiser is equal to or greater than 462.7 lbs/day
- 123.2 + [462.7 - $CBOD_5$ seasonal average individual load from Kaiser (lbs/day)] ÷4.247, when the $CBOD_5$ seasonal average individual load from Kaiser is less than 462.7 lbs/day

The Permittee will not be considered in violation of the seasonal average individual limit for $CBOD_5$ unless the seasonal average bubble (aggregate) limit is also exceeded.

Appendix E also contains the bubble limit calculations for total phosphorus (LimnoTech 2020b). These results show a trading ratio of 3.4 for total phosphorus (a one pound increase in IEP TP loading requires a 3.4 pound decrease in Kaiser loading). Similarly, the proposed permit will specify a final water quality based effluent limit for total phosphorus as:

- A seasonal average individual limit for total phosphorus (as P) as 2.39 lbs/day
- A seasonal average bubble (aggregate) limit for total phosphorus (as P) as:
  - 2.39 lbs/day, when the total phosphorus (as P) seasonal average individual load from Kaiser is equal to or greater than 3.21 lbs/day
  - 2.39 + [3.21 – total phosphorus seasonal average individual load from Kaiser (lbs/day)] ÷ 3.4, when the total phosphorus (as P) seasonal average individual load from IEP is less than 2.39 lbs/day

The Permittee will not be considered in violation of the seasonal average individual limit for total phosphorus unless the seasonal average bubble (aggregate) limit is also exceeded.

4. Bioavailable Phosphorus

Ecology also committed to evaluate a demonstration that a certain stable fraction of the phosphorus discharged from the facility is not bio-available in the river environment and is not a nutrient source. Ecology would recognize this demonstration (i.e., that a certain stable fraction of the phosphorus discharged from the facility is not bio-available in the river environment and is not a nutrient source) through a modification to the Spokane River DO TMDL.

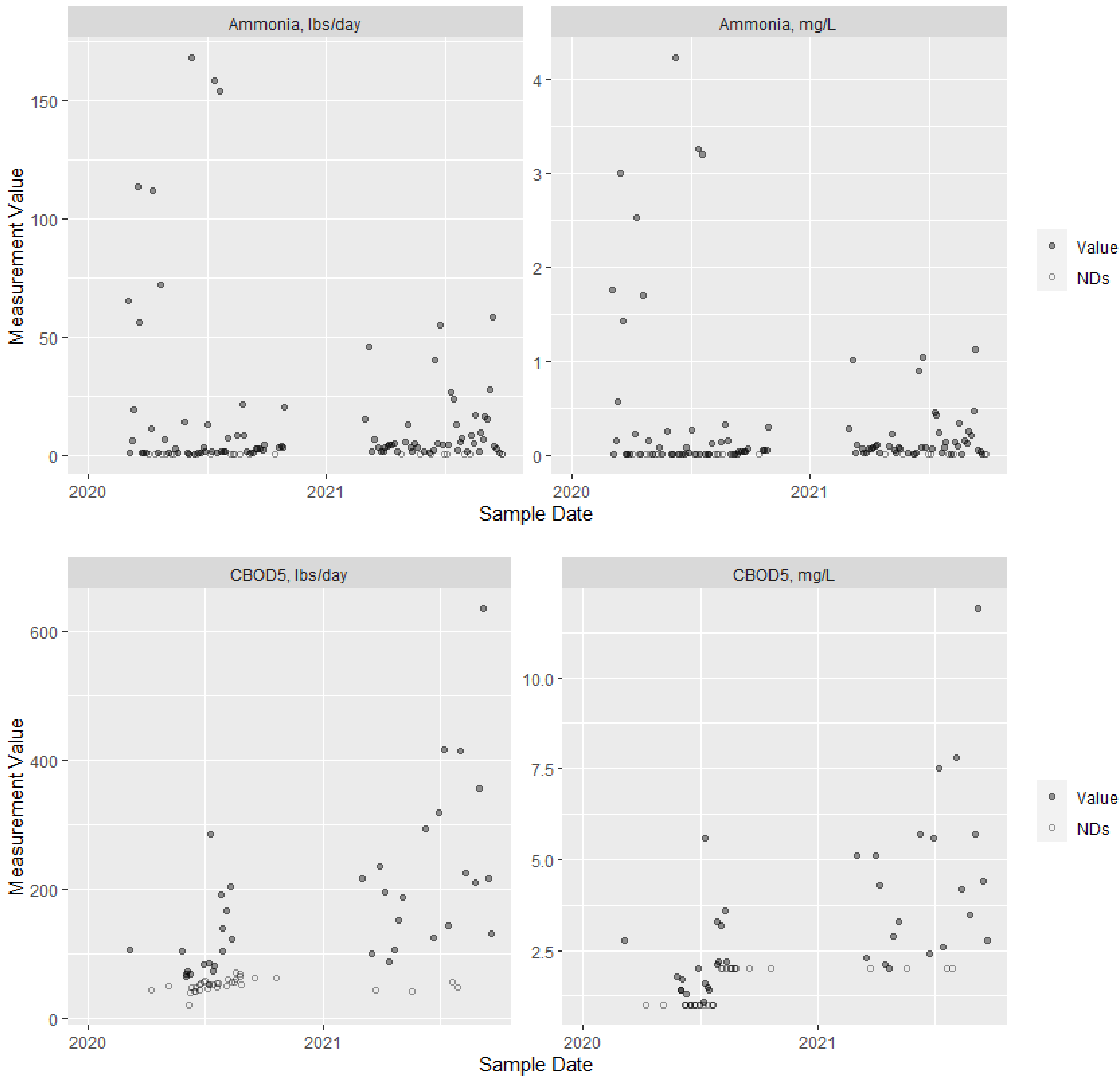
Ecology remains uncertain on the merits of bioavailable phosphorus and does not plan any modification to the Spokane River DO TMDL at this time.

Extension of Compliance Schedule for Ammonia, $CBOD_5$, and Total Phosphorus

In late 2019, IEP completed installation of the ultrafiltration system and began testing and optimizing its operation. Based on discharge information collected since that time, it appears that IEP will be unable to meet waste load allocations for total phosphorus and $CBOD_5$.

Figure 4 compares seasonal average loading values with waste load allocations while Figure 5 compares seasonal average loading values with waste load allocations combined with delta elimination tools (available bubble capacity from Kaiser Aluminum plus intake credits for total phosphorus contained in non-contact cooling water).

Figure 3: Effluent Ammonia, $CBOD_5$, and Total Phosphorus Levels



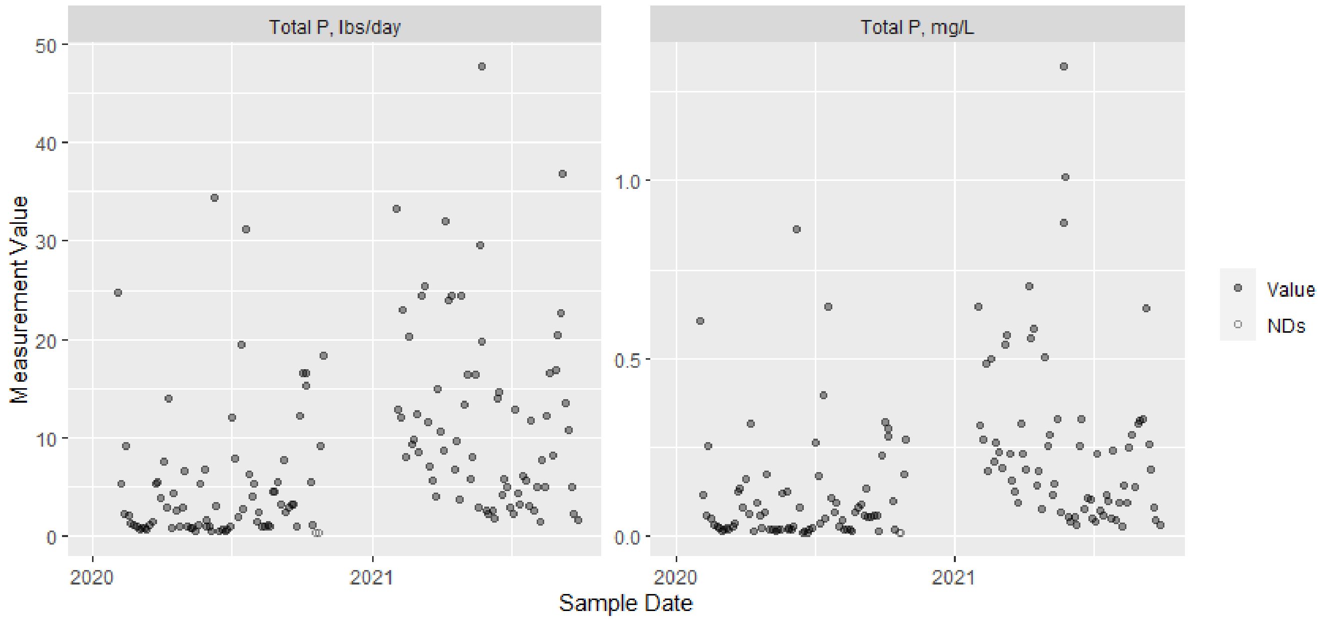


Figure 4: Seasonal Average Loadings

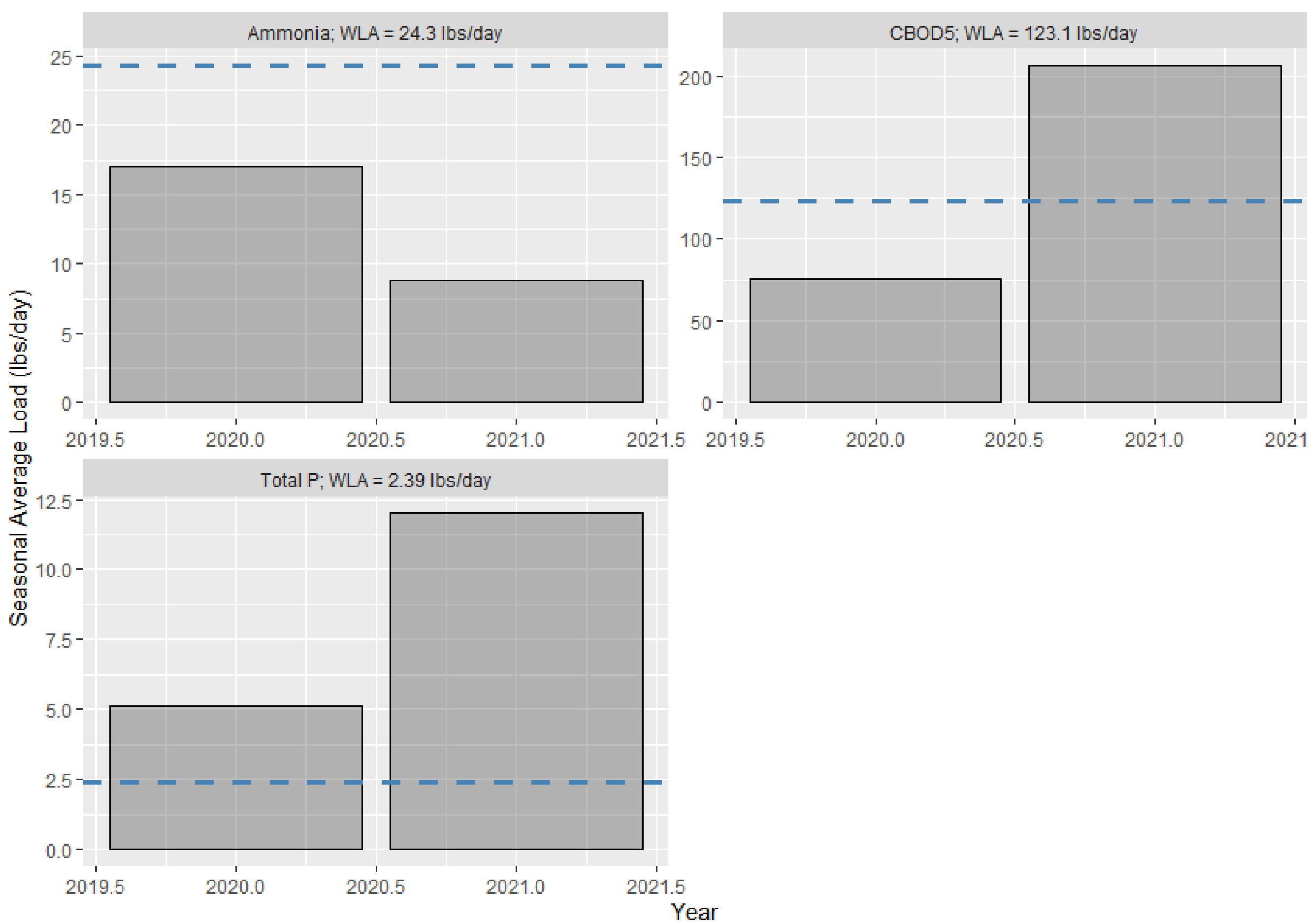
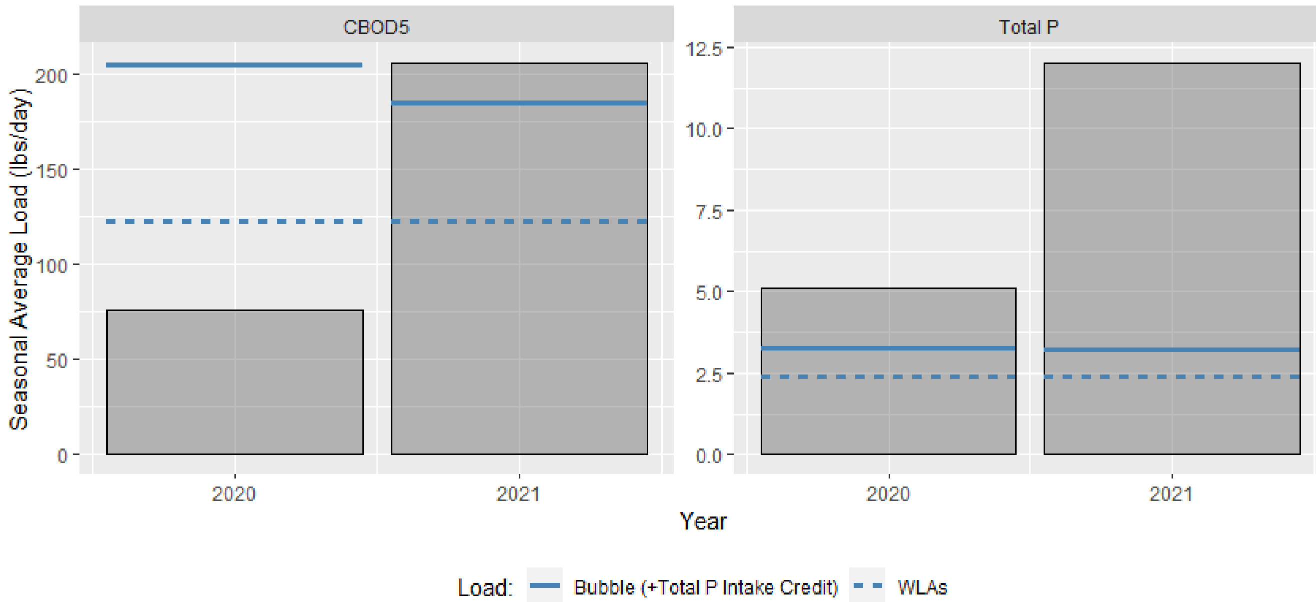


Figure 5: Seasonal Average Loadings



In a letter dated November 10, 2021, IEP requested additional time to meet its final WQBELs for total phosphorus and $CBOD_5$. IEP expects that further optimization of its mill processes and effluent treatment system are needed in order to meet these limits. Compliance may also depend on the use of delta elimination tools as discussed above.

The water quality standards in WAC 173-201A-510(4) contain provisions for extending compliance schedules past ten years. When an approved TMDL has established wasteload allocations for a permitted discharge, Ecology may authorize a compliance schedule longer than ten years if:

i The permittee is not able to meet its waste load allocation in the TMDL solely by controlling and treating its own effluent.

ii The permittee has made significant progress to reduce pollutant loading during the permit term.

iii The permittee is meeting all of its requirements under the TMDL as soon as possible.

iv Actions specified in the compliance schedule are sufficient to achieve water quality standards as soon as possible.

As shown above, effluent data has demonstrated that IEP is unable to meet its waste load allocations by controlling and treating its own effluent. The Permittee has also made significant progress to reduce pollutant loadings during the previous permit term that included mill-wide process improvements and installation of advanced treatment technology for reducing pollutant loadings. The Permittee has met other remaining requirements of the TMDL including preparing a delta elimination plan, completing a selection protocol for treatment technology, preparing an engineering report for the treatment technology, and completing installation of the treatment technology.

In extending the schedule, Ecology must require compliance with these effluent limitations as soon as possible. IEP had requested an additional five years to meet these limitations. In considering this request, Ecology has proposed to extend the compliance schedule an additional two compliance seasons (2022 and 2023). Ecology believes this will:

- Allow sufficient time for the Permittee to optimize its mill processes and effluent treatment system
- Allow time to address any unforeseen circumstances
- Meet the ‘as soon as possible’ requirement.

The proposed permit will include of annual status reports that provides the status of the Permittee’s progress in meeting the effluent limitations for total phosphorus and $CBOD_5$.

The proposed permit will also set interim effluent limits for total phosphorus and $CBOD_5$ during the compliance schedule period. Ecology evaluated performance-based effluent limits by examining effluent data collected during the 2020 and 2021 compliance seasons (February through October for total phosphorus and March through October for $CBOD_5$). Both data sets appeared to vary from log normal distributions. Because this complicates statistical analysis that assume a log normal distribution, Ecology did not use its spreadsheet equations to calculate performance-based limits. Rather, Ecology used a 99th percentile of the data to set daily maximum interim limits; and the highest monthly average values to set monthly average interim limits. IEP reported the highest monthly average discharge for total phosphorus during May 2021 of 16.3 lbs/day; and the highest monthly average discharge for $CBOD_5$ during September 2021 of 334.3 lbs/day.

Table 23: Performance-based Total Phosphorus and $CBOD_5$ Limits

Metal	Monthly Average	Daily Maximum
Total Phosphorus (as P), lbs/day	16.3	35.7
$CBOD_5$, lbs/day	334.3	481.4

pH — Ecology modeled the impact of the effluent pH on the receiving water using the calculations from EPA, 1988, and the chronic dilution factor tabulated above. **Appendix D** includes the model results.

Ecology predicts no violation of the pH criteria under critical conditions using the upper value of the technology-based effluent pH limit of 9.0. However, modeling predicts a violation at the lower pH value of the technology-based effluent limit of 5.0 with a variation at the mixing zone boundary exceeding 0.5 units over background. Based on trial and error, a minimum pH 6.6 su does not cause a variation exceeding 0.5 units at the mixing zone boundary. Therefore, the proposed permit includes a pH limitation within the range of 6.6 to 9.0 s.u.

Turbidity — Ecology evaluated the impact of turbidity based on the range of turbidity in the effluent and turbidity of the receiving water. Based on visual observation of the facility’s effluent, Ecology expects no violations of the turbidity criteria outside the designated mixing zone.

Cadmium, Lead, and Zinc — The Spokane River dissolved metals TMDL set waste load allocations on the most restrictive permit limits based on:

- Aquatic life toxicity criteria at effluent hardness at the end-of-pipe
- Maintaining existing concentrations of metals in effluent using performance based limits with an added 10 percent compliance buffer.

Ecology calculated end-of-pipe effluent limits for lead and zinc using a 10th percentile end-of-pipe hardness of 132.5 mg/L as $CaCO_3$, as recommended by the TMDL. The resulting limits are as follows:

Table 24: End-of-Pipe Metal Limits

Metal	Monthly Average	Daily Maximum	Maximum/Average Ratio
Cadmium, µg/L	1.5	2.3	1.46
Lead, µg/L	8.5	12.2	1.44
Zinc, µg/L	129.5	148.9	1.15

Ecology also evaluated performance-based effluent limits for cadmium, lead, and zinc. The zinc data set did not fit a log normal distribution while the lead and cadmium data sets contained over 45 percent and 94 percent of non-detectable results, respectively. Because these factors complicate statistical analysis that typically assume a log normal distribution, Ecology did not use its spreadsheet equations to calculate performance-based limits.

Ecology did not calculate a performance-based limit for cadmium because of the high number of non-detectable results in the data set. For lead and zinc, Ecology choose a performance-based limit as the highest value in each data set plus a 10 percent compliance buffer as outlined in the TMDL. When collecting compliance monitoring samples at a required testing frequency of once per month or less, results are compared to a monthly average to determine permit compliance. Since both data sets included only once per month results, Ecology used these performance-based values to set monthly average permit limits. Daily maximums were calculated from the ratios from the end-of-pipe metal limits calculations shown in Table 23.

The resulting performance-based limits for lead and zinc are as follows:

Table 25: Performance-based Metals Limits

Metal	Monthly Average	Daily Maximum
Lead, ug/L	3.18	4.58
Zinc, ug/L	126.5	145.4

The performance-based limits for both lead and zinc are most restrictive, and Ecology will include these limits in the proposed permit.

Toxic Pollutants —Facilities with technology-based effluent limits must also meet the surface water quality standards.

The following toxic pollutants are present in the discharge: ammonia, aluminum, arsenic, cadmium, copper, iron, mercury, and nickel. Ecology conducted a reasonable potential analysis (See **Appendix D**) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature and pH in the receiving freshwater. To evaluate ammonia toxicity, Ecology used the available receiving water information as listed in Table 4 and Ecology spreadsheet tools.

No valid ambient background data were available for iron. Ecology used zero for background. Valid ambient background data were available for ammonia, aluminum, arsenic, cadmium, copper, mercury, and nickel (See Table 4 for ambient background data for these pollutants). Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards.

Ecology determined that ammonia, aluminum, arsenic, cadmium, copper, iron, mercury, and nickel pose no reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991 (**Appendix D**) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

Temperature--The state temperature standards (WAC 173-201A, WAC 173-201A-200, WAC 173-201A-600, and WAC 173-201A-602) include multiple elements:

- Annual summer maximum threshold criteria (June 15 to September 15)
- Supplemental spawning and rearing season criteria (September 15 to June 15)
- Incremental warming restrictions
- Protections against acute effects
- Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.
- Annual summer maximum and supplementary spawning/rearing criteria

Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), WAC 173-201A-210(1)(c), and WAC 173-201A-602, Table 602]. These threshold criteria (e.g., 12, 16, 17.5, 20°C) protect specific categories of aquatic life by controlling the effect of human actions on summer temperatures.

Some waters have an additional threshold criterion to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-602, Table 602]. These criteria apply during specific date-windows.

The threshold criteria apply at the edge of the chronic mixing zone. Criteria for most fresh waters are expressed as the highest 7-Day average of daily maximum temperature (7-DADMax). The 7-DADMax temperature is the arithmetic average of seven consecutive measures of daily maximum temperatures. Criteria for marine waters and some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

- Incremental warming criteria

The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-200(1)(c)(i)-(ii), WAC 173-201A-210(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment. These increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

- Guidelines to prevent acute mortality or barriers to migration of salmonids. These site-level considerations do no override the temperature criteria listed above.
  1. Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C, unless a dilution analysis indicates ambient temperatures will not exceed 33°C two seconds after discharge.
  2. General lethality and migration blockage: Temperature at the edge of a chronic mixing zone must not exceed either a 1DMax of 23°C or a 7DADMax of 22°C.
  3. Lethality to incubating fish: The temperature must not exceed 17.5°C at locations where eggs are incubating.

Reasonable Potential Analysis

Annual summer maximum and incremental warming criteria: Ecology calculated the reasonable potential for the discharge to exceed the annual summer maximum and the incremental warming criteria at the edge of the chronic mixing zone during critical conditions. Ecology allows warming increments only when they do not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

At times when the background ambient temperature is cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment, t. Incremental temperature increases resulting from individual point source activities must not, at any time, exceed the equation below as measured at the edge of a mixing zone boundary. "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge. Calculate t as follows:

- $t = 28/(T_{ambient} + 7) = 28/(19.2 + 7) = 28/26.2 = 1.07$ °C

These warming increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum. Therefore, the actual warming allowance (t’) is the lesser of:

- t of 1.07, or
- the numeric criteria minus the ambient temperature = 20.0 – 19.2 = 0.8 °C

An effluent limit is needed any time the ambient background temperature ($T_{ambient}$) is cooler than the assigned criterion and the temperature at the edge of the chronic mixing zone ($T_{chronic}$) is greater than ($T_{ambient}$ + t'):

Where:

$T_{chronic} = T_{ambient} + (T_{effluent95} - T_{ambient})/DF) = 19.2 + (25.0 - 19.2)/16.8 = 19.5$ °C

$T_{ambient}$ = background water temperatures colder than the threshold criterion = 19.2 °C

$T_{effluent95}$ = 95th percentile 1-Dmax effluent temperature = 25.0 °C

t' = the allowable increment of warming to ambient waters = 0.8 °C

DF = the dilution factor at the critical condition = 16.8

Since the temperature at the edge of the chronic mixing zone ($T_{chronic}$ = 19.5°C) is less than ambient temperature plus the incremental warming allowance ($T_{ambient}$ + t' = 19.2 + 0.8 = 20.0 °C), the proposed permit does not include a temperature limit.

Lethality to incubating fish: Human actions must not cause warming above 17.5°C at locations where eggs are incubating. A reasonable potential exists if $T_{spawning}$ is greater than 17.5°C.

For Rainbow Trout in the Spokane River, spawning and incubation occurs from April 1 to June 15. For this analysis, Ecology used a critical 7Q10 flow of 2,592 calculated from April 1 to June 15 for the USGS gage at the Spokane River at Spokane (12422500) of 2,592 cfs, a 95^{th} percentile effluent temperature of 25.0°C, a daily maximum effluent flow of 7.13 mgd (11.03 cfs), and a 90^{th} percentile receiving water temperature of 17.37°C.

$DF_{spawning} = (Flow_{effluent95} + 0.25*7Q10)/ Flow_{effluent95} = (11.03 + 0.25*2,592)/11.03 = 59.7$

$T_{ambient90}$ = 17.37°C

$T_{effluent95}$ = 25.0°C

$T_{spawning} = T_{ambient90} + (T_{effluent95} - T_{ambient90})/(DF_{spawning})$

$T_{spawning} = 17.37 + (25.0 - 17.37)/59.7 = 17.5$°C

Since the calculated temperature is not greater than 17.5°C, no reasonable potential exists.

G. Human health

Washington's water quality standards include numeric human health-based criteria for priority pollutants that Ecology must consider when writing NPDES permits.

Ecology determined the effluent may contain chemicals of concern for human health based on data or information indicating the discharge contains regulated chemicals.

Ecology evaluated the discharge's potential to cause or contribute to an excursion of the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the:

- EPA Publication PB91-127415, **Technical Support Document for Water Quality Based Toxics Control,** available online at https://www3.epa.gov/npdes/pubs/owm0264.pdf
- Ecology's Permit Writer's Manual available online at https://apps.ecology.wa.gov/publications/documents/92109.pdf.

The evaluation showed that for antimony, chloroform, copper, iron, manganese, nickel, and radium 226+228 have no reasonable potential to cause or contribute to a violation of water quality standards, and an effluent limit is not needed.

Arsenic - In 1992, EPA adopted risk-based inorganic arsenic criteria for the protection of human health for the State of Washington of 0.018 µg/L, based on exposure from fish and shellfish tissue and water ingestion. In 2015, the State proposed revised human health based criteria for total arsenic of 10 µg/L based on the drinking water maximum contaminant level (MCL).

Ultimately, EPA disapproved the State's proposed arsenic criteria of 10 µg/L of total arsenic. EPA, in 40 CFR Part 131.45, promulgated a human health criteria value of 0.018 µg/L of inorganic arsenic, unchanged from the 1992 criteria.

This criteria differs from the drinking water maximum contaminant level (MCL) of 10 µg/L of total arsenic. In addition, natural background concentrations of arsenic in surface and groundwater often exceeds the human health criteria value.

NPDES-approved analytical test methods for arsenic listed in 40 CFR Part 136 measure only the total recoverable portion of metal, and not the inorganic portion. Without an approved analytical method for measuring inorganic arsenic, or an approved translator for determining inorganic-to-total recoverable arsenic ratios, Ecology is unable to determine an effluent limitation for discharges to surface waters.

In their approval/disapproval of Washington's Human Health Water Quality Criteria, located online at https://www.epa.gov/sites/production/files/2017-10/documents/wawqs-letter-11152016.pdf, EPA states that the federal agency intended to conduct a toxicological review of inorganic arsenic in 2017.

However, EPA has not completed this task. The proposed permit requires routine monitoring for total arsenic in the final effluent to support effluent limit decisions for arsenic when the regulatory issues with the human health-based criteria are resolved.

Total PCBs – Ecology has determined that the discharge has a reasonable potential to contribute to excursions above the water quality standards for PCBs. This determination is based on the presence of PCBs in the effluent and the 303(d) listing for PCBs in fish tissue in the Spokane River at the point of discharge.

Because of the reasonable potential determination, federal regulations in CFR Part 122.44(d) require this permit contains water quality-based limits to control PCBs. The proposed permit will include an end of pipe limit based on the human health criterion of 170 pg/L.

Federal regulations in 40 CFR Part 122.44(k)(4) also allow the use of best management practices (BMPs) to control or abate the discharge of pollutants when the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the Clean Water Act.

BMPs are the actions identified to manage, prevent contamination of, and treat wastewater discharges. BMPs include schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural, and/or managerial practices to prevent or reduce the pollution of waters of the state. BMPs also include treatment systems, operating procedures, and practices used to control plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage.

The proposed permit will include BMPs and other measures intended to control and abate PCBs discharged to the Spokane River as a PCB pollutant minimization plan (PMP).

The proposed permit will require that the PCB PMP include the following:

- Purchasing standards that require elimination/substitution of products that may contribute PCBs to the final discharge.
- BMPs used to prevent contributions of PCBs to the final discharge during site demolition and remodeling work.

The proposed permit also continues the comprehensive approach towards addressing point and nonpoint sources of PCBs in the Spokane River through the Spokane River Regional Toxics Task Force (Task Force). The goal of the Task Force is to develop and implement a comprehensive plan to bring the Spokane River into compliance with applicable water quality standards for PCBs.

In October 2011, the Sierra Club brought a citizen suit under provisions of the Clean Water Act against EPA (Sierra Club, et al. v. McLerran, No. 11-CV-1759-BJR), claiming EPA failed to perform a nondiscretionary duty of establishing a TMDL for PCBs in the Spokane River. In an Order issued by the U.S. District Court on March 16, 2015, the Court directed EPA to consult with Ecology and file a schedule for measuring and completing the work of the Task Force, including quantifiable benchmarks, plans for acquiring missing scientific information, deadlines for completed scientific studies, concrete permitting recommendations for the interim, specific standards upon which to judge the Task Force's effectiveness, and a definite endpoint at which time Ecology must pursue and finalize its TMDL.

EPA submitted its Plan for Addressing PCBs in the Spokane River (http://srrttf.org/wp-content/uploads/2015/07/EPA-plan-for-PCBs-in-response-to-court-order.pdf) to the Court on July 14, 2015. EPA's plan included a December 15, 2020, date for meeting an instream concentration of PCBs in the Spokane River of 200 pg/L; and a December 15, 2024, date for meeting an instream concentration of PCBs of 170 pg/L. In October 2020, the Sierra Club moved to amend its complaint to challenge EPA's plan and to renew its claim that EPA had a nondiscretionary duty to develop a TMDL for PCBs in the Spokane River. EPA is now seeking public input on a proposed consent decree with the plaintiffs to settle this litigation, with an EPA obligation to issue a TMDLs for PCBs by a deadline of September 30, 2024 for PCB-impaired waters in the Spokane River, the Little Spokane River, and Lake Spokane (Long Lake).

EPA's Plan includes BMP and monitoring recommendations for point sources discharging into the Spokane River. The proposed permit includes recommendations applicable to IEP with the following qualifications:

- EPA recommended that the permits require receiving water monitoring for PCB congeners upstream and downstream of the outfalls using EPA Method 1668C at a frequency adequate to assess both high and low river flow conditions. Since the Task Force has characterized PCB concentrations in the river at both high and low flow conditions, the proposed permit does not include this additional monitoring.
- EPA also recommended that Ecology should analyze available effluent TSS and PCB data to determine if effluent TSS and PCB concentrations are positively correlated. If so, permits should establish all known, available, and reasonable treatment (AKART) or performance-based effluent limits for TSS. AKART or performance-based TSS limits should be re-evaluated following completion and optimization of tertiary filtration.

IEP has installed a tertiary filtration system in order to meet its water quality-based effluent limits for total phosphorus, $CBOD_5$, and ammonia. However, system optimizing is ongoing. Ecology will delay an analysis of effluent PCB and TSS data until sufficient effluent data is available from the system. This analysis will likely occur at the next permit renewal.

The proposed permit includes specific tasks for the Permittee to pursue from the 2016 Comprehensive Plan to Reduce Polychlorinated Biphenyls (PCBs) in the Spokane River (Comprehensive Plan). These tasks consist of regulatory reform of the Federal Toxic Substances Control Act (TSCA) and the Food and Drug Administration's (FDA) food packaging regulations to:

- revisit currently allowed concentration of PCBs in chemical processes
- eliminate or reduce the creation of inadvertently generated PCBs
- reassess the current use authorizations for PCBs.

PBDEs – Ecology could not determine reasonable potential for PBDEs because of a lack of effluent data. Based on the industry type, Ecology believes the potential for PBDEs to be present in the discharge is low. Ecology will require IEP to submit PBDE effluent data with the next permit renewal application.

Methylmercury – The human health based criteria for methylmercury is expressed as a concentration in fish tissue. At this time, Ecology has not calculated a water column translation of the fish tissue criterion nor are site-specific data available to calculate a translator. Based on the lack of a translator, it is infeasible to calculate a numeric WQBEL.

EPA and Ecology have both developed guidance in implementing water quality criteria for methylmercury (EPA 2010 and Ecology 2018). EPA and Ecology recommend using effluent concentrations of total mercury as an indicator to determine whether reasonable potential exists for methylmercury in fish tissue. Where reasonable potential exists, a narrative permit limitation approach is taken with requirements to develop, implement, and track BMPs to minimize the discharge of mercury to surface waters.

Reasonable potential for methylmercury is determined by assessing whether total mercury effluent concentrations exceed the chronic aquatic life-based criteria for mercury. Because the discharge occurs in a 303(d) listed waterbody for methylmercury, the point of compliance applies at the end of pipe. Based on the effluent sample results for total mercury, the discharge will not have a reasonable potential to exceed human health criteria for methylmercury (the discharge meets the chronic aquatic life-based criteria at the end of pipe).

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).

Additional information about sediments is available online at the Aquatic Lands Cleanup Unit webpage at https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Sediment-cleanups.

The Spokane River in the vicinity of the discharge is not an area of sediment deposition. However, depositional areas do occur downstream from the Permittee behind Upriver Dam. PCB deposits in river-bottom sediments behind Upriver Dam were investigated and cleaned up from 2003 to 2007 in accordance with a consent decree Ecology entered into with Avista Development, Inc. (Avista) and Kaiser Aluminum Washington, LLC.

Because sediment deposition does not occur near the outfall, Ecology believes the potential for this discharge to cause a violation of sediment quality standards is low. If, in the future, Ecology determines a potential for violation of the sediment quality standards, Ecology may issue an order requiring IEP to demonstrate either:

- The point of discharge is not an area of deposition, or
- Toxics do not accumulate in the sediments even though the point of discharge is a depositional area.

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 with 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.

Laboratories accredited by Ecology for WET testing know how to use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format.

Accredited laboratory staff know about WET testing and how to calculate an NOEC, LC50, EC50, IC25, etc. Ecology gives all accredited labs the most recent version of Ecology Publication No. WQ-R-95-80, **Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria (**https://fortress.wa.gov/ecy/publications/documents/9580.pdf), which is referenced in the permit. Ecology recommends that IEP send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted for submittal with the 2021 permit renewal application showed no reasonable potential for effluent discharges to cause receiving water acute or chronic toxicity. The proposed permit will not include an acute or chronic WET limit. IEP must retest the effluent before submitting an application for permit renewal.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization. IEP may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing and/or chemical analyses after the process or material changes have been made. Ecology recommends that the Permittee check with it first to make sure that Ecology will consider the demonstration adequate to support a decision to not require an additional effluent characterization.
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

J. Comparison of effluent limits with the previous permit issued on September 29, 2011

Ecology used the end-of-pipe limits for cadmium calculated using a 10^{th} percentile hardness value of 132.5 mg/L as $CaCO_3$, because they were more restrictive than the limits calculated in the previous permit.

Table 26: Comparison of Previous and Proposed Effluent Limits: Year-Round

Parameter	Basis of Limit	Previous Average Monthly	Previous Daily Maximum	Proposed Average Monthly	Proposed Daily Maximum
TSS, lbs/day	Technology	4,525	8,450	1,149	2,367
Total Zinc, µg/L	Water Quality	203	296	126.5	145.4

Parameter	Basis of Limit	Previous Average Monthly	Previous Daily Maximum	Proposed Average Monthly	Proposed Daily Maximum
Total Lead, µg/L	Water Quality	20.0	29.1	3.18	4.58
Total Cadmium, µg/L	Water Quality	2.8	4.1	1.5	2.3
Total PCBs, pg/L	Water Quality	narrative	narrative	170	248

Table 27: Comparison of Previous and Proposed Effluent Limits pH: Year-Round

Parameter	Basis of Limit	Previous Limit	Proposed Limit
pH	Water Quality Technology	within the range 5.0 to 9.0	within the range 6.6 to 9.0

Table 28: Comparison of Previous and Proposed Effluent Limits: March – October

Parameter	Basis of Limit	Previous Average Monthly	Previous Daily Maximum	Proposed Average Monthly	Proposed Daily Average
BOD_5, lbs/day	Technology	1,101	1,555	-	-
$CBOD_5$, lbs/day	Technology	-	-	334.3	481.4
TSS, lbs/day	Technology	4,525	8,450	1,149	2,367
Total Phosphorus (as P), lbs/day	Technology	24.7	49.7	16.3 [a]	35.7 [a]

Footnote for Table 28: Comparison of Previous and Proposed Effluent Limits: March – October

[a] Applies from February - October

Table 29: Comparison of Previous and Proposed Effluent Limits: March - October

Parameter	Basis of Limit	Previous Average Monthly	Previous Daily Maximum	Proposed Seasonal Average
Ammonia, lbs/day	Water-Quality	narrative	narrative	24.29 March-October

Table 30: Comparison of Previous and Proposed Effluent Limits: November - February

Parameter	Basis of Limit	Previous Average Monthly	Previous Daily Maximum	Proposed Average Monthly	Proposed Daily Average
BOD_5, lbs/day	Technology	3,530	6,655	1,138	1,872
TSS, lbs/day	Technology	6,392	12,070	1,149	2,367

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. Prior to the proposed permit development, Ecology had preliminary discussions with IEP regarding the addition of monitoring at the two internal outfalls described in Section A, below.

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

A. Treated process wastewater, non-contact cooling water, and final effluent monitoring

As described previously, an average treated process wastewater flow of about 3.0 million gallons mixes with about 3.6 million gallons per day of non-contact cooling water prior to discharge into the Spokane River via Outfall 001. At times, the dilution of pollutants from the combination of process wastewater and non-contact cooling water results in concentrations below detection levels of the approved analytical methods.

The proposed permit specifies monitoring at Outfall 003 (treated process wastewater prior to mixing with non-contact cooling water) for the technology-based limits of BOD_5 and TSS. The proposed permit specifies reporting of the sum of pollutant loads from Outfalls 003 (treated process wastewater) and 004 (non-contact cooling water) for waste load applications from the Spokane River and Lake Spokane DO TMDL (ammonia, $CBOD_5$, and total phosphorus). The remaining regulated pollutants (pH, cadmium, lead, zinc, and total PCBs) will be measured and reported at Outfall 001 (combined discharge to the Spokane River).

The proposed permit requires IEP to conduct monitoring at Outfall 001 for polybrominated diphenyl ethers (PBDEs) and submit the data with the next permit renewal application. The candidate 2018 303(d) list includes PBDEs in fish tissue in the reach of the river that includes the discharge location.

The monitoring schedule is detailed in the proposed permit under Special Condition S.2. 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.

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 laboratory at this facility for the following:

Table 31: Accredited Parameters

Parameter Name	Category	Method Name	Matrix Description
Hardness, Total (as CaCO3)	General Chemistry	SM 2340 C-2011	Non-Potable Water
Solids, Total Suspended	General Chemistry	SM 2540 D-2011	Non-Potable Water
pH	General Chemistry	SM 4500-H+ B-2011	Non-Potable Water
Ammonia	General Chemistry	SM 4500-NH3 F-2011	Non-Potable Water
Orthophosphate	General Chemistry	SM 4500-P E-2011	Non-Potable Water
Phosphorus, Total	General Chemistry	SM 4500-P E-2011	Non-Potable Water
Biochemical Oxygen Demand (BOD_5)	General Chemistry	SM 5210 B-2011	Non-Potable Water
Carbonaceous BOD_5 ($CBOD_5$)	General Chemistry	SM 5210 B-2011	Non-Potable Water

For sampling under the previous permit issued in 2011, the Permittee sent samples to an accredited third party laboratory for metals (cadmium, lead, and zinc) and total PCB analysis.

C. Effluent limits which are near detection or quantitation levels

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

D. Total PCB analytical methods

The selection of the appropriate method for a wastewater PCB analysis relates to the anticipated concentration of the toxin in the sample. Method 608.3, approved by the EPA (40 CFR Part 136) has much higher detection and quantitation limits, DL and QL, respectively, than Method 1668. Method 1668 has not been approved by the EPA for compliance with effluent limits set in NPDES permits.

A comparison between DLs and QLs for Methods 608.3 and 1668 can be found below:

Table 32: EPA Method Comparison

EPA Method/Criteria	Analyte	DL (µg/L)	QL (µg/L)
608.3	Aroclors	0.065	0.195
1668	Congeners	0.00005	0.0001
Human Health Criteria	Sum Total	0.000170	0.000170

Ecology has specified Method 1668 to evaluate BMP effectiveness in this proposed permit to ensure the return of usable data. Method 1668 results will enable Ecology to continue to determine the effectiveness of the BMPs related to reduction of toxicant loading to the Spokane River. DLs and QLs for Method 1668 are much lower than Method 608.3 (see Table 30, above).

Ecology's Water Quality Program guidance regarding appropriate use of Method 1668 is summarized below. These conclusions support Ecology's decision to include this method for the purpose of BMP effectiveness monitoring in the proposed permit.

Method 1668, a very sensitive analytical method, has the capability of detecting 209 different PCB congeners. Costs for this analysis are higher than Method 608.3.

Water quality standards are based on Total PCBs (the sum of all Arochlors, isomers, homologs, or congeners), and have most frequently been measured as a calculated sum of all or a select group of Aroclors found in a sample. The data generated by Method 1668 is more complex and extensive than data generated by other methods (608.3 and 8082), and must be carefully managed, assessed and applied.

Data produced from this method must be used in a documented and consistent manner with procedures (e.g., blank correction, calculating total PCBs) specific to the level of certainty required in decision-making. Because these data could be used as the basis for effluent limits, to measure attainment of water quality standards, and other critical measures, the QA/QC must be rigorous.

For example, when PCB concentrations are very low, background contamination in laboratory blanks may interfere with the calculation of total PCB. To address this, a process known as censoring or blank correction is often applied. The choice of a censoring technique is specific to data and project needs and should be spelled out in a Quality Assurance Project Plan (QAPP). The most commonly used technique is described in EPA's National Functional Guidelines for the Contract Laboratory Program and is available online at https://www.epa.gov/clp/superfund-clp-national-functional-guidelines-data-review.

Method 1668 is not currently approved by EPA under 40 CFR Part 136 for compliance with effluent limits set in NPDES permits. Ecology will continue to use the most sensitive methods approved by EPA to evaluate compliance with numeric effluent limits.

This permit will require the use of Method 608.3 for compliance with numeric effluent limits as follows:

1. **Required monitoring to complete a permit application** – Use only 40 CFR Part 136 methods. 40 CFR 122.21(e)(3) says the application shall not be considered complete unless 40 CFR Part 136 approved methods are used.
2. **Evaluating compliance with numeric effluent limits** – Use only 40 CFR part 136 methods. This is currently Method 608. 40 CFR 122.44(i)(1) specifically requires monitoring to assure compliance with permit limitations according to Part 136 approved methods.

However, Ecology will also use data from Method 1668 in targeted situations as described below. In this permit, Ecology used results from EPA Method 1668 to evaluate reasonable potential and has specified using EPA Method 1668 to evaluate the effectiveness of best management practices.

1. **Evaluating reasonable potential** - Use all valid and applicable data, including data collected using methods not approved under 40 CFR Part 136 (e.g. Method 1668).

   EPA's **Technical Support Document (TSD), Section 3.2** supports the use of all available information when evaluating reasonable potential, including available data, and in some cases the lack of data.

2. **Calculating numeric effluent limits** - Use all valid and applicable data, including data collected using methods not approved under 40 CFR Part 136 (e.g. Method 1668). If valid data collected using a more sensitive, but non-Part 136, method make it feasible to calculate limits, those data should be used to calculate the numeric effluent limit.

   Effluent limits are required when there is reasonable potential (RP). Numeric effluent limits are required where it is feasible to calculate them.

3. **Conducting analysis for All Known Available and Reasonable Technology (AKART)** - Use methods appropriate for the facility.
   a) As a toxic pollutant, PCBs are subject to WAC 173-220-130 and RCW 90.48.520, which requires the application of all known, available, and reasonable methods to control toxicants in the applicant's wastewater (also known as AKART).
   b) Methods of control for PCBs may include, but are not limited to, treatment technology, source control, or best management practices.
   c) A general discussion about AKART and how it is applied in wastewater discharge permits is provided in Section 3 of Chapter 4 in Ecology's **Water Quality Program Permit Writer's Manual.**
   d) For the purposes of applying AKART, Method 1668 may be required where identification of sources based on congener profile is required, or where expected concentrations are below analytical levels achievable by 608, and where treatment to lower levels is found to be reasonable. Site specific factors must be considered when choosing the appropriate test method.

4. **Evaluating effectiveness of best management practices** - Use methods appropriate for evaluating the effectiveness of the best management practice (BMP).

   PCB analytical method selection will depend on expected concentrations in the sampled media, the BMPs required or selected, and the potential sources of PCBs on and to the site.

   For example:

   - A PCB Aroclor Method (608 or 8082) would typically be used where it is sufficiently sensitive to evaluate the effectiveness of the BMP. For example, a source tracing program aimed at finding and addressing PCB sources at individual properties based on PCB concentrations in catch basin solids which are routinely detectable using Method 8082.
   - Method 1668 would typically be used for source identification when the potential sources are likely to have different congener profiles. Where the sources of PCBs on an individual property are not known, PCB congener data may be useful in identifying sources on and to the site.
   - Method 1668 would typically be used when expected concentrations are below analytical levels achievable by an Aroclor method (608 or 8082). The congener method (1668) is needed to characterize influent or effluent or ambient water quality where PCBs are expected to be below 0.016 ug/L. These data may be used to evaluate trends over time and to quantify reductions in influent, effluent and/or receiving waters.

Other Permit Conditions

A. Compliance schedule

The proposed permit includes an extension of the compliance schedule for meeting final water quality based effluent limits for $CBOD_5$ and total phosphorus.

Table 33: Proposed Compliance Schedule

Item	Task	Compliance Date
1	Annual Status Reports on Actions Taken and Progress Meeting the Final Water Quality Based Effluent Limits for $CBOD_5$ and total phosphorus	November 1 of each year
2	Meet Final Water Quality Based Effluent Limits for CBOD5 and total phosphorus	Beginning with the 2024 Compliance Seasons

B. Reporting and record keeping

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

C. Non routine and unanticipated wastewater

Occasionally, this facility may generate wastewater which was not characterized in the permit application because it is not a routine discharge and was not anticipated at the time of application. These wastes typically consist of waters used to pressure-test storage tanks or fire water systems or of leaks from drinking water systems.

The permit authorizes the discharge of non-routine and unanticipated wastewater under certain conditions. The facility must characterize these waste waters for pollutants and examine the opportunities for reuse. Depending on the nature and extent of pollutants in this wastewater and on any opportunities for reuse, Ecology may:

- Authorize the facility to discharge the wastewater.
- Require the facility to treat the wastewater.
- Require the facility to reuse the wastewater.

D. Spill plan

This facility stores a quantity of chemicals on-site that have the potential to cause water pollution if accidentally released. Ecology can require a facility to develop best management plans to prevent this accidental release:

- Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) https://www.epa.gov/cwa-404/clean-water-act-section-402-national-pollutant-discharge-elimination-system
- RCW 90.48.080 Discharge of polluting matter in waters prohibited https://app.leg.wa.gov/RCW/default.aspx?cite=90.48.080

IEP developed a plan for preventing the accidental release of pollutants to state waters and for minimizing damages if such a spill occurs. The proposed permit requires the facility to update this plan and submit it to Ecology.

E. Solid waste control plan

IEP could cause pollution of the waters of the state through inappropriate disposal of solid waste or through the release of leachate from solid waste.

This proposed permit requires this facility to update the solid waste control plan designed to prevent solid waste from causing pollution of waters of the state. The facility must submit the updated plan to Ecology for approval (RCW 90.48.080). You can obtain an Ecology guidance document, which describes how to develop a Solid Waste Control Plan at https://fortress.wa.gov/ecy/publications/documents/0710024.pdf.

F. Operation and maintenance manual

Ecology requires industries to take all reasonable steps to properly operate and maintain their wastewater treatment system in accordance with state and federal regulations [40 CFR 122.41(e) and WAC 173-220-150 (1)(g)].

The facility has prepared and submitted an operation and maintenance manual as required by state regulation for the construction of wastewater treatment facilities (WAC 173-240-150). Implementation of the procedures in the operation and maintenance manual ensures the facility's compliance with the terms and limits in the permit.

G. General conditions

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

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, after obtaining 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 includes all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of five years.

References for Text and Appendices

Environmental Protection Agency (EPA)

1992. National Toxics Rule. Federal Register, V. 57, No. 246, Tuesday, December 22, 1992.

1991. Technical Support Document for Water Quality-based Toxics Control. EPA/505/2-90-001.

1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington, D.C.

1985. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water. EPA/600/6-85/002a.

1983. Water Quality Standards Handbook**.** USEPA Office of Water, Washington, D.C. Tsivoglou, E.C., and J.R. Wallace.

1972. Characterization of Stream Reaeration Capacity. EPA-R3-72-012. (Cited in EPA 1985 op.cit.)

1979. In-stream Deoxygenation Rate Prediction. Journal Environmental Engineering Division, ASCE. 105(EE2). (Cited in EPA 1985 op.cit.)

Washington State Department of Ecology

July 2018. Permit Writer's Manual. Publication Number 92-109 (https://apps.ecology.wa.gov/publications/summarypages/92109.html)

September 2011. Water Quality Program Guidance Manual – Supplemental Guidance on Implementing Tier II Antidegradation. Publication Number 11-10-073 (https://apps.ecology.wa.gov/publications/SummaryPages/1110073.html)

October 2010 (revised). Water Quality Program Guidance Manual – Procedures to Implement the State's Temperature Standards through NPDES Permits. Publication Number 06-10-100 (https://apps.ecology.wa.gov/publications/documents/0610100.pdf)

February 2007. Focus Sheet on Solid Waste Control Plan, Developing a Solid Waste Control Plan for Industrial Wastewater Discharge Permittees, Publication Number 07-10-024. (https://apps.ecology.wa.gov/publications/SummaryPages/0710024.html)

Laws and Regulations (http://leg.wa.gov/LawsAndAgencyRules/Pages/default.aspx)

Permit and Wastewater Related Information (https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance)

Appendix A - Public Involvement Information

Ecology proposes to reissue a permit to Inland Empire Paper Company. 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 Application on April 22, 2021 and April 29, 2021 in the Spokesman Review to inform the public about the submitted application and to invite comment on the reissuance of this permit.

Ecology will place a Public Notice of Draft on March 4, 2022 in the Spokesman Review to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice:

- Tells where copies of the draft Permit and Fact Sheet are available for public evaluation (a local public library, the closest Regional or Field Office, posted on our website).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period
- Tells how to request a public hearing of comments about the proposed NPDES permit.
- Explains the next step(s) in the permitting process.

For frequently asked questions about public comments, Ecology Publication #03-07-023, **Effective Public Commenting,** is available on our website at https://apps.ecology.wa.gov/publications/documents/0307023.pdf.

For more information, call the Department of Ecology Eastern Regional Office at (509) 329-3400 or visit Ecology's webpage at www.ecy.wa.gov.

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.

Table 34: 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 RCW 90.48.520, 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.

Annual average design flow (AADF) – average of the daily flow volumes anticipated to occur over a calendar year.

Average monthly (intermittent) discharge limit – The average of the measured values obtained over a calendar months' time taking into account zero discharge days.

Average monthly discharge limit – The average of the measured values obtained over a calendar months' 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: plant 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.

Categorical pretreatment standards – National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

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.

Compliance inspection-without sampling – A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance inspection-with sampling – A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

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).

Construction activity – Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

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%.

Distribution uniformity – The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value – The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit – The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a groundwater criterion will not be exceeded and that background water quality will be protected.

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 WAC 173-240-130.

Enterococci – A subgroup of fecal streptococci that includes *S. faecalis, S. faecium, S. gallinarum,* and *S. avium.* The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10°C and 45°C.

E. coli – A bacterium in the family Enterobacteriaceae named Escherichia coli and is a common inhabitant of the intestinal tract of warm-blooded animals, and its presence in water samples is an indication of fecal pollution and the possible presence of enteric pathogens.

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.

Groundwater – Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

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 stormwater 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.

Major facility – A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

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 Detection Limit.

Minor facility -- A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

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 (https://www.epa.gov/cwa-404/clean-water-act-section-402-national-pollutant-discharge-elimination-system) 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.

Peak hour design flow (PHDF) – The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak instantaneous design flow (PIDF) – The maximum anticipated instantaneous flow.

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 plant 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 and 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 or contribute to 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).

Sample Maximum – No sample may exceed this value.

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 plant; 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.

Soil scientist – An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5,3,or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

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.

Soluble BOD_5 – Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

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 stormwater 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 - 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 in the PermitCalc workbook on Ecology's webpage at: https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance.

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 (C_{mz}) is based on the following calculation:

$$C_{mz} = Ca + \frac{(Ce - Ca)}{DF}$$

where: Ce = Effluent Concentration
Ca = Ambient Concentration
DF = Dilution Factor

Reasonable Potential Analysis:

The spreadsheets Input 2 – Reasonable Potential, and LimitCalc in Ecology's PermitCalc Workbook determine reasonable potential (to violate the aquatic life and human health water quality standards) and calculate effluent limits. The process and formulas for determining reasonable potential and effluent limits in these spreadsheets are taken directly from the Technical Support Document for Water Quality-based Toxics Control, (EPA 505/2-90-001) located online at https://www3.epa.gov/npdes/pubs/owm0264.pdf. 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 = (acute criteria x DF_a) – [(background conc. x (DF_a - 1)]

   WLA_c = (chronic criteria x DF_c) – [(background conc. x (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.

MDL=Maximum Daily Limit

$MDL = LTA x e^{(Z\sigma - 0.5\sigma^2)}$

where: $\sigma^2 = \ln[CV^2 + 1]$

z = 2.326 (99th percentile occurrence)

LTA = Limiting long term average

AML = Average Monthly Limit

$AML = LTA x\ e^{(Z\sigma_n - 0.5\sigma_n^2)}$

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

n = number of samples/month

z = 1.645 (95th % occurrence probability)

LTA = Limiting long term average

Reasonable Potential Spreadsheet; Part 1

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Inland Empire Paper Co
Receiving Water	Spokane River

Step 2: Enter Dilution Factors -OR- Calculate DFs by entering Facility/Receiving Water Flow Data

Do you want to enter dilution factors -or- flow data?	Flow Data

	Annual Average	Max Monthly Average	Daily Max
Facility Flow, MGD	7.47	7.67	8.49
Facility Flow, cfs (calculated)	11.56	11.87	13.13

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed	%Effluent	
Aquatic Life - Acute	7Q10	749	0.025	**2.4**	41.2	ACEC
Aquatic Life - Chronic	7Q10	749	0.25	**16.8**	6.0	CCEC
HH-Non-Carcinogen	30Q5	892	0.25	**19.8**	5.1	
HH-Carcinogen	Harmonic Mean	2557	0.25	**56.3**	1.8	
Whole river at 7Q10	7Q10	749	1	**64.1**	1.6	

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25	19.2
pH, s.u.	9	7.9
Alkalinity, mg/L as CaCO3	100	55
Hardness, mg/L CaCO3	135.8	19.4
Salinity, psu		
Receiving water TSS, mg/L (leave blank if unknown)		
If TSS is annual data, enter 'A'; if from critical period, enter 'S'; If no TSS, leave blank		

Step 4: Specifiy if using 'Mixed' values for hardness, temperature, and pH

	Use 'Mixed Hardness' (Y/N)	Use 'Mixed Max Temp' (Y/N)	Use 'Mixed pH (Y/N)
	Y	Y	Y
Acute Zone Boundary	67.4	21.6	8.2
Chronic Zone Boundary	26.3	19.5	7.9
Whole river at 7Q10	21.2	19.3	7.9

Reasonable Potential Spreadsheet; Part 2

Reasonable Potential Calculation - Page 1

Facility	Inland Empire Paper Co
Water Body Type	Freshwater
Rec. Water Hardness	Acute=67.4, Chronic=26.3 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	2.4	16.8
Human Health Carcinogenic		56.3
Human Health Non-Carcinogenic		19.8

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ALUMINUM, total recoverable, pH 6.5-9.0 7429905	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	CHLOROFORM 67663 11V	COPPER - 744058 6M Hardness dependent	IRON 7439896	MANGANESE 7439965	METHYL CHLORIDE 74873 21V	MERCURY 7439976 8M	NICKEL - 7440020 9M - Dependent on hardness
Effluent Data	# of Samples (n)		122	1	1	1	1	1	1	1	1	1	1
	Coeff of Variation (Cv)		2.64	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		1.757	77	2.65	2.97	1.06	4.34	72.6	612	1.56	0.00567	2.05
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L		0.028	9		0.52		0.576	0			0.00236	0.39
	Geo Mean, ug/L				0		0	0.527	0	0		0.00116	0.227
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	3,811	750	-	360	-	11.73127	-	-	-	2.1	1013.57
		Chronic	1,044	87	-	190	-	3.629904	1000	-	-	0.012	50.8419
	WQ Criteria for Protection of Human Health, ug/L		-	-	12	-	260	1300	300	50	-	0.14	150
	Metal Criteria Translator, decimal	Acute	-	-	-	1	-	0.996	-	-	-	0.85	0.998
		Chronic	-	-	-	1	-	0.996	-	-	-	-	0.997
	Carcinogen?		N	N	N	Y	Y	N	N	N	-	N	N

Aquatic Life Reasonable Potential

			AMMONIA	ALUMINUM	ANTIMONY	ARSENIC	CHLOROFORM	COPPER	IRON	MANGANESE	METHYL CHLORIDE	MERCURY	NICKEL
Effluent percentile value			0.950	0.950		0.950		0.950	0.950			0.950	0.950
s	$s^2=\ln(CV^2+1)$		1.441	0.555		0.555		0.555	0.555			0.555	0.555
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.976	0.050		0.050		0.050	0.050			0.050	0.050
Multiplier			1.00	6.20		6.20		6.20	6.20			6.20	6.20
Max concentration (ug/L) at edge of…		Acute	1	202.028		7.894		11.383	185.497			0.014	5.457
		Chronic	0	36.902		1.586		2.138	26.813			0.004	1.122
Reasonable Potential? Limit Required?			**NO**	**NO**		**NO**		**NO**	**NO**			**NO**	**NO**

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		
LTA Coeff. Var. (CV), decimal		
Permit Limit Coeff. Var. (CV), decimal		
Waste Load Allocations, ug/L	Acute	
	Chronic	
Long Term Averages, ug/L	Acute	
	Chronic	
Limiting LTA, ug/L		
Metal Translator or 1?		
Average Monthly Limit (AML), ug/L		
Maximum Daily Limit (MDL), ug/L		

Human Health Reasonable Potential

		AMMONIA	ALUMINUM	ANTIMONY	ARSENIC	CHLOROFORM	COPPER	IRON	MANGANESE	METHYL CHLORIDE	MERCURY	NICKEL
s	$s^2=\ln(CV^2+1)$			0.554513		0.554513	0.554513	0.554513	0.55451		0.55451	0.55451
Pn	Pn=(1-confidence level)1/n			0.050		0.050	0.050	0.050	0.050		0.050	0.050
Multiplier				2.489527		2.489527	2.489527	2.489527	2.48953		2.48953	2.48953
Dilution Factor				19.794		56.31715	19.794	19.794	19.794		19.794	19.794
Max Conc. at edge of Chronic Zone, ug/L				0.333295		0.046858	1.0E+00	9.1E+00	76.9724		0.00181	0.47336
Reasonable Potential? Limit Required?				**NO**		**NO**	**NO**	**NO**	**YES**		**NO**	**NO**

Human Health Limit Calculation

	MANGANESE
# of Compliance Samples Expected per month	1
Average Monthly Effluent Limit, ug/L	**989.7**
Maximum Daily Effluent Limit, ug/L	**1443.79**

Reasonable Potential Spreadsheet; Part 3

Reasonable Potential Calculation - Page 2

Facility	Inland Empire Paper Co
Water Body Type	Freshwater
Rec. Water Hardness	Acute=67.4, Chronic=26.3 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	2.4	16.8
Human Health Carcinogenic		56.3
Human Health Non-Carcinogenic		19.8

Pollutant, CAS No. & NPDES Application Ref. No.			**RADIUM 226 & 228 (note: units are in pCi/L)**										
Effluent Data	# of Samples (n)		1										
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		4.13										
	Calculated 50th percentile Effluent Conc. (when n>10)												
Receiving Water Data	90th Percentile Conc., ug/L												
	Geo Mean, ug/L		0										
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	-										
		Chronic	-										
	WQ Criteria for Protection of Human Health, ug/L		5										
	Metal Criteria Translator, decimal	Acute	-										
		Chronic	-										
	Carcinogen?		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?			

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		
LTA Coeff. Var. (CV), decimal		
Permit Limit Coeff. Var. (CV), decimal		
Waste Load Allocations, ug/L	Acute	
	Chronic	
Long Term Averages, ug/L	Acute	
	Chronic	
Limiting LTA, ug/L		
Metal Translator or 1?		
Average Monthly Limit (AML), ug/L		
Maximum Daily Limit (MDL), ug/L		

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.55451
Pn	Pn=(1-confidence level)1/n	0.050
Multiplier		2.48953
Dilution Factor		56.3172
Max Conc. at edge of Chronic Zone, ug/L		0.18257
Reasonable Potential? Limit Required?		**NO**

Human Health Limit Calculation

# of Compliance Samples Expected per month	
Average Monthly Effluent Limit, ug/L	
Maximum Daily Effluent Limit, ug/L	

Reasonable Potential Spreadsheet – No Mixing Zone; Part 1

Dilution Factor Calculations and Receiving Water Critical Conditions

Facility Name	Inland Empire Paper Co - No MZ
Receiving Water	Spokane River

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Step 2: Enter Dilution Factors -OR- Calculate DFs by entering Facility/Receiving Water Flow Data

Do you want to enter dilution factors -or- flow data?	Flow Data

	Annual Average	Max Monthly Average	Daily Max
Facility Flow, MGD	7.47	7.67	8.49
Facility Flow, cfs (calculated)	11.56	11.87	13.13

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed	%Effluent	
Aquatic Life - Acute	7Q10	749	0.025	1.0	100	ACEC
Aquatic Life - Chronic	7Q10	749	0.25	1.0	100	CCEC
HH-Non-Carcinogen	30Q5	892	0.25	1.0	100	
HH-Carcinogen	Harmonic Mean	2557	0.25	1.0	100	
Whole river at 7Q10	7Q10	749	1	1.0	100	

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25	19.2
pH, s.u.	9	7.9
Alkalinity, mg/L as CaCO3	100	55
Hardness, mg/L CaCO3	135.8	19.4
Salinity, psu		
Receiving water TSS, mg/L (leave blank if unknown)		
If TSS is annual data, enter 'A'; if from critical period, enter 'S'; If no TSS, leave blank		

Step 4: Specifiy if using 'Mixed' values for hardness, temperature, and pH

	Use 'Mixed Hardness' (Y/N)	Use 'Mixed Max Temp' (Y/N)	Use 'Mixed pH (Y/N)
	Y	Y	Y
Acute Zone Boundary	135.8	25.0	9.0
Chronic Zone Boundary	135.8	25.0	9.0
Whole river at 7Q10	135.8	25.0	9.0

Reasonable Potential Spreadsheet – No Mixing Zone; Part 2

Reasonable Potential Calculation

Facility	Inland Empire Paper Co - No MZ
Water Body Type	Freshwater
Rec. Water Hardness	Acute=135.8, Chronic=135.8 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	1.0	1.0
Human Health Carcinogenic		1.0
Human Health Non-Carcinogenic		1.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	CADMIUM - 7440439 4M Hardness dependent	LEAD - 7439921 7M Dependent on hardness	Polychlorinated Biphenyls (PCB's) 53469219, 11097691, 11104282, 11141165, 12672296, 11096825, 12674112 18P-24P	ZINC- 7440666 13M hardness dependent						
Effluent Data	# of Samples (n)		1	48	48	5	48						
	Coeff of Variation (Cv)		0.6	0.6	0.576	0.6	0.207	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)			500	500	0.00193	500						
	Calculated 50th percentile Effluent Conc. (when n>10)						250						
Receiving Water Data	90th Percentile Conc., ug/L			0.185	1.05		54						
	Geo Mean, ug/L					0.000078							
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	6,766	5.15791	89.96838	2	148.3241						
		Chronic	1,148	1.29261	3.505938	0.014	135.4424						
	WQ Criteria for Protection of Human Health, ug/L		-	-	-	0.00017	2300						
	Metal Criteria Translator, decimal	Acute	-	0.943	0.466	-	0.996						
		Chronic	-	0.943	0.466	-	0.996						
	Carcinogen?		N	N	N	Y	N						

Aquatic Life Reasonable Potential

			AMMONIA	CADMIUM	LEAD	PCBs	ZINC
Effluent percentile value			0.950	0.950	0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.535	0.555	0.205
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.050	0.939	0.939	0.549	0.939
Multiplier			6.20	1.00	1.00	2.32	1.00
Max concentration (ug/L) at edge of…		Acute	0	471.500	233.000	0.004	498.000
		Chronic	0	471.500	233.000	0.004	498.000
Reasonable Potential? Limit Required?			**NO**	**YES**	**YES**	**NO**	**YES**

Aquatic Life Limit Calculation

		AMMONIA	CADMIUM	LEAD	PCBs	ZINC
# of Compliance Samples Expected per month			1	1		1
LTA Coeff. Var. (CV), decimal			0.6	0.576		0.207
Permit Limit Coeff. Var. (CV), decimal			0.6	0.576		0.207
Waste Load Allocations, ug/L	Acute		5.15791	89.96838		148.3241
	Chronic		1.29261	3.505938		135.4424
Long Term Averages, ug/L	Acute		1.65612	29.89461		94.06044
	Chronic		0.68177	1.892146		107.1012
Limiting LTA, ug/L			0.68177	1.892146		94.06044
Metal Translator or 1?			0.943	0.466		1.00
Average Monthly Limit (AML), ug/L			**1.5**	**8.5**		**129.5**
Maximum Daily Limit (MDL), ug/L			**2.3**	**12.2**		**148.9**
	Ratio:		1.46	1.44		1.15

Human Health Reasonable Potential

		AMMONIA	CADMIUM	LEAD	PCBs	ZINC
s	$s^2=\ln(CV^2+1)$				0.554513	0.204833
Pn	Pn=(1-confidence level)1/n				0.549	0.939
Multiplier					0.9336323	0.72789
Dilution Factor					1	1
Max Conc. at edge of Chronic Zone, ug/L					0.0018019	250
Reasonable Potential? Limit Required?					**YES**	**NO**

Human Health Limit Calculation

	AMMONIA	CADMIUM	LEAD	PCBs	ZINC
# of Compliance Samples Expected per month				1	
Average Monthly Effluent Limit, ug/L				**0.00017**	
Maximum Daily Effluent Limit, ug/L				**0.000248**	

Reasonable Potential Spreadsheet – pH Calculations

INPUT					
	@ Acute Boundary	@ Chronic Boundary	@ Chronic Boundary	@ Chronic Boundary	@ Chronic Boundary
1. Dilution Factor at Mixing Zone Boundary	2.4	16.8	16.8	16.8	16.8
2. Ambient/Upstream/Background Conditions					
Temperature (deg C):	20.70	19.20	19.20	19.20	19.20
pH:	7.90	7.90	7.90	7.50	7.50
Alkalinity (mg CaCO3/L):	50.00	55.00	55.00	55.00	55.00
3. Effluent Characteristics					
Temperature (deg C):	25.00	25.00	25.00	25.00	25.00
pH:	7.20	**6.60**	9.00	6.20	9.00
Alkalinity (mg CaCO3/L):	100.00	100.00	100.00	100.00	100.00
4. Aquatic Life Use Designation	Other species (salmonid/redband trout/warmwater species)		Other species (salmonid/redband trout/warmwater species)		Other species (salmonid/redband trout/warmwater species)
OUTPUT					
1. Ionization Constants					
Upstream/Background pKa:	6.38	6.39	6.39	6.39	6.39
Effluent pKa:	6.35	6.35	6.35	6.35	6.35
2. Ionization Fractions					
Upstream/Background Ionization Fraction:	0.97	0.97	0.97	0.93	0.93
Effluent Ionization Fraction:	0.88	0.64	1.00	0.41	1.00
3. Total Inorganic Carbon					
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	52	57	57	59	59
Effluent Total Inorganic Carbon (mg CaCO3/L):	114	156	100	241	100
4. Condtions at Mixing Zone Boundary					
Temperature (deg C):	22.49	19.55	19.55	19.55	19.55
Alkalinity (mg CaCO3/L):	70.83	57.68	57.68	57.68	57.68
Total Inorganic Carbon (mg CaCO3/L):	77.59	62.62	59.28	70.08	61.69
pKa:	6.37	6.39	6.39	6.39	6.39
5. Allowable pH change	NA	0.50	0.50	0.50	0.50
RESULTS					
pH at Mixing Zone Boundary:	**7.39**	**7.45**	**7.94**	**7.05**	**7.54**
pH change at Mixing Zone Boundary:	0.51	0.45	0.04	0.45	0.04
Is permit limit needed?	NO	NO	NO	NO	NO

```
IEP Alkalinity - receiving water
[1] 60.6 42.1 71.6 99.7 78.3 72.5 66.0 76.4 70.0 65.6 56.9 54.8

quantile(iepAlks, c(0.10, 0.90))
  10%   90%
55.01 78.11
```

Receiving water alkalinities obtained from EIM sampling locations:
57A140 SPOKANE RIVER @ PLANTE'S FERRY PARK
KT-RIVER Spokane River at Pump House
Date range: 2011-10-26 to 2013-10-22
During low flow months of July - October

```
IEP pH - receiving water
[1] 7.72 7.36 7.62 7.79 7.51 7.80 7.58 8.14 7.92 7.92 7.83 7.94 7.95
7.47 7.84 7.62 7.64 7.68 7.64
[20] 7.76

quantile(ieppHs, c(0.10, 0.90))
  10%   90%
7.506 7.941
```

Receiving water pH obtained from EIM sampling locations:
57A140 SPOKANE RIVER @ PLANTE'S FERRY PARK
SRRTTF_SR7 SRRTTF_SR7
Date range: 2012-07-17 to 2016-10-26
During low flow months of July - October

Technology Based Effluent Limits Calculation

	NSPS Mechanical 40 CFR 430, Subpart G		NSPS Deink 40 CFR 430, Subpart I	
Parameter	Daily Max	Monthly Avg	Daily Max	Monthly Avg
BOD, lbs/1000 lbs of product	4.6	2.5	6.0	3.2
TSS, lbs/1,000 lbs of product	7.3	3.8	12.0	6.3

Production Summary*

NSPS Mechanical		NSPS Deink		Total	
Tons/day	lbs/day	Tons/day	lbs/day	Tons/day	lbs/day
431.8	863,668	123.3	246,505	555.1	1,110,173
77.8%		22.2%		100.0%	

Effluent Limit Calculation

	NSPS Mechanical		NSPS Deink		Total	
Parameter	Daily Max	Monthly Avg	Daily Max	Monthly Avg	Daily Max	Monthly Avg
BOD, lbs/day	3,973	2,159	1,479	789	5,452	2,948
TSS, lbs/day	6,305	3,282	2,958	1,553	9,263	4,835

* - Highest 12 consecutive month average production, September 2017 to August 2018

Appendix E – Bubble (Aggregate) Limit Calculations

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Memorandum

From: Dave Dilks, Scott Hinz
Date: February 8, 2020
Project: IEP3
To: Pat Hallinan
CC: Doug Krapas, IEP; Brent Downey, Kaiser

SUBJECT: DRAFT: CBOD Bubble Permit Calculation for IEP and Kaiser

Summary

IEP and Kaiser are interested in developing a bubble permit that combines the allowable loading of their CBOD and TP discharges for purposes of determining compliance with the dissolved oxygen (DO) TMDL. LimnoTech (2018) described the planned approach and included an example application for CBOD. The approach merges the bubble permit concept as described in the Spokane DO TMDL Toolbox (http://spokaneriver.net/initiatives/spokane-river-do-tmdl-implementation/do-tmdl-toolbox/) with EPA's test for compliance to determine if the DO impacts of an alternate loading scenario are consistent with the Spokane DO TMDL.

LimnoTech (2020) formally applied the approach to develop proposed bubble permit limits for TP. This memorandum formally applies that approach to develop bubble permit limits for CBOD. CE-QUAL-W2 model results indicate that each one pound increase in IEP CBOD5 loading will require a 4.247 pound decrease in Kaiser loading, while a one pound decrease in IEP CBOD5 loading will allow for a 2.99 pound increase in Kaiser loading. The differences between these "trading ratios" is due to a factor of safety that ensures that the bubble permit will be protective of dissolved oxygen concentrations both as an average across Avista-affected segments/times, as well for individual Avista-affected segments/times for Kaiser load increases up to 25% and IEP load increases up to 30%.

CBOD Bubble Permit Calculations

This section applies the approach initially described in a preliminary manner (LimnoTech, 2018), and supplements it with additional model simulations, to demonstrate calculation of CBOD bubble permit values that are protective of dissolved oxygen when averaged across all Avista-affected segments and time periods, as well as individual Avista-affected segments and time periods. It is divided into separate discussions of:

- Results of loading sensitivity runs
- Protection of average DO
- Protection of segment/time Specific DO

Results of loading sensitivity runs

Four CBOD loads were assessed for each discharge, corresponding to a 25% and 50% reduction, and a 50% and 100% increase, of the current TMDL load. Tables B-1 and B-2 in Appendix B show incremental dissolved oxygen changes in each segment and time in response to these sensitivity runs. The change in dissolved oxygen concentrations averaged across all Avista-affected cells are displayed in Table 1 for these simulations.

Table 1. Results of Loading Sensitivity Runs for CBOD

Discharger (i)	Change from TMDL (%)	ΔL_i (lbs/day)	ΔDO_i (mg/L)
1. IEP	-50%	-61.6	+0.00911
1. IEP	-25%	-30.8	+0.00492
1. IEP	+50%	+61.6	-0.00746
1. IEP	+100%	+123.2	-0.01810
2. Kaiser	-50%	-231.5	+0.00732
2. Kaiser	-25%	-115.7	+0.00583
2. Kaiser	+50%	+231.4	-0.01285
2. Kaiser	+100%	+462.7	-0.02105

Linear regressions were developed between ΔDO_i and ΔL_i for each discharge. Regressions across all load sensitivities are shown in Figure 1 for IEP and Kaiser.

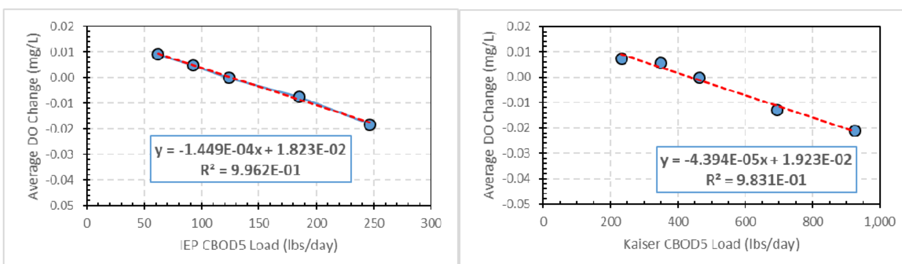

Figure 1. Linear Regressions for All CBOD Loading Sensitivity Runs

Following the same safety factor approach applied previously for the TP bubble permit calculations, separate slopes were developed for the decreased load sensitivity and increased load sensitivity runs. Consistent with the agreed-upon approach, separate regressions were derived for both the load decrease and load increase scenarios. The regressions forced a zero intercept with respect to the TDML (i.e. zero change from TMDL load results in zero effect on DO). The resulting regressions are shown in Figure 2 for load reductions and Figure 3 for load increases.

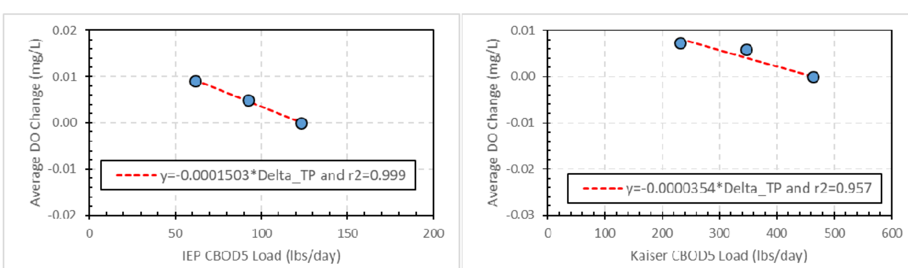

Figure 2. Linear Regressions for Decreased CBOD Loading Sensitivity Runs

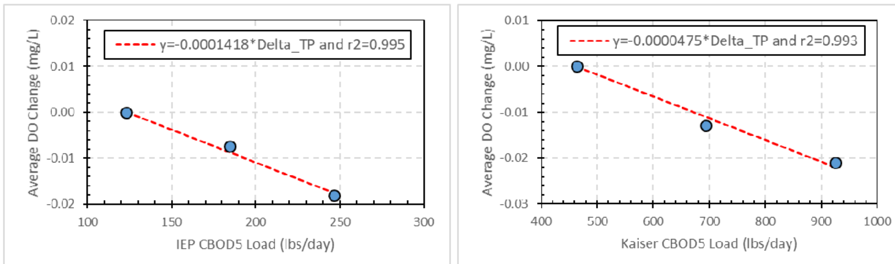

Figure 3. Linear Regression for Increased CBOD Loading Sensitivity Runs

The slopes from Figures 2 and 3 are contained in Table 2 to demonstrate how the bubble permit calculations could be applied to determine the required decrease in Kaiser CBOD5 load needed to offset a given increase in IEP load. An 10 lb/day increase in IEP CBOD5, multiplied by the most restrictive slope of -1.503E-04 (mg/l)/(lbs.day), results in an average dissolved oxygen decrease of -0.001503 mg/l. A decrease in Kaiser loading of 42.47 lb/day, multiplied by the most restrictive slope of -3.539E-05, results in an average dissolved oxygen increase 0.001503 mg/l, which offsets the IEP decrease. The ratio of 10 lb of IEP load increase being equivalent to 42.47 pounds of Kaiser load can also be expressed as 1 lb of IEP load increase being equivalent to 4.247 pounds of Kaiser load decrease.

Table 2. Example Compliance Table for the CBOD Bubble – IEP Increase

(1) Index (Discharge)	(2) Discharger	(3) Pollutant	(4) $IOEF_{i,j}$ Increase (mg/L)/(lb/day)	(5) $IOEF_{i,j}$ Decrease (mg/L)/(lb/day)	(6) Change from TMDL Load (lbs/day)	(7)* ΔDO (mg/L)
1	IEP	CBOD5	-1.418E-04	-1.503E-04	10	-0.001503
2	Kaiser	CBOD5	-4.750E-05	-3.539E-05	-42.47	0.001503
(positive number is in compliance, negative number is out of compliance)					Sum	0.0000

* If Column (6) change from TMDL Load is positive, Column (7) = Max[Column (4), Column (5)] x Column (6)
If Column (6) change from TMDL Load is negative, Column (7) = Min[Column (4), Column (5)] x Column (6)

Table 3 shows example calculations for an increase in Kaiser CBOD load. A 10 lb/day increase in Kaiser CBOD5, multiplied by the most restrictive slope of -4.750E-05, results in an average dissolved oxygen decrease of -4.750E-04. A decrease in IEP loading of 3.35 lb/day, multiplied by the most restrictive slope of -1.418E-04, results in an average dissolved oxygen increase of -4.750E-04 mg/l, which offsets the Kaiser decrease. The ratio of 10 lb of Kaiser load increase being equivalent to 3.35 pounds of IEP load decrease can also be expressed as 1 lb of IEP load decrease being equivalent to 2.99 pounds of Kaiser load increase (i.e. 10/3.35.)

Table 3. Example Compliance Table for the CBOD Bubble – Kaiser Increase

(1) Index (Discharge)	(2) Discharger	(3) Pollutant	(4) $IOEF_{i,j}$ Increase (mg/L)/(lb/day)	(5) $IOEF_{i,j}$ Decrease (mg/L)/(lb/day)	(6) Change from TMDL Load (lbs/day)	(7)* ΔDO (mg/L)
1	IEP	CBOD5	-1.418E-04	-1.503E-04	-3.35	-4.750E-04
2	Kaiser	CBOD5	-4.750E-05	-3.539E-05	10	-4.750E-04
(positive number is in compliance, negative number is out of compliance)					Sum	0.0000

* If Column (6) change from TMDL Load is positive, Column (7) = Max[Column (4), Column (5)] x Column (6)
If Column (6) change from TMDL Load is negative, Column (7) = Min[Column (4), Column (5)] x Column (6)

The results from Tables 2 and 3 show "trading ratios" (i.e. pounds of Kaiser load needed to offset a pound of IEP load) of 4.247:1 for IEP decreases and 2.99:1 for IEP increases that will be protective of Avista-averaged dissolved oxygen concentrations while considering a factor of safety. The magnitude of the safety factor inherent in these calculations can be estimated by considering the "best-fit" slopes shown previously in Figure 1. The effect of IEP loading on dissolved oxygen had a best-fit slope of -1.499E-04 (mg/L)/(lb/day), the effect of Kaiser loading on dissolved oxygen had a best-fit slope of -4.394E-05 (mg/L)/(lb/day). This indicates that a best fit trading ratio is approximately 3.41:1 (i.e. -1.499E-04 ÷ -4.394E-05), meaning that one pound of IEP load is equivalent to 3.41 pounds of Kaiser load. The proposed trading ratios of 2.99 for Kaiser increases, and 4.247:1 for IEP increases add a safety factor ranging from 14% (3.41:1 is 14% larger than 2.99:1) to 25% (4.247:1 is 25% larger than 3.41:1).

Protection of Segment/Time Specific DO

The ratios determined above were next applied to determine whether they were protective of dissolved oxygen in individual Avista-affected segments and time periods. The slopes used to calculate DO in each segment/time pair are presented in Tables B-3 and B-4 in Appendix B for IEP and Kaiser, respectively.

The metric of concern when evaluating TMDL equivalency for individual cells corresponds to whether there is a change in Avista responsibility in any cell, when rounded to nearest 0.1 mg/l. Because this metric does not behave in a directly linear fashion, a wide range of combinations of loads were tested to ensure that compliance will occur.

Table 4 shows the resulting calculations for IEP load increases. For a change in IEP load ranging from 1 to 30% of the existing TMDL (302 to 9,055 lb/season), the number of segment/time pairs with increased responsibility is always the same as the number of segment/time pairs with decreased responsibility, and the maximum DO decrease in any segment/time pair with increased responsibility is no greater than 0.0033 mg/l and within the error of the model.

Table 5 shows similar calculations for Kaiser load increases. For a change in Kaiser load ranging from 1 to 25% (1,134 to 28,341 lb/season), the number of segment/time pairs with increased responsibility is always the same as the number of segment/time pairs with decreased responsibility. The 30% Kaiser load increase resulted in there being one more segment/time pair with increased responsibility than the number of segment/time pairs with decreased responsibility The maximum DO decrease in any segment/time pair with increased responsibility is no greater than 0.0027 mg/l. These impacts are well within the error of the model.

Table 4. Demonstration of Protectiveness in Individual Segment/Time Pairs for a Range of IEP CBOD5 Load Increases

Change in IEP Load (%)	Increase in IEP Load (lbs/season)	Decrease in Kaiser Load (lbs/season)	No. of Avista Segment/time pairs		Maximum decrease in DO (mg/l)
			Increased responsibility	Decreased responsibility	
1	302	1,282	5	5	0.0001
2	604	2,564	5	5	0.0002
5	1,509	6,410	5	5	0.0006
10	3,018	12,819	5	5	0.0011
25	7,546	32,048	5	5	0.0027
30	9,055	38,457	5	5	0.0033

Table 5. Demonstration of Protectiveness in Individual Segment/Time Pairs for a Range of Kaiser CBOD5 Load Increases

Change in Kaiser Load (%)	Increase in Kaiser Load (lbs/season)	Decrease in IEP Load (lbs/season)	Responsibility Change - Number of Avista Segment/time pairs		Maximum decrease in DO (mg/l)
			Increased	Decreased	
1	1,134	380	5	5	0.0001
2	2,267	760	5	5	0.0002
5	5,668	1,899	5	5	0.0006
10	11,336	3,798	5	5	0.0012
25	28,341	9,496	5	5	0.0029
30	34,009	11,395	6	5	0.0035

These results indicate (for a range of IEP load increases up to 9,055 pounds per season, and a range of Kaiser load increases up to 28,341 pounds per season) that the safety factors used to calculate IOEF slopes protective of average DO across all Avista-affected segments and times are also protective of DO in individual Avista-affected segments and times. A bubble permit that reflects these slopes will be protective of the TMDL.

References

LimnoTech, 2020. DRAFT: TP Bubble Permit Calculation for IEP and Kaiser. January 22, 2020.

LimnoTech, 2018. DRAFT: Technical Methodology for Developing a Bubble Permit for IEP and Kaiser – CBOD Example. October, 7, 2018.

Washington Department of Ecology, 2010. Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load, Water Quality Improvement Report. Publication No. 07-10-073. Revised February 2010.

Washington Department of Ecology and U.S. EPA, 2011. Evaluation of Alternative Effluent Limits for Consistency with the Spokane River TMDL and Compliance with Washington Water Quality Standards. http://www.spokaneriver.net/wp-content/uploads/2012/04/Final_EPA_Ecology_Basis_for_Equivalence_2011_v3.pdf

Appendix A: Table 7 from TMDL

Table 7. TMDL Scenario #1 dissolved oxygen concentrations *(italics) are compared with No Source scenario concentrations (bold) for June 1 through September 15. Avista's responsibility (mg/L DO) for each segment is quantified in the shaded cells.*

Segment	June 1-15			June 15-30			July 1-15			July 16-31			Aug 1-15			Aug 16-31			Sept 1-15		
157	9.23	9.40	_	9.44	9.66	_	8.94	9.46	_	8.93	9.43	_	9.06	9.55	_	9.22	9.93	_	9.40	9.96	_
158	9.42	9.66	_	9.42	9.79	_	9.06	9.49	_	9.11	9.60	_	9.14	9.65	_	9.31	9.84	_	9.46	9.99	_
159	9.54	9.84	_	9.46	9.86	_	9.13	9.53	_	9.19	9.62	_	9.19	9.63	_	9.32	9.78	_	9.47	9.93	_
160	9.57	9.88	_	9.45	9.85	_	9.12	9.47	_	9.19	9.58	_	9.18	9.56	_	9.30	9.70	_	9.44	9.87	_
161	9.56	9.87	_	9.51	9.94	_	9.16	9.52	_	9.19	9.57	_	9.19	9.55	_	9.30	9.68	_	9.45	9.84	_
162	9.56	9.89	_	9.55	10.01	_	9.16	9.53	_	9.18	9.59	_	9.18	9.53	_	9.26	9.61	_	9.41	9.79	_
163	9.58	9.96	_	9.59	10.06	_	9.18	9.56	_	9.17	9.63	_	9.17	9.53	_	9.18	9.52	_	9.31	9.73	_
164	9.61	10.03	_	9.58	10.08	_	9.15	9.52	_	9.14	9.62	_	9.13	9.47	_	9.10	9.37	_	9.20	9.62	_
165	9.62	10.05	_	9.57	10.10	_	9.06	9.38	_	9.09	9.53	_	9.07	9.36	_	8.96	9.12	_	9.11	9.50	_
166	9.59	10.03	_	9.51	10.03	_	8.87	9.07	_	8.98	9.30	_	8.97	9.15	_	8.82	8.85	_	9.07	9.38	_
167	9.59	10.03	_	9.48	9.98	_	8.73	8.87	_	8.84	9.07	_	8.87	8.97	_	8.69	8.63	_	9.01	9.27	_
168	9.61	10.10	_	9.43	9.91	_	8.52	8.58	_	8.55	8.63	_	8.66	8.57	_	8.44	8.20	0.0	8.95	9.11	_
169	9.62	10.16	_	9.37	9.82	_	8.41	8.41	_	8.36	8.37	_	8.47	8.31	_	8.25	7.92	0.1	8.85	8.91	_
170	9.60	10.18	_	9.28	9.72	_	8.37	8.36	_	8.27	8.23	_	8.37	8.17	_	8.13	7.71	0.2	8.69	8.66	_
171	9.58	10.17	_	9.23	9.66	_	8.40	8.39	_	8.23	8.17	_	8.31	8.07	0.0	8.04	7.55	0.3	8.57	8.43	_
172	9.50	10.08	_	9.08	9.46	_	8.23	8.17	_	7.96	7.80	_	7.98	7.63	0.2	7.70	7.07	0.4	8.35	8.06	0.1
173	9.40	9.96	_	8.96	9.31	_	8.12	8.00	_	7.80	7.55	0.0	7.80	7.36	0.2	7.51	6.78	0.5	8.15	7.75	0.2
174	9.29	9.80	_	8.81	9.12	_	7.96	7.79	_	7.59	7.27	0.1	7.56	7.05	0.3	7.26	6.42	0.6	7.85	7.34	0.3
175	9.20	9.68	_	8.69	8.99	_	7.86	7.66	_	7.46	7.09	0.2	7.40	6.84	0.4	7.09	6.21	0.7	7.62	7.04	0.4
176	9.12	9.59	_	8.63	8.91	_	7.83	7.60	0.0	7.41	6.99	0.2	7.39	6.79	0.4	7.06	6.13	0.7	7.55	6.91	0.4
177	8.93	9.31	_	8.35	8.54	_	7.50	7.19	0.1	6.99	6.46	0.3	6.92	6.22	0.5	6.56	5.54	0.8	7.01	6.24	0.6
178	8.85	9.21	_	8.27	8.42	_	7.44	7.10	0.1	6.92	6.34	0.4	6.88	6.15	0.5	6.51	5.47	0.8	6.89	6.06	0.6
179	8.79	9.14	_	8.24	8.37	_	7.42	7.07	0.1	6.88	6.27	0.4	6.86	6.11	0.6	6.51	5.44	0.9	6.81	5.92	0.7
180	8.73	9.05	_	8.19	8.30	_	7.38	7.02	0.2	6.83	6.19	0.4	6.81	6.03	0.6	6.49	5.42	0.9	6.67	5.75	0.7
181	8.66	8.95	_	8.15	8.21	_	7.36	6.97	0.2	6.78	6.08	0.5	6.74	5.89	0.6	6.47	5.36	0.9	6.52	5.53	0.8
182	8.67	8.95	_	8.16	8.21	_	7.41	7.01	0.2	6.84	6.13	0.5	6.78	5.92	0.7	6.56	5.46	0.9	6.53	5.52	0.8
183	8.55	8.78	_	8.00	7.98	_	7.26	6.85	0.2	6.70	5.97	0.5	6.58	5.69	0.7	6.37	5.29	0.9	6.29	5.27	0.8
184	8.54	8.75	_	7.98	7.94	_	7.30	6.88	0.2	6.77	6.01	0.6	6.63	5.71	0.7	6.43	5.33	0.9	6.30	5.34	0.8
185	8.47	8.63	_	7.94	7.87	_	7.29	6.88	0.2	6.78	6.00	0.6	6.58	5.64	0.7	6.42	5.29	0.9	6.23	5.27	0.8
186	8.34	8.44	_	7.84	7.74	_	7.18	6.76	0.2	6.63	5.84	0.6	6.37	5.41	0.8	6.24	5.08	1.0	5.96	4.93	0.8
187	8.31	8.40	_	7.85	7.75	_	7.23	6.79	0.2	6.66	5.83	0.6	6.36	5.35	0.8	6.27	5.05	1.0	5.96	4.90	0.9
188	8.20	8.25	_	7.67	7.56	_	7.10	6.65	0.2	6.53	5.71	0.6	6.15	5.17	0.8	6.07	4.88	1.0	5.73	4.68	0.8

Table 7 (continued). TMDL Scenario #1 dissolved oxygen concentrations *(italics) are compared with No Source scenario concentrations (bold) for September 16 through December 31. Avista's responsibility (mg/L DO) for each segment is quantified in the shaded cells.*

Segment	Sept 16-30			Oct 1-15			Oct 16-31			Nov 1-15			Nov 16-30			Dec 1-15			Dec 16-31		
157	9.58	9.90	_	9.81	10.07	_	10.40	10.49	_	10.59	10.83	_	10.82	10.79	_	11.41	11.50	_			_
158	9.63	9.91	_	9.99	10.08	_	10.49	10.55	_	10.67	10.85	_	10.80	10.80	_	11.43	11.49	_	11.50	11.54	_
159	9.62	9.85	_	10.01	10.09	_	10.51	10.56	_	10.70	10.89	_	10.83	10.81	_	11.43	11.49	_	11.51	11.58	_
160	9.60	9.79	_	10.01	10.10	_	10.52	10.56	_	10.69	10.90	_	10.82	10.78	_	11.43	11.48	_	11.50	11.59	_
161	9.60	9.77	_	10.02	10.10	_	10.52	10.54	_	10.69	10.88	_	10.83	10.77	_	11.43	11.48	_	11.49	11.57	_
162	9.58	9.74	_	10.04	10.12	_	10.55	10.57	_	10.67	10.83	_	10.82	10.73	_	11.43	11.46	_	11.49	11.57	_
163	9.52	9.72	_	10.01	10.12	_	10.57	10.60	_	10.66	10.80	_	10.81	10.70	_	11.42	11.45	_	11.49	11.56	_
164	9.41	9.66	_	9.91	10.06	_	10.55	10.60	_	10.65	10.79	_	10.80	10.66	_	11.40	11.41	_	11.48	11.54	_
165	9.30	9.59	_	9.77	10.00	_	10.47	10.54	_	10.65	10.79	_	10.81	10.64	_	11.39	11.38	_	11.47	11.53	_
166	9.26	9.47	_	9.70	9.91	_	10.42	10.48	_	10.60	10.70	_	10.78	10.59	_	11.37	11.33	_	11.45	11.49	_
167	9.20	9.36	_	9.63	9.85	_	10.37	10.42	_	10.59	10.67	_	10.79	10.58		11.36	11.30	_	11.43	11.48	_
168	9.15	9.23	_	9.56	9.78	_	10.28	10.36	_	10.59	10.64	_	10.80	10.57		11.34	11.27	_	11.43	11.47	_
169	9.10	9.13	_	9.49	9.70	_	10.17	10.28	_	10.61	10.66	_	10.79	10.55		11.27	11.11	_	11.41	11.43	_
170	9.03	9.01	_	9.40	9.60	_	10.04	10.17	_	10.56	10.63	_	10.79	10.51		11.20	10.92		11.38	11.37	_
171	8.96	8.86	_	9.31	9.48	_	9.91	10.06	_	10.48	10.54	_	10.75	10.44		11.20	10.92		11.36	11.31	_
172	8.86	8.65	0.0	9.26	9.40	_	9.82	9.99	_	10.37	10.41	_	10.72	10.40		11.29	11.06		11.43	11.39	_
173	8.75	8.46	0.1	9.21	9.31	_	9.77	9.91	_	10.29	10.29	_	10.68	10.35		11.29	11.03		11.46	11.41	_
174	8.56	8.16	0.2	9.17	9.18	_	9.75	9.85	_	10.27	10.24	_	10.66	10.33		11.27	10.97		11.45	11.38	_
175	8.37	7.92	0.3	9.09	9.06	_	9.73	9.80	_	10.24	10.19	_	10.64	10.32		11.26	10.95		11.46	11.37	_
176	8.27	7.77	0.3	8.95	8.87	_	9.67	9.72	_	10.16	10.08	_	10.60	10.30		11.24	10.90		11.50	11.39	_
177	7.79	7.15	0.4	8.66	8.46	0.0	9.69	9.70	_	10.15	10.05	_	10.58	10.29		11.21	10.86		11.50	11.37	_
178	7.60	6.88	0.5	8.50	8.23	0.1	9.68	9.67	_	10.12	10.00	_	10.55	10.27		11.19	10.83		11.52	11.37	_
179	7.53	6.75	0.6	8.44	8.13	0.1	9.65	9.63	_	10.08	9.93	_	10.52	10.25		11.18	10.80		11.58	11.40	_
180	7.36	6.51	0.7	8.30	7.92	0.2	9.62	9.57	_	10.06	9.88	_	10.50	10.23		11.17	10.78		11.61	11.40	
181	7.18	6.24	0.7	8.12	7.64	0.3	9.54	9.43	_	10.04	9.84	_	10.48	10.20		11.16	10.76		11.59	11.35	
182	7.03	6.04	0.8	7.97	7.47	0.3	9.41	9.25	_	10.04	9.83		10.48	10.19		11.15	10.74		11.56	11.31	
183	6.66	5.63	0.8	7.59	7.01	0.4	9.28	9.09	_	10.02	9.79		10.47	10.17		11.15	10.74		11.59	11.30	
184	6.50	5.50	0.8	7.29	6.69	0.4	9.14	8.88	0.1	10.01	9.76		10.46	10.16		11.14	10.73		11.59	11.29	
185	6.31	5.29	0.8	7.02	6.35	0.5	8.90	8.56	0.1	10.00	9.74		10.46	10.16		11.13	10.71		11.59	11.26	
186	5.94	4.89	0.8	6.66	5.82	0.6	8.64	8.26	0.2	9.96	9.68		10.46	10.15		11.11	10.67		11.55	11.21	
187	5.88	4.81	0.9	6.39	5.52	0.7	8.51	8.14	0.2	9.94	9.63		10.44	10.12		11.09	10.64		11.52	11.18	
188	5.57	4.52	0.8	5.88	5.12	0.6	7.96	7.52	0.2	9.91	9.52		10.40	10.08		11.07	10.61		11.55	11.19	

DRAFT: CBOD Bubble Permit Calculation for IEP and Kaiser February 8, 2020

Appendix B: Model Results for CBOD Calculations

Table B-1 Incremental Dissolved Oxygen Changes in Response to Changes in IEP CBOD Load

	July 1 - 15					July 16 - 31					August 1 - 15					August 15 - 31				
	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x
IEP CBODu (mg/L)	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75
Segment																				
158	0.000	0.002	0.000	-0.002	-0.003	0.000	-0.004	0.000	-0.002	-0.005	0.000	-0.001	0.000	-0.003	-0.004	0.005	0.003	0.000	0.001	-0.001
159	0.001	0.001	0.000	-0.002	-0.003	0.001	-0.003	0.000	-0.002	-0.004	0.001	-0.001	0.000	-0.003	-0.004	0.004	0.002	0.000	0.000	-0.002
160	0.000	0.001	0.000	-0.003	-0.004	-0.001	0.000	0.000	-0.001	-0.005	0.001	-0.001	0.000	-0.002	-0.006	0.004	0.002	0.000	0.000	-0.003
161	0.000	0.001	0.000	-0.002	-0.003	-0.001	0.000	0.000	-0.001	-0.004	0.001	-0.001	0.000	-0.002	-0.005	0.003	0.002	0.000	-0.001	-0.003
162	0.001	0.002	0.000	-0.002	-0.003	0.000	0.000	0.000	-0.001	-0.004	0.001	0.000	0.000	-0.002	-0.005	0.003	0.002	0.000	-0.001	-0.003
163	0.002	0.004	0.000	-0.001	-0.001	0.001	0.002	0.000	-0.001	-0.002	0.002	0.001	0.000	-0.002	-0.004	0.003	0.002	0.000	-0.002	-0.003
164	0.002	0.005	0.000	0.000	0.000	0.003	0.004	0.000	0.000	0.000	0.002	0.001	0.000	-0.003	-0.004	0.003	0.002	0.000	-0.002	-0.005
165	0.004	0.009	0.000	0.003	0.003	0.002	0.005	0.000	0.000	0.000	0.002	0.000	0.000	-0.005	-0.005	0.002	0.000	0.000	-0.004	-0.007
166	0.005	0.009	0.000	0.004	0.004	0.001	0.003	0.000	0.001	-0.001	0.001	0.000	0.000	-0.006	-0.007	0.001	-0.001	0.000	-0.006	-0.010
167	0.004	0.007	0.000	0.002	0.002	-0.001	-0.001	0.000	-0.003	-0.006	0.000	0.000	0.000	-0.005	-0.009	0.001	-0.001	0.000	-0.007	-0.012
168	0.003	0.005	0.000	0.000	0.003	-0.002	-0.002	0.000	-0.006	-0.009	-0.004	0.002	0.000	-0.001	-0.015	-0.001	-0.003	0.000	-0.009	-0.016
169	0.002	0.005	0.000	0.000	0.004	-0.003	-0.004	0.000	-0.008	-0.011	-0.003	0.005	0.000	-0.001	-0.017	0.001	-0.001	0.000	-0.008	-0.016
170	0.003	0.006	0.000	0.001	0.003	-0.002	-0.003	0.000	-0.007	-0.010	-0.001	0.006	0.000	-0.001	-0.016	0.002	0.000	0.000	-0.009	-0.017
171	0.005	0.007	0.000	0.002	0.004	0.002	-0.001	0.000	-0.005	-0.009	0.001	0.007	0.000	-0.002	-0.016	0.004	0.001	0.000	-0.008	-0.018
172	0.004	0.007	0.000	0.002	0.004	0.005	0.001	0.000	-0.004	-0.008	0.002	0.009	0.000	-0.001	-0.016	0.005	0.002	0.000	-0.008	-0.020
173	0.004	0.007	0.000	0.003	0.002	0.005	0.002	0.000	-0.003	-0.008	0.003	0.010	0.000	-0.001	-0.015	0.004	0.001	0.000	-0.010	-0.023
174	0.002	0.004	0.000	0.002	-0.003	0.006	0.005	0.000	-0.002	-0.008	0.006	0.010	0.000	-0.003	-0.015	0.006	0.003	0.000	-0.011	-0.025
175	0.001	0.003	0.000	0.002	-0.005	0.007	0.005	0.000	-0.002	-0.009	0.007	0.010	0.000	-0.003	-0.015	0.007	0.004	0.000	-0.010	-0.025
176	0.003	0.004	0.000	0.002	-0.005	0.008	0.005	0.000	-0.002	-0.009	0.008	0.010	0.000	-0.003	-0.015	0.008	0.004	0.000	-0.010	-0.025
177	0.005	0.003	0.000	0.001	-0.006	0.011	0.007	0.000	-0.002	-0.010	0.012	0.011	0.000	-0.004	-0.015	0.011	0.006	0.000	-0.010	-0.026
178	0.008	0.005	0.000	0.001	-0.006	0.012	0.007	0.000	-0.002	-0.011	0.012	0.011	0.000	-0.004	-0.015	0.012	0.007	0.000	-0.009	-0.026
179	0.008	0.004	0.000	-0.001	-0.006	0.012	0.006	0.000	-0.002	-0.012	0.011	0.009	0.000	-0.006	-0.017	0.013	0.007	0.000	-0.009	-0.026
180	0.010	0.005	0.000	-0.003	-0.006	0.013	0.007	0.000	-0.002	-0.013	0.012	0.008	0.000	-0.007	-0.018	0.013	0.008	0.000	-0.009	-0.025
181	0.012	0.006	0.000	-0.004	-0.005	0.013	0.008	0.000	-0.002	-0.014	0.012	0.007	0.000	-0.008	-0.020	0.014	0.009	0.000	-0.008	-0.025
182	0.011	0.006	0.000	-0.006	-0.005	0.014	0.009	0.000	-0.002	-0.014	0.013	0.006	0.000	-0.008	-0.021	0.014	0.009	0.000	-0.008	-0.026
183	0.012	0.006	0.000	-0.006	-0.007	0.015	0.009	0.000	-0.003	-0.015	0.014	0.007	0.000	-0.008	-0.021	0.016	0.010	0.000	-0.008	-0.026
184	0.009	0.005	0.000	-0.008	-0.008	0.012	0.008	0.000	-0.003	-0.016	0.012	0.005	0.000	-0.008	-0.022	0.013	0.009	0.000	-0.008	-0.025
185	0.006	0.004	0.000	-0.008	-0.010	0.008	0.006	0.000	-0.004	-0.017	0.009	0.004	0.000	-0.007	-0.023	0.011	0.007	0.000	-0.008	-0.026
186	0.008	0.006	0.000	-0.006	-0.009	0.010	0.007	0.000	-0.004	-0.017	0.011	0.006	0.000	-0.006	-0.023	0.014	0.009	0.000	-0.009	-0.026
187	0.009	0.007	0.000	-0.006	-0.008	0.011	0.007	0.000	-0.005	-0.018	0.012	0.006	0.000	-0.006	-0.023	0.017	0.011	0.000	-0.010	-0.025
188	0.003	0.005	0.000	-0.005	-0.010	0.003	0.003	0.000	-0.005	-0.019	0.004	0.002	0.000	-0.006	-0.025	0.007	0.005	0.000	-0.009	-0.029

	September 1 - 15					September 16 - 30					October 1 - 15					October 16 - 31				
	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x
IEP CBODu (mg/L)	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75
Segment																				
158	0.005	0.004	0.000	-0.002	-0.003	0.002	0.002	0.000	-0.002	-0.003	0.000	-0.002	0.000	-0.002	-0.004	-0.001	-0.001	0.000	-0.002	-0.003
159	0.003	0.002	0.000	-0.004	-0.005	0.002	0.004	0.000	-0.003	-0.005	0.000	-0.002	0.000	-0.002	-0.004	0.000	0.000	0.000	-0.002	-0.003
160	0.003	0.002	0.000	-0.004	-0.005	0.004	0.002	0.000	-0.002	-0.004	0.000	-0.002	0.000	-0.003	-0.005	0.000	0.000	0.000	-0.002	-0.003
161	0.003	0.002	0.000	-0.003	-0.005	0.003	0.003	0.000	-0.002	-0.005	0.000	-0.002	0.000	-0.003	-0.006	0.000	0.000	0.000	-0.002	-0.004
162	0.003	0.003	0.000	-0.003	-0.005	0.003	0.003	0.000	-0.003	-0.006	0.000	-0.001	0.000	-0.003	-0.006	0.000	0.000	0.000	-0.003	-0.005
163	0.004	0.003	0.000	-0.002	-0.004	0.002	0.002	0.000	-0.003	-0.006	0.000	-0.001	0.000	-0.003	-0.006	0.000	0.000	0.000	-0.003	-0.006
164	0.003	0.002	0.000	-0.002	-0.004	0.002	0.003	0.000	-0.003	-0.006	0.001	0.000	0.000	-0.002	-0.006	0.001	0.000	0.000	-0.003	-0.006
165	0.004	0.004	0.000	-0.002	-0.003	0.002	0.003	0.000	-0.003	-0.006	0.002	0.001	0.000	-0.002	-0.005	0.001	0.000	0.000	-0.003	-0.006
166	0.004	0.003	0.000	-0.002	-0.004	0.003	0.002	0.000	-0.004	-0.007	0.001	0.000	0.000	-0.003	-0.006	0.001	0.000	0.000	-0.003	-0.007
167	0.004	0.002	0.000	-0.003	-0.006	0.003	0.002	0.000	-0.004	-0.009	0.001	0.000	0.000	-0.003	-0.006	0.002	0.001	0.000	-0.003	-0.007
168	0.003	0.002	0.000	-0.003	-0.006	0.003	0.003	0.000	-0.004	-0.010	0.001	0.001	0.000	-0.003	-0.006	0.003	0.001	0.000	-0.002	-0.007
169	0.002	0.001	0.000	-0.003	-0.007	0.002	0.003	0.000	-0.004	-0.010	0.001	0.001	0.000	-0.004	-0.007	0.002	0.001	0.000	-0.003	-0.007
170	0.005	0.004	0.000	-0.001	-0.005	0.002	0.002	0.000	-0.004	-0.011	0.002	0.001	0.000	-0.004	-0.007	0.003	0.002	0.000	-0.002	-0.007
171	0.008	0.007	0.000	0.002	-0.002	0.002	0.001	0.000	-0.004	-0.012	0.002	0.001	0.000	-0.004	-0.007	0.003	0.002	0.000	-0.003	-0.007
172	0.009	0.007	0.000	0.003	-0.002	-0.003	-0.004	0.000	-0.008	-0.015	0.002	0.001	0.000	-0.004	-0.008	0.004	0.002	0.000	-0.002	-0.007
173	0.008	0.006	0.000	0.000	-0.005	-0.005	-0.008	0.000	-0.012	-0.018	0.002	0.001	0.000	-0.004	-0.008	0.004	0.002	0.000	-0.002	-0.007
174	0.007	0.004	0.000	-0.004	-0.010	-0.010	-0.011	0.000	-0.015	-0.022	0.000	-0.001	0.000	-0.005	-0.010	0.004	0.002	0.000	-0.003	-0.007
175	0.010	0.007	0.000	-0.004	-0.010	-0.011	-0.011	0.000	-0.017	-0.023	-0.003	-0.003	0.000	-0.005	-0.011	0.004	0.002	0.000	-0.003	-0.007
176	0.010	0.006	0.000	-0.006	-0.012	-0.007	-0.008	0.000	-0.014	-0.021	-0.002	-0.002	0.000	-0.005	-0.011	0.005	0.003	0.000	-0.003	-0.007
177	0.011	0.006	0.000	-0.010	-0.017	-0.009	-0.009	0.000	-0.017	-0.024	-0.005	-0.005	0.000	-0.007	-0.015	0.005	0.002	0.000	-0.003	-0.008
178	0.011	0.005	0.000	-0.012	-0.020	-0.002	-0.004	0.000	-0.015	-0.022	-0.004	-0.004	0.000	-0.008	-0.016	0.005	0.002	0.000	-0.003	-0.008
179	0.011	0.006	0.000	-0.013	-0.023	-0.001	-0.003	0.000	-0.014	-0.023	-0.004	-0.005	0.000	-0.008	-0.017	0.005	0.002	0.000	-0.003	-0.008
180	0.012	0.006	0.000	-0.013	-0.024	0.002	-0.001	0.000	-0.015	-0.024	-0.004	-0.004	0.000	-0.009	-0.018	0.003	0.002	0.000	-0.004	-0.009
181	0.012	0.007	0.000	-0.013	-0.027	0.005	0.001	0.000	-0.015	-0.026	-0.005	-0.005	0.000	-0.010	-0.020	0.007	0.003	0.000	-0.004	-0.009
182	0.013	0.006	0.000	-0.014	-0.029	0.009	0.004	0.000	-0.014	-0.026	-0.003	-0.004	0.000	-0.010	-0.020	0.009	0.004	0.000	-0.004	-0.010
183	0.013	0.007	0.000	-0.014	-0.030	0.015	0.009	0.000	-0.012	-0.024	-0.003	-0.004	0.000	-0.011	-0.022	0.006	0.002	0.000	-0.005	-0.011
184	0.012	0.007	0.000	-0.013	-0.029	0.020	0.014	0.000	-0.008	-0.020	0.002	0.000	0.000	-0.011	-0.022	0.008	0.002	0.000	-0.005	-0.011
185	0.013	0.008	0.000	-0.013	-0.028	0.025	0.017	0.000	-0.007	-0.019	0.011	0.004	0.000	-0.011	-0.021	0.015	0.004	0.000	-0.005	-0.011
186	0.018	0.011	0.000	-0.012	-0.029	0.031	0.020	0.000	-0.008	-0.021	0.017	0.005	0.000	-0.013	-0.024	0.011	0.001	0.000	-0.005	-0.013
187	0.022	0.012	0.000	-0.012	-0.029	0.034	0.019	0.000	-0.009	-0.023	0.019	0.005	0.000	-0.012	-0.026	0.012	0.001	0.000	-0.005	-0.013
188	0.019	0.011	0.000	-0.011	-0.028	0.036	0.019	0.000	-0.009	-0.023	0.032	0.009	0.000	-0.011	-0.024	0.030	0.005	0.000	-0.005	-0.012

Table B-2. Incremental Dissolved Oxygen Changes in Response to Changes in Kaiser CBOD Load

	July 1 - 15					July 16 - 31					August 1 - 15					August 15 - 31				
	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x
Kaiser CBODu (mg/L)	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75
Segment																				
158	0.004	0.004	0.000	-0.005	-0.006	0.000	-0.003	0.000	-0.010	-0.010	0.001	0.000	0.000	-0.006	-0.010	0.006	0.001	0.000	-0.002	-0.005
159	0.004	0.004	0.000	-0.007	-0.008	0.002	0.000	0.000	-0.010	-0.010	0.002	0.001	0.000	-0.005	-0.011	0.005	0.001	0.000	-0.003	-0.006
160	0.005	0.004	0.000	-0.008	-0.010	0.003	0.000	0.000	-0.008	-0.011	0.002	0.001	0.000	-0.008	-0.012	0.005	0.001	0.000	-0.003	-0.007
161	0.005	0.004	0.000	-0.007	-0.010	0.003	0.000	0.000	-0.008	-0.011	0.002	0.001	0.000	-0.008	-0.012	0.004	0.002	0.000	-0.002	-0.006
162	0.006	0.005	0.000	-0.007	-0.010	0.003	0.001	0.000	-0.007	-0.011	0.002	0.001	0.000	-0.007	-0.011	0.004	0.002	0.000	-0.002	-0.006
163	0.008	0.006	0.000	-0.006	-0.009	0.004	0.003	0.000	-0.005	-0.009	0.004	0.002	0.000	-0.005	-0.010	0.004	0.002	0.000	-0.002	-0.005
164	0.009	0.006	0.000	-0.005	-0.007	0.007	0.006	0.000	-0.004	-0.007	0.005	0.003	0.000	-0.004	-0.010	0.003	0.002	0.000	-0.002	-0.006
165	0.013	0.007	0.000	-0.003	-0.005	0.007	0.007	0.000	-0.002	-0.008	0.006	0.002	0.000	-0.006	-0.012	0.002	0.000	0.000	-0.005	-0.008
166	0.014	0.008	0.000	-0.003	-0.004	0.005	0.007	0.000	-0.005	-0.010	0.006	0.002	0.000	-0.008	-0.014	0.001	-0.001	0.000	-0.008	-0.010
167	0.012	0.008	0.000	-0.005	-0.005	0.003	0.002	0.000	-0.009	-0.011	0.004	0.002	0.000	-0.010	-0.015	0.000	-0.001	0.000	-0.010	-0.011
168	0.011	0.007	0.000	-0.006	-0.004	0.003	0.002	0.000	-0.012	-0.012	-0.013	0.004	0.000	-0.023	-0.017	-0.004	-0.003	0.000	-0.016	-0.013
169	0.010	0.007	0.000	-0.006	-0.002	0.003	0.002	0.000	-0.014	-0.013	-0.016	0.006	0.000	-0.027	-0.017	-0.002	-0.002	0.000	-0.018	-0.014
170	0.011	0.006	0.000	-0.006	-0.005	0.005	0.003	0.000	-0.013	-0.012	-0.014	0.008	0.000	-0.025	-0.018	-0.001	-0.002	0.000	-0.019	-0.016
171	0.012	0.005	0.000	-0.005	-0.007	0.007	0.005	0.000	-0.013	-0.012	-0.008	0.009	0.000	-0.023	-0.018	-0.001	0.000	0.000	-0.018	-0.016
172	0.012	0.007	0.000	-0.005	-0.003	0.008	0.008	0.000	-0.012	-0.011	-0.006	0.012	0.000	-0.021	-0.018	-0.001	0.002	0.000	-0.020	-0.017
173	0.012	0.007	0.000	-0.007	-0.005	0.009	0.008	0.000	-0.012	-0.012	-0.002	0.013	0.000	-0.017	-0.019	-0.002	0.003	0.000	-0.021	-0.018
174	0.010	0.005	0.000	-0.011	-0.008	0.010	0.009	0.000	-0.011	-0.013	0.003	0.013	0.000	-0.015	-0.020	-0.001	0.005	0.000	-0.021	-0.019
175	0.008	0.004	0.000	-0.012	-0.011	0.010	0.009	0.000	-0.012	-0.013	0.006	0.014	0.000	-0.013	-0.020	0.000	0.007	0.000	-0.020	-0.019
176	0.009	0.002	0.000	-0.012	-0.015	0.011	0.009	0.000	-0.012	-0.015	0.008	0.013	0.000	-0.011	-0.021	0.002	0.007	0.000	-0.020	-0.021
177	0.008	0.003	0.000	-0.012	-0.016	0.012	0.011	0.000	-0.012	-0.015	0.011	0.015	0.000	-0.010	-0.020	0.004	0.010	0.000	-0.020	-0.020
178	0.009	0.003	0.000	-0.011	-0.019	0.012	0.011	0.000	-0.012	-0.017	0.012	0.014	0.000	-0.009	-0.022	0.006	0.011	0.000	-0.019	-0.022
179	0.009	0.001	0.000	-0.011	-0.022	0.012	0.010	0.000	-0.012	-0.019	0.012	0.011	0.000	-0.010	-0.023	0.007	0.011	0.000	-0.018	-0.023
180	0.009	0.002	0.000	-0.010	-0.023	0.012	0.009	0.000	-0.012	-0.021	0.013	0.010	0.000	-0.011	-0.026	0.009	0.011	0.000	-0.016	-0.024
181	0.010	0.003	0.000	-0.008	-0.022	0.012	0.008	0.000	-0.012	-0.024	0.013	0.008	0.000	-0.012	-0.026	0.011	0.011	0.000	-0.014	-0.027
182	0.010	0.004	0.000	-0.008	-0.022	0.012	0.007	0.000	-0.012	-0.026	0.012	0.006	0.000	-0.013	-0.027	0.011	0.010	0.000	-0.013	-0.028
183	0.010	0.004	0.000	-0.009	-0.021	0.012	0.008	0.000	-0.012	-0.025	0.012	0.006	0.000	-0.013	-0.027	0.012	0.011	0.000	-0.012	-0.027
184	0.009	0.002	0.000	-0.010	-0.021	0.011	0.005	0.000	-0.013	-0.026	0.011	0.004	0.000	-0.014	-0.027	0.010	0.008	0.000	-0.013	-0.028
185	0.008	0.000	0.000	-0.010	-0.022	0.009	0.002	0.000	-0.014	-0.028	0.010	0.001	0.000	-0.015	-0.028	0.009	0.004	0.000	-0.013	-0.029
186	0.010	0.003	0.000	-0.008	-0.020	0.010	0.003	0.000	-0.013	-0.027	0.011	0.003	0.000	-0.014	-0.028	0.011	0.006	0.000	-0.012	-0.028
187	0.011	0.004	0.000	-0.007	-0.019	0.010	0.003	0.000	-0.013	-0.028	0.011	0.003	0.000	-0.014	-0.028	0.013	0.007	0.000	-0.011	-0.027
188	0.010	-0.001	0.000	-0.008	-0.019	0.006	-0.004	0.000	-0.015	-0.028	0.008	-0.004	0.000	-0.017	-0.029	0.009	-0.002	0.000	-0.016	-0.030

	September 1 - 15					September 16 - 30					October 1 - 15					October 16 - 31				
	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x
Kaiser CBODu (mg/L)	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75	18.75	28.125	37.5	56.25	75
Segment																				
158	0.007	0.004	0.000	-0.002	-0.009	0.005	0.003	0.000	-0.008	-0.014	0.004	0.000	0.000	-0.009	-0.014	0.002	0.000	0.000	-0.006	-0.010
159	0.005	0.003	0.000	-0.004	-0.008	0.006	0.004	0.000	-0.008	-0.016	0.004	0.001	0.000	-0.009	-0.014	0.003	0.001	0.000	-0.007	-0.011
160	0.005	0.003	0.000	-0.004	-0.008	0.008	0.005	0.000	-0.009	-0.018	0.004	0.001	0.000	-0.010	-0.017	0.004	0.002	0.000	-0.007	-0.012
161	0.005	0.003	0.000	-0.004	-0.009	0.007	0.004	0.000	-0.010	-0.018	0.005	0.001	0.000	-0.011	-0.019	0.004	0.002	0.000	-0.008	-0.014
162	0.005	0.003	0.000	-0.003	-0.008	0.007	0.004	0.000	-0.010	-0.018	0.006	0.002	0.000	-0.012	-0.019	0.005	0.003	0.000	-0.010	-0.016
163	0.005	0.004	0.000	-0.002	-0.006	0.006	0.003	0.000	-0.009	-0.017	0.005	0.001	0.000	-0.011	-0.018	0.005	0.002	0.000	-0.010	-0.017
164	0.004	0.003	0.000	-0.002	-0.006	0.006	0.003	0.000	-0.009	-0.016	0.006	0.002	0.000	-0.010	-0.017	0.006	0.003	0.000	-0.010	-0.017
165	0.005	0.004	0.000	0.000	-0.005	0.006	0.004	0.000	-0.008	-0.015	0.006	0.002	0.000	-0.008	-0.014	0.005	0.003	0.000	-0.010	-0.016
166	0.005	0.004	0.000	-0.001	-0.006	0.006	0.004	0.000	-0.009	-0.016	0.006	0.002	0.000	-0.009	-0.015	0.005	0.003	0.000	-0.010	-0.016
167	0.004	0.003	0.000	-0.003	-0.008	0.006	0.003	0.000	-0.009	-0.017	0.006	0.002	0.000	-0.008	-0.015	0.006	0.003	0.000	-0.009	-0.016
168	0.004	0.001	0.000	-0.004	-0.009	0.007	0.003	0.000	-0.009	-0.019	0.006	0.002	0.000	-0.008	-0.015	0.006	0.004	0.000	-0.008	-0.014
169	0.004	-0.003	0.000	-0.007	-0.010	0.007	0.003	0.000	-0.010	-0.020	0.006	0.002	0.000	-0.008	-0.015	0.005	0.003	0.000	-0.008	-0.014
170	0.007	-0.002	0.000	-0.006	-0.008	0.007	0.003	0.000	-0.011	-0.021	0.006	0.002	0.000	-0.008	-0.014	0.005	0.003	0.000	-0.006	-0.011
171	0.011	0.000	0.000	-0.004	-0.007	0.007	0.002	0.000	-0.011	-0.022	0.006	0.002	0.000	-0.008	-0.014	0.004	0.003	0.000	-0.005	-0.010
172	0.013	-0.002	0.000	-0.005	-0.007	0.003	-0.002	0.000	-0.015	-0.027	0.006	0.002	0.000	-0.008	-0.015	0.004	0.003	0.000	-0.004	-0.008
173	0.012	-0.002	0.000	-0.006	-0.009	0.001	-0.004	0.000	-0.017	-0.031	0.006	0.002	0.000	-0.009	-0.016	0.004	0.003	0.000	-0.004	-0.008
174	0.010	-0.002	0.000	-0.009	-0.011	-0.002	-0.007	0.000	-0.020	-0.034	0.005	0.001	0.000	-0.011	-0.018	0.004	0.003	0.000	-0.005	-0.009
175	0.012	0.000	0.000	-0.008	-0.011	-0.003	-0.007	0.000	-0.020	-0.033	0.004	-0.002	0.000	-0.011	-0.019	0.004	0.003	0.000	-0.004	-0.008
176	0.010	0.000	0.000	-0.009	-0.013	-0.001	-0.005	0.000	-0.018	-0.029	0.003	-0.002	0.000	-0.011	-0.020	0.004	0.003	0.000	-0.004	-0.007
177	0.009	0.002	0.000	-0.012	-0.014	-0.002	-0.006	0.000	-0.019	-0.029	0.002	-0.004	0.000	-0.013	-0.024	0.004	0.003	0.000	-0.005	-0.009
178	0.008	0.003	0.000	-0.014	-0.016	0.002	-0.001	0.000	-0.016	-0.025	0.002	-0.003	0.000	-0.013	-0.024	0.004	0.003	0.000	-0.005	-0.010
179	0.007	0.004	0.000	-0.014	-0.017	0.004	0.000	0.000	-0.015	-0.023	0.002	-0.004	0.000	-0.014	-0.025	0.004	0.003	0.000	-0.005	-0.010
180	0.006	0.007	0.000	-0.013	-0.018	0.005	0.001	0.000	-0.015	-0.022	0.002	-0.002	0.000	-0.014	-0.025	0.004	0.002	0.000	-0.006	-0.011
181	0.006	0.008	0.000	-0.014	-0.019	0.006	0.002	0.000	-0.013	-0.019	0.002	-0.005	0.000	-0.015	-0.027	0.006	0.006	0.000	-0.006	-0.012
182	0.005	0.008	0.000	-0.014	-0.020	0.007	0.003	0.000	-0.013	-0.018	0.003	-0.003	0.000	-0.014	-0.027	0.006	0.008	0.000	-0.006	-0.012
183	0.006	0.009	0.000	-0.014	-0.021	0.011	0.006	0.000	-0.011	-0.017	0.002	-0.003	0.000	-0.014	-0.027	0.005	0.005	0.000	-0.007	-0.014
184	0.006	0.009	0.000	-0.013	-0.021	0.014	0.010	0.000	-0.007	-0.015	0.006	0.001	0.000	-0.013	-0.026	0.005	0.007	0.000	-0.007	-0.013
185	0.008	0.010	0.000	-0.011	-0.020	0.016	0.015	0.000	-0.005	-0.014	0.008	0.010	0.000	-0.011	-0.022	0.005	0.016	0.000	-0.006	-0.012
186	0.010	0.013	0.000	-0.011	-0.022	0.017	0.020	0.000	-0.006	-0.014	0.010	0.014	0.000	-0.012	-0.026	0.003	0.012	0.000	-0.008	-0.015
187	0.012	0.015	0.000	-0.011	-0.022	0.016	0.023	0.000	-0.007	-0.015	0.009	0.015	0.000	-0.011	-0.025	0.003	0.012	0.000	-0.008	-0.015
188	0.011	0.013	0.000	-0.011	-0.023	0.015	0.028	0.000	-0.007	-0.014	0.010	0.027	0.000	-0.009	-0.016	0.006	0.031	0.000	-0.007	-0.012

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Table B-3. Individual Segment/Time-Specific Slopes for IEP

	July 1 - 15			July 16 - 31			August 1 - 15			August 15 - 31		
	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc
IEP CBOD5 Change (mg/L)	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60
Segment												
158	-7.19E-5	-2.13E-5	-7.47E-5	-7.14E-5	-1.07E-5	-1.39E-4	-8.28E-5	-2.67E-5	-1.09E-4	-8.58E-5	-2.45E-4	-2.40E-5
159	-6.43E-5	0.00E+0	-2.92E-5	-6.54E-5	-2.21E-5	-3.84E-5	-9.31E-5	-3.31E-6	-4.91E-5	-9.87E-5	0.00E+0	-1.75E-5
160	-8.66E-5	0.00E+0	-4.52E-5	-6.79E-5	-1.07E-5	-4.01E-5	-1.05E-4	-4.78E-6	-5.50E-5	-1.08E-4	0.00E+0	-2.13E-5
161	-7.37E-5	0.00E+0	-3.29E-5	-6.16E-5	-8.09E-6	-3.57E-5	-1.08E-4	-3.68E-7	-5.37E-5	-1.08E-4	0.00E+0	-2.94E-5
162	-7.78E-5	0.00E+0	-3.16E-5	-6.47E-5	0.00E+0	-3.16E-5	-1.07E-4	0.00E+0	-5.09E-5	-1.11E-4	0.00E+0	-3.13E-5
163	-7.37E-5	0.00E+0	-9.20E-6	-6.80E-5	0.00E+0	-2.15E-5	-1.05E-4	0.00E+0	-4.23E-5	-1.18E-4	0.00E+0	-3.49E-5
164	-7.23E-5	0.00E+0	-4.41E-6	-6.57E-5	0.00E+0	-5.52E-7	-1.21E-4	0.00E+0	-4.67E-5	-1.34E-4	0.00E+0	-4.25E-5
165	-4.63E-5	0.00E+0	0.00E+0	-5.42E-5	0.00E+0	0.00E+0	-1.37E-4	0.00E+0	-6.68E-5	-1.60E-4	0.00E+0	-7.65E-5
166	-3.94E-5	0.00E+0	0.00E+0	-4.21E-5	0.00E+0	-1.29E-6	-1.55E-4	0.00E+0	-8.42E-5	-2.06E-4	-7.36E-7	-1.08E-4
167	-5.51E-5	0.00E+0	0.00E+0	-9.02E-5	-1.69E-5	-5.74E-5	-1.62E-4	-1.47E-6	-8.74E-5	-2.31E-4	-5.15E-6	-1.24E-4
168	-2.00E-5	0.00E+0	0.00E+0	-1.41E-4	-4.12E-5	-1.01E-4	-2.12E-4	-2.21E-6	-1.14E-4	-2.76E-4	-4.45E-5	-1.71E-4
169	-2.76E-7	0.00E+0	0.00E+0	-1.59E-4	-6.18E-5	-1.23E-4	-2.59E-4	0.00E+0	-1.26E-4	-3.08E-4	-4.78E-6	-1.64E-4
170	-2.33E-5	0.00E+0	0.00E+0	-1.70E-4	-4.08E-5	-1.16E-4	-2.89E-4	0.00E+0	-1.25E-4	-3.45E-4	0.00E+0	-1.71E-4
171	-2.90E-5	0.00E+0	0.00E+0	-1.89E-4	0.00E+0	-9.32E-5	-3.21E-4	0.00E+0	-1.29E-4	-3.79E-4	0.00E+0	-1.76E-4
172	-1.60E-5	0.00E+0	0.00E+0	-2.03E-4	0.00E+0	-7.61E-5	-3.50E-4	0.00E+0	-1.24E-4	-4.39E-4	0.00E+0	-1.94E-4
173	-4.94E-5	0.00E+0	0.00E+0	-2.28E-4	0.00E+0	-7.67E-5	-3.49E-4	0.00E+0	-1.16E-4	-4.86E-4	0.00E+0	-2.25E-4
174	-8.85E-5	0.00E+0	-1.34E-5	-2.54E-4	0.00E+0	-7.49E-5	-3.96E-4	0.00E+0	-1.27E-4	-5.42E-4	0.00E+0	-2.40E-4
175	-1.06E-4	0.00E+0	-2.92E-5	-2.68E-4	0.00E+0	-7.80E-5	-4.11E-4	0.00E+0	-1.24E-4	-5.62E-4	0.00E+0	-2.38E-4
176	-1.31E-4	0.00E+0	-2.72E-5	-2.87E-4	0.00E+0	-7.96E-5	-4.19E-4	0.00E+0	-1.24E-4	-5.74E-4	0.00E+0	-2.38E-4
177	-1.81E-4	0.00E+0	-4.17E-5	-3.53E-4	0.00E+0	-8.64E-5	-4.81E-4	0.00E+0	-1.32E-4	-6.53E-4	0.00E+0	-2.46E-4
178	-2.17E-4	0.00E+0	-4.14E-5	-3.87E-4	0.00E+0	-9.20E-5	-4.82E-4	0.00E+0	-1.35E-4	-6.67E-4	0.00E+0	-2.44E-4
179	-2.31E-4	0.00E+0	-4.95E-5	-3.94E-4	0.00E+0	-1.02E-4	-5.02E-4	0.00E+0	-1.54E-4	-6.73E-4	0.00E+0	-2.43E-4
180	-2.58E-4	0.00E+0	-5.87E-5	-4.20E-4	0.00E+0	-1.10E-4	-5.22E-4	0.00E+0	-1.69E-4	-6.71E-4	0.00E+0	-2.34E-4
181	-2.80E-4	0.00E+0	-5.43E-5	-4.47E-4	0.00E+0	-1.14E-4	-5.57E-4	0.00E+0	-1.88E-4	-6.78E-4	0.00E+0	-2.27E-4
182	-2.99E-4	0.00E+0	-6.91E-5	-4.59E-4	0.00E+0	-1.15E-4	-5.72E-4	0.00E+0	-1.97E-4	-6.69E-4	0.00E+0	-2.22E-4
183	-3.27E-4	0.00E+0	-8.22E-5	-4.86E-4	0.00E+0	-1.23E-4	-6.06E-4	0.00E+0	-2.02E-4	-6.94E-4	0.00E+0	-2.22E-4
184	-3.23E-4	0.00E+0	-1.03E-4	-4.67E-4	0.00E+0	-1.32E-4	-5.83E-4	0.00E+0	-2.08E-4	-6.72E-4	0.00E+0	-2.30E-4
185	-3.02E-4	0.00E+0	-1.16E-4	-4.38E-4	0.00E+0	-1.46E-4	-5.47E-4	0.00E+0	-2.09E-4	-6.47E-4	0.00E+0	-2.37E-4
186	-3.20E-4	0.00E+0	-9.99E-5	-4.74E-4	0.00E+0	-1.52E-4	-5.74E-4	0.00E+0	-2.02E-4	-7.04E-4	0.00E+0	-2.42E-4
187	-3.26E-4	0.00E+0	-9.10E-5	-4.89E-4	0.00E+0	-1.57E-4	-5.93E-4	0.00E+0	-2.03E-4	-7.42E-4	0.00E+0	-2.39E-4
188	-2.52E-4	0.00E+0	-9.84E-5	-3.95E-4	0.00E+0	-1.68E-4	-4.94E-4	0.00E+0	-2.16E-4	-6.23E-4	0.00E+0	-2.61E-4

	September 1 - 15			September 16 - 30			October 1 - 15			October 16 - 31		
	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc
IEP CBOD5 Change (mg/L)	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60
Segment												
158	-1.47E-4	-2.51E-4	-8.53E-5	-9.66E-5	-1.12E-4	-7.47E-5	-6.07E-5	0.00E+0	-1.07E-4	-4.05E-5	0.00E+0	-8.00E-5
159	-1.55E-4	0.00E+0	-5.46E-5	-1.52E-4	0.00E+0	-5.55E-5	-6.07E-5	-2.21E-5	-4.05E-5	-5.98E-5	0.00E+0	-3.31E-5
160	-1.57E-4	0.00E+0	-5.83E-5	-1.43E-4	0.00E+0	-3.90E-5	-8.28E-5	-2.21E-5	-5.33E-5	-5.98E-5	0.00E+0	-3.31E-5
161	-1.57E-4	0.00E+0	-5.61E-5	-1.49E-4	0.00E+0	-4.80E-5	-9.84E-5	-2.21E-5	-6.07E-5	-7.54E-5	0.00E+0	-4.05E-5
162	-1.49E-4	0.00E+0	-4.76E-5	-1.61E-4	0.00E+0	-5.68E-5	-1.06E-4	-1.10E-5	-6.07E-5	-9.75E-5	0.00E+0	-5.33E-5
163	-1.38E-4	0.00E+0	-3.95E-5	-1.53E-4	0.00E+0	-6.33E-5	-1.06E-4	-1.10E-5	-6.07E-5	-1.13E-4	0.00E+0	-6.07E-5
164	-1.39E-4	0.00E+0	-4.43E-5	-1.66E-4	0.00E+0	-6.58E-5	-1.19E-4	0.00E+0	-5.52E-5	-1.25E-4	0.00E+0	-6.07E-5
165	-1.44E-4	0.00E+0	-3.38E-5	-1.72E-4	0.00E+0	-6.49E-5	-1.25E-4	0.00E+0	-4.93E-5	-1.25E-4	0.00E+0	-6.07E-5
166	-1.56E-4	0.00E+0	-4.29E-5	-1.87E-4	0.00E+0	-7.21E-5	-1.28E-4	0.00E+0	-6.00E-5	-1.41E-4	0.00E+0	-6.80E-5
167	-1.69E-4	0.00E+0	-5.72E-5	-2.10E-4	0.00E+0	-8.59E-5	-1.33E-4	0.00E+0	-6.12E-5	-1.60E-4	0.00E+0	-6.80E-5
168	-1.75E-4	0.00E+0	-6.42E-5	-2.30E-4	0.00E+0	-9.27E-5	-1.41E-4	0.00E+0	-6.51E-5	-1.66E-4	0.00E+0	-6.25E-5
169	-1.55E-4	0.00E+0	-7.04E-5	-2.37E-4	0.00E+0	-1.00E-4	-1.49E-4	0.00E+0	-6.91E-5	-1.60E-4	0.00E+0	-6.80E-5
170	-1.63E-4	0.00E+0	-4.10E-5	-2.34E-4	0.00E+0	-1.05E-4	-1.55E-4	0.00E+0	-7.04E-5	-1.73E-4	0.00E+0	-6.25E-5
171	-1.75E-4	0.00E+0	-7.36E-6	-2.45E-4	0.00E+0	-1.10E-4	-1.67E-4	0.00E+0	-7.45E-5	-1.79E-4	0.00E+0	-6.80E-5
172	-1.78E-4	0.00E+0	-3.68E-7	-2.29E-4	-6.03E-5	-1.56E-4	-1.73E-4	0.00E+0	-7.72E-5	-1.78E-4	0.00E+0	-6.23E-5
173	-2.22E-4	0.00E+0	-4.27E-5	-2.31E-4	-1.22E-4	-1.93E-4	-1.86E-4	0.00E+0	-8.40E-5	-1.88E-4	0.00E+0	-6.38E-5
174	-2.91E-4	0.00E+0	-8.99E-5	-2.35E-4	-1.99E-4	-2.45E-4	-1.75E-4	-7.72E-6	-9.66E-5	-1.95E-4	0.00E+0	-6.79E-5
175	-3.44E-4	0.00E+0	-9.27E-5	-2.45E-4	-2.07E-4	-2.58E-4	-1.45E-4	-4.93E-5	-1.04E-4	-2.01E-4	0.00E+0	-6.91E-5
176	-3.91E-4	0.00E+0	-1.23E-4	-2.88E-4	-1.38E-4	-2.36E-4	-1.68E-4	-4.34E-5	-1.14E-4	-2.08E-4	0.00E+0	-6.97E-5
177	-5.07E-4	0.00E+0	-1.81E-4	-3.05E-4	-1.66E-4	-2.67E-4	-1.70E-4	-9.53E-5	-1.44E-4	-2.17E-4	0.00E+0	-7.60E-5
178	-5.61E-4	0.00E+0	-2.14E-4	-3.76E-4	-5.89E-5	-2.39E-4	-2.09E-4	-7.87E-5	-1.55E-4	-2.24E-4	0.00E+0	-7.93E-5
179	-6.18E-4	0.00E+0	-2.40E-4	-4.17E-4	-3.38E-5	-2.45E-4	-2.33E-4	-8.28E-5	-1.70E-4	-2.27E-4	0.00E+0	-8.13E-5
180	-6.48E-4	0.00E+0	-2.50E-4	-4.86E-4	0.00E+0	-2.60E-4	-2.54E-4	-7.61E-5	-1.79E-4	-2.22E-4	0.00E+0	-8.75E-5
181	-7.08E-4	0.00E+0	-2.73E-4	-5.67E-4	0.00E+0	-2.74E-4	-2.75E-4	-1.00E-4	-2.05E-4	-2.79E-4	0.00E+0	-8.96E-5
182	-7.30E-4	0.00E+0	-2.84E-4	-6.37E-4	0.00E+0	-2.69E-4	-3.16E-4	-6.80E-5	-2.07E-4	-3.14E-4	0.00E+0	-9.62E-5
183	-7.62E-4	0.00E+0	-2.93E-4	-6.95E-4	0.00E+0	-2.46E-4	-3.42E-4	-6.88E-5	-2.21E-4	-2.87E-4	0.00E+0	-1.06E-4
184	-7.34E-4	0.00E+0	-2.84E-4	-7.06E-4	0.00E+0	-1.89E-4	-4.32E-4	0.00E+0	-2.21E-4	-3.13E-4	0.00E+0	-1.08E-4
185	-7.32E-4	0.00E+0	-2.73E-4	-7.67E-4	0.00E+0	-1.76E-4	-5.65E-4	0.00E+0	-2.16E-4	-4.11E-4	0.00E+0	-1.05E-4
186	-8.23E-4	0.00E+0	-2.79E-4	-8.93E-4	0.00E+0	-1.98E-4	-6.96E-4	0.00E+0	-2.49E-4	-3.71E-4	0.00E+0	-1.21E-4
187	-8.76E-4	0.00E+0	-2.77E-4	-9.70E-4	0.00E+0	-2.21E-4	-7.45E-4	0.00E+0	-2.58E-4	-3.84E-4	0.00E+0	-1.23E-4
188	-8.17E-4	0.00E+0	-2.65E-4	-9.88E-4	0.00E+0	-2.16E-4	-8.84E-4	0.00E+0	-2.33E-4	-6.22E-4	0.00E+0	-1.17E-4

Table B-4. Individual Segment/Time-Specific Slopes for Kaiser

	July 1 - 15			July 16 - 31			August 1 - 15			August 15 - 31			September 1 - 15			September 16 - 30			October 1 - 15			October 16 - 31		
	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc
Kaiser CBOD5 Change (mg/L)	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60	0.00	-1.80	3.60
Segment																								
158	-1.08E-3	-1.17E-3	-8.67E-4	-1.04E-3	0.00E+0	-1.39E-3	-1.02E-3	-3.20E-4	-1.29E-3	-7.87E-4	-1.49E-3	-6.00E-4	-1.29E-3	-1.79E-3	-1.16E-3	-1.70E-3	-1.31E-3	-1.81E-3	-1.62E-3	-1.07E-3	-1.87E-3	-1.09E-3	-5.33E-4	-1.33E-3
159	-1.20E-3	0.00E+0	-4.58E-4	-1.16E-3	0.00E+0	-6.34E-4	-1.19E-3	0.00E+0	-5.54E-4	-8.70E-4	0.00E+0	-2.85E-4	-1.18E-3	0.00E+0	-4.02E-4	-1.99E-3	0.00E+0	-8.18E-4	-1.66E-3	0.00E+0	-7.63E-4	-1.30E-3	0.00E+0	-5.98E-4
160	-1.42E-3	0.00E+0	-5.68E-4	-1.26E-3	0.00E+0	-6.07E-4	-1.30E-3	0.00E+0	-6.47E-4	-9.59E-4	0.00E+0	-3.20E-4	-1.16E-3	0.00E+0	-4.06E-4	-2.40E-3	0.00E+0	-9.19E-4	-1.93E-3	0.00E+0	-9.01E-4	-1.48E-3	0.00E+0	-6.34E-4
161	-1.44E-3	0.00E+0	-5.54E-4	-1.31E-3	0.00E+0	-6.45E-4	-1.29E-3	0.00E+0	-6.40E-4	-9.10E-4	0.00E+0	-3.08E-4	-1.18E-3	0.00E+0	-4.17E-4	-2.37E-3	0.00E+0	-9.61E-4	-2.17E-3	0.00E+0	-1.00E-3	-1.66E-3	0.00E+0	-7.36E-4
162	-1.51E-3	0.00E+0	-5.60E-4	-1.31E-3	0.00E+0	-6.03E-4	-1.31E-3	0.00E+0	-6.10E-4	-8.89E-4	0.00E+0	-2.98E-4	-1.12E-3	0.00E+0	-3.66E-4	-2.33E-3	0.00E+0	-9.58E-4	-2.30E-3	0.00E+0	-1.03E-3	-1.98E-3	0.00E+0	-8.64E-4
163	-1.53E-3	0.00E+0	-4.71E-4	-1.26E-3	0.00E+0	-4.74E-4	-1.26E-3	0.00E+0	-5.06E-4	-7.66E-4	0.00E+0	-2.39E-4	-9.56E-4	0.00E+0	-2.69E-4	-2.09E-3	0.00E+0	-8.74E-4	-2.10E-3	0.00E+0	-9.66E-4	-2.02E-3	0.00E+0	-9.01E-4
164	-1.50E-3	0.00E+0	-4.13E-4	-1.29E-3	0.00E+0	-3.46E-4	-1.36E-3	0.00E+0	-4.89E-4	-8.51E-4	0.00E+0	-3.02E-4	-8.46E-4	0.00E+0	-2.52E-4	-1.97E-3	0.00E+0	-8.17E-4	-2.08E-3	0.00E+0	-9.01E-4	-2.12E-3	0.00E+0	-9.01E-4
165	-1.53E-3	0.00E+0	-2.71E-4	-1.36E-3	0.00E+0	-3.68E-4	-1.55E-3	0.00E+0	-5.91E-4	-8.97E-4	0.00E+0	-4.24E-4	-8.13E-4	0.00E+0	-1.85E-4	-1.92E-3	0.00E+0	-7.66E-4	-1.82E-3	0.00E+0	-7.53E-4	-1.98E-3	0.00E+0	-8.64E-4
166	-1.55E-3	0.00E+0	-2.46E-4	-1.49E-3	0.00E+0	-4.99E-4	-1.75E-3	0.00E+0	-7.20E-4	-1.06E-3	-3.27E-17	-5.87E-4	-9.47E-4	0.00E+0	-2.70E-4	-2.09E-3	0.00E+0	-8.40E-4	-1.86E-3	0.00E+0	-7.89E-4	-1.98E-3	0.00E+0	-8.64E-4
167	-1.60E-3	0.00E+0	-3.32E-4	-1.45E-3	0.00E+0	-6.66E-4	-1.85E-3	0.00E+0	-8.43E-4	-1.15E-3	-6.07E-5	-6.95E-4	-1.02E-3	0.00E+0	-3.50E-4	-2.14E-3	0.00E+0	-8.82E-4	-1.82E-3	0.00E+0	-7.62E-4	-2.01E-3	0.00E+0	-8.37E-4
168	-1.38E-3	0.00E+0	-2.89E-4	-1.51E-3	0.00E+0	-7.52E-4	-1.46E-3	-2.45E-4	-1.26E-3	-1.21E-3	-2.85E-4	-9.12E-4	-1.15E-3	0.00E+0	-4.62E-4	-2.33E-3	0.00E+0	-9.54E-4	-1.83E-3	0.00E+0	-7.75E-4	-1.86E-3	0.00E+0	-7.36E-4
169	-1.25E-3	0.00E+0	-2.51E-4	-1.64E-3	0.00E+0	-8.32E-4	-1.44E-3	-2.76E-4	-1.37E-3	-1.43E-3	-1.86E-4	-9.89E-4	-1.10E-3	-2.39E-5	-5.50E-4	-2.46E-3	0.00E+0	-1.02E-3	-1.84E-3	0.00E+0	-7.79E-4	-1.76E-3	0.00E+0	-7.36E-4
170	-1.45E-3	0.00E+0	-3.37E-4	-1.79E-3	0.00E+0	-8.18E-4	-1.67E-3	-7.54E-5	-1.35E-3	-1.68E-3	-1.31E-4	-1.08E-3	-1.19E-3	0.00E+0	-4.60E-4	-2.51E-3	0.00E+0	-1.08E-3	-1.79E-3	0.00E+0	-7.49E-4	-1.46E-3	0.00E+0	-5.70E-4
171	-1.62E-3	0.00E+0	-3.90E-4	-1.98E-3	0.00E+0	-8.09E-4	-1.95E-3	0.00E+0	-1.29E-3	-1.82E-3	-1.29E-5	-1.10E-3	-1.34E-3	0.00E+0	-3.71E-4	-2.54E-3	0.00E+0	-1.12E-3	-1.79E-3	0.00E+0	-7.45E-4	-1.29E-3	0.00E+0	-5.06E-4
172	-1.42E-3	0.00E+0	-2.75E-4	-2.05E-3	0.00E+0	-7.48E-4	-2.11E-3	0.00E+0	-1.23E-3	-1.98E-3	0.00E+0	-1.17E-3	-1.44E-3	0.00E+0	-4.05E-4	-2.68E-3	0.00E+0	-1.39E-3	-1.83E-3	0.00E+0	-7.69E-4	-1.11E-3	0.00E+0	-4.14E-4
173	-1.57E-3	0.00E+0	-3.69E-4	-2.15E-3	0.00E+0	-7.81E-4	-2.44E-3	0.00E+0	-1.20E-3	-2.13E-3	0.00E+0	-1.24E-3	-1.52E-3	0.00E+0	-5.04E-4	-2.87E-3	-1.56E-4	-1.60E-3	-1.98E-3	0.00E+0	-8.33E-4	-1.06E-3	0.00E+0	-3.87E-4
174	-1.73E-3	0.00E+0	-5.98E-4	-2.28E-3	0.00E+0	-7.88E-4	-2.70E-3	0.00E+0	-1.15E-3	-2.31E-3	0.00E+0	-1.26E-3	-1.66E-3	0.00E+0	-6.39E-4	-2.88E-3	-4.52E-4	-1.78E-3	-2.11E-3	0.00E+0	-9.66E-4	-1.17E-3	0.00E+0	-4.40E-4
175	-1.87E-3	0.00E+0	-7.26E-4	-2.33E-3	0.00E+0	-8.02E-4	-2.81E-3	0.00E+0	-1.09E-3	-2.42E-3	0.00E+0	-1.26E-3	-1.83E-3	0.00E+0	-6.33E-4	-2.75E-3	-5.20E-4	-1.76E-3	-2.02E-3	0.00E+0	-1.01E-3	-1.15E-3	0.00E+0	-4.28E-4
176	-2.17E-3	0.00E+0	-8.61E-4	-2.56E-3	0.00E+0	-8.87E-4	-3.01E-3	0.00E+0	-1.10E-3	-2.61E-3	0.00E+0	-1.31E-3	-1.94E-3	0.00E+0	-7.30E-4	-2.63E-3	-3.26E-4	-1.58E-3	-2.05E-3	0.00E+0	-1.03E-3	-1.03E-3	0.00E+0	-3.68E-4
177	-2.31E-3	0.00E+0	-9.38E-4	-2.70E-3	0.00E+0	-8.84E-4	-3.10E-3	0.00E+0	-1.02E-3	-2.84E-3	0.00E+0	-1.30E-3	-2.11E-3	0.00E+0	-8.53E-4	-2.54E-3	-3.79E-4	-1.58E-3	-2.21E-3	-1.66E-4	-1.22E-3	-1.23E-3	0.00E+0	-4.67E-4
178	-2.57E-3	0.00E+0	-1.03E-3	-2.87E-3	0.00E+0	-9.53E-4	-3.19E-3	0.00E+0	-1.05E-3	-3.03E-3	0.00E+0	-1.31E-3	-2.20E-3	0.00E+0	-9.45E-4	-2.54E-3	0.00E+0	-1.34E-3	-2.32E-3	-9.20E-5	-1.24E-3	-1.30E-3	0.00E+0	-4.91E-4
179	-2.70E-3	0.00E+0	-1.13E-3	-2.99E-3	0.00E+0	-1.06E-3	-3.28E-3	0.00E+0	-1.13E-3	-3.20E-3	0.00E+0	-1.34E-3	-2.37E-3	0.00E+0	-1.03E-3	-2.53E-3	0.00E+0	-1.26E-3	-2.40E-3	-1.14E-4	-1.30E-3	-1.29E-3	0.00E+0	-4.97E-4
180	-2.75E-3	0.00E+0	-1.13E-3	-3.12E-3	0.00E+0	-1.13E-3	-3.36E-3	0.00E+0	-1.19E-3	-3.38E-3	0.00E+0	-1.33E-3	-2.44E-3	0.00E+0	-1.03E-3	-2.48E-3	0.00E+0	-1.20E-3	-2.40E-3	-5.89E-5	-1.28E-3	-1.37E-3	0.00E+0	-5.65E-4
181	-2.73E-3	0.00E+0	-1.04E-3	-3.30E-3	0.00E+0	-1.23E-3	-3.44E-3	0.00E+0	-1.28E-3	-3.58E-3	0.00E+0	-1.36E-3	-2.59E-3	0.00E+0	-1.09E-3	-2.37E-3	0.00E+0	-1.07E-3	-2.56E-3	-1.86E-4	-1.42E-3	-1.71E-3	0.00E+0	-6.16E-4
182	-2.70E-3	0.00E+0	-1.03E-3	-3.36E-3	0.00E+0	-1.27E-3	-3.45E-3	0.00E+0	-1.34E-3	-3.61E-3	0.00E+0	-1.37E-3	-2.66E-3	0.00E+0	-1.13E-3	-2.37E-3	0.00E+0	-1.01E-3	-2.60E-3	-7.17E-5	-1.38E-3	-1.83E-3	0.00E+0	-6.39E-4
183	-2.65E-3	0.00E+0	-1.01E-3	-3.34E-3	0.00E+0	-1.25E-3	-3.45E-3	0.00E+0	-1.34E-3	-3.61E-3	0.00E+0	-1.33E-3	-2.80E-3	0.00E+0	-1.16E-3	-2.55E-3	0.00E+0	-9.34E-4	-2.56E-3	-8.83E-5	-1.38E-3	-1.80E-3	0.00E+0	-7.06E-4
184	-2.58E-3	0.00E+0	-1.05E-3	-3.30E-3	0.00E+0	-1.33E-3	-3.37E-3	0.00E+0	-1.40E-3	-3.52E-3	0.00E+0	-1.40E-3	-2.79E-3	0.00E+0	-1.15E-3	-2.61E-3	0.00E+0	-7.53E-4	-2.68E-3	0.00E+0	-1.26E-3	-1.77E-3	0.00E+0	-6.62E-4
185	-2.53E-3	0.00E+0	-1.08E-3	-3.22E-3	0.00E+0	-1.39E-3	-3.29E-3	0.00E+0	-1.44E-3	-3.43E-3	0.00E+0	-1.44E-3	-2.77E-3	0.00E+0	-1.06E-3	-2.70E-3	0.00E+0	-6.46E-4	-2.88E-3	0.00E+0	-1.10E-3	-2.01E-3	0.00E+0	-5.90E-4
186	-2.52E-3	0.00E+0	-9.54E-4	-3.23E-3	0.00E+0	-1.36E-3	-3.37E-3	0.00E+0	-1.41E-3	-3.50E-3	0.00E+0	-1.38E-3	-3.14E-3	0.00E+0	-1.11E-3	-3.03E-3	0.00E+0	-6.80E-4	-3.34E-3	0.00E+0	-1.21E-3	-2.05E-3	0.00E+0	-7.73E-4
187	-2.50E-3	0.00E+0	-8.76E-4	-3.26E-3	0.00E+0	-1.39E-3	-3.45E-3	0.00E+0	-1.43E-3	-3.49E-3	0.00E+0	-1.30E-3	-3.36E-3	0.00E+0	-1.12E-3	-3.24E-3	0.00E+0	-7.62E-4	-3.15E-3	0.00E+0	-1.13E-3	-2.06E-3	0.00E+0	-7.68E-4
188	-2.28E-3	0.00E+0	-9.13E-4	-2.94E-3	0.00E+0	-1.46E-3	-3.17E-3	0.00E+0	-1.55E-3	-3.25E-3	0.00E+0	-1.52E-3	-3.27E-3	0.00E+0	-1.14E-3	-3.28E-3	0.00E+0	-7.20E-4	-3.13E-3	0.00E+0	-8.49E-4	-2.64E-3	0.00E+0	-6.25E-4

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Memorandum

From: Dave Dilks, Scott Hinz
Date: January 22, 2020
Project: IEP3
To: Pat Hallinan
CC: Doug Krapas, IEP; Brent Downey, Kaiser

SUBJECT: DRAFT: TP Bubble Permit Calculation for IEP and Kaiser

Summary

IEP and Kaiser are interested in developing a bubble permit that combines the allowable loading of their CBOD and TP discharges for purposes of determining compliance with the dissolved oxygen (DO) TMDL. LimnoTech (2018) described the planned approach and included an example application for CBOD. The approach merges the bubble permit concept as described in the Spokane DO TMDL Toolbox (http://spokaneriver.net/initiatives/spokane-river-do-tmdl-implementation/do-tmdl-toolbox/) with EPA's test for compliance to determine if the DO impacts of an alternate loading scenario are consistent with the Spokane DO TMDL.

This memorandum applies that same approach previously developed for CBOD to develop bubble permit limits for TP. CE-QUAL-W2 model results indicate that each one pound increase in IEP TP loading will require a 3.4 pound decrease in Kaiser loading, while a one pound decrease in IEP TP loading will allow for a 1.1[1] pound increase in Kaiser loading. The differences between these "trading ratios" is due to a factor of safety that ensures that the bubble permit will be protective of dissolved oxygen concentrations both as an average across Avista-affected segments/times, as well for individual Avista-affected segments/times.

TP Bubble Permit Calculations

This section applies the approach described previously to CBOD (LimnoTech, 2018) to demonstrate calculation of TP bubble permit values that are protective of dissolved oxygen when averaged across all Avista-affected segments and time periods, as well as individual Avista-affected segments and time periods. It is divided into separate discussions of:

- Results of loading sensitivity runs
- Protection of Average DO
- Protection of Segment/Time Specific DO

Results of loading sensitivity runs

Four TP loads were initially assessed for each discharge, corresponding to a 25% and 50% reduction, and a 50% and 100% increase for both dischargers, of the current TMDL load. Additional 12.5% and 37.5% Kaiser TP load reduction simulations were subsequently conducted because of the relatively poor regression ($r^2 = 0.49$) observed between DO deficit and TP load for

[1] 1.87, if the results of one potentially anomalous simulation are excluded from the analysis

the 0%, 25% and 50% reduction simulations. Tables B-1 and B-2 in Appendix B show incremental dissolved oxygen changes in each segment and time in response to these sensitivity runs. The change in dissolved oxygen concentrations averaged across all Avista-affected cells are displayed in Table 1 for these simulations, to serve as an example of how the approach will be applied.

Table 1. Results of Loading Sensitivity Runs for TP

Discharger (i)	Change from TMDL (%)	ΔL_i (lbs/day)	ΔDO_i (mg/L)
1. IEP	-50%	-1.196	0.0023
1. IEP	-25%	-0.598	0.0015
1. IEP	+50%	1.196	-0.0014
1. IEP	+100%	2.392	-0.0077
2. Kaiser	-50%	-1.6	0.0017
2. Kaiser	-37.5%	-1.2	0.0012
2. Kaiser	-25%	-0.8	0.0053
2. Kaiser	-12.5%	-0.4	0.0012
2. Kaiser	+50%	1.6	-0.0001
2. Kaiser	+100%	3.2	-0.0034

Linear regressions were developed between ΔDO_i and ΔL_i for each discharge. Regressions across all load sensitivities are shown in Figure 1 for IEP and Kaiser.

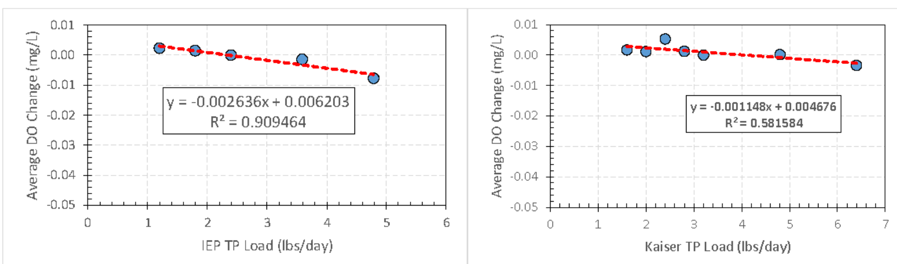

Figure 1. Linear Regressions for All TP Loading Sensitivity Runs

Following the same safety factor approach applied previously for the CBOD bubble permit calculations, separate slopes were developed for the decreased load sensitivity and increased load sensitivity runs. Consistent with the approach described for CBOD, regressions were derived to force a zero intercept with respect to the TDML (i.e. zero change from TMDL load results in zero effect on DO). The resulting regressions are shown in Figure 2 for load reductions and Figure 3 for load increases.

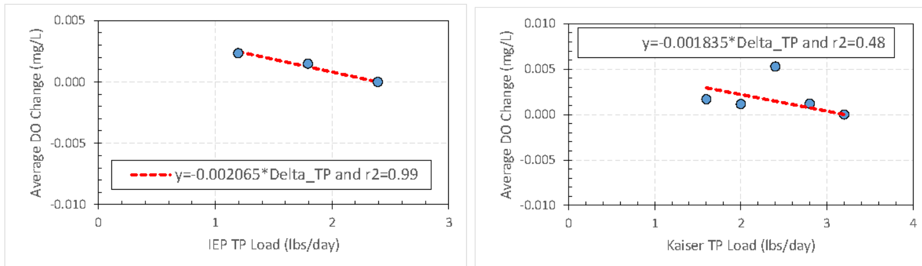

Figure 2. Linear Regressions for Decreased TP Loading Sensitivity Runs

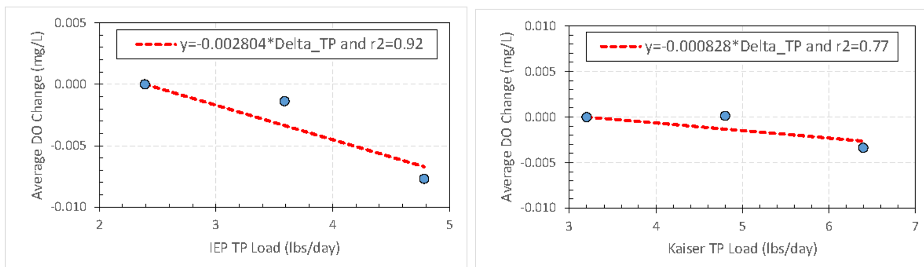

Figure 3. Linear Regression for Increased TP Loading Sensitivity Runs

Results for the 25% Kaiser reduction run (i.e. TP load = 2.4 pounds per day) appear somewhat anomalous relative to the remaining simulations as shown in Table 1 and Figures 1 and 2. This simulation results in a greater predicted average DO impact than do the 37.5% and 50% load reductions, and significantly weakens the correlation between load reduction and resulting DO impact. For this reason, bubble permit calculations provided subsequently were also conducted with the results from this simulation excluded from analysis.

The slopes from Figures 2 and 3 are contained in Table 2 to demonstrate how the bubble permit calculations could be applied to determine the required decrease in Kaiser TP load needed to offset a given increase in IEP load. An 0.1 lb/day increase in IEP TP, multiplied by the most restrictive slope of -0.002804 (mg/l)/(lbs.day), results in an average dissolved oxygen decrease of -0.00028 mg/l. A decrease in Kaiser loading of 0.34 lb/day, multiplied by the most restrictive slope of -0.000828, results in an average dissolved oxygen increase 0.00028 mg/l, which offsets the IEP decrease. The ratio of 0.1 lb of IEP load increase being equivalent to 0.34 pounds of Kaiser load can also be expressed as 1 lb of IEP load increase being equivalent to 3.4 pounds of Kaiser load decrease.

Table 2. Example Compliance Table for the TP Bubble– IEP Increase

(1) Index (Discharge)	(2) Discharger	(3) Pollutant	(4) $IOEF_{i,j}$ Increase (mg/L)/(lb/day)	(5) $IOEF_{i,j}$ Decrease (mg/L)/(lb/day)	(6) Change from TMDL Load (lbs/day)	(7)* ΔDO (mg/L)
1	IEP	TP	-0.002804	-0.002065	0.10	-0.00028
2	Kaiser	TP	-0.000828	-0.001835	-0.34	0.00028
(positive number is in compliance, negative number is out of compliance)					Sum	0.0000

* If Column (6) change from TMDL Load is positive, Column (7) = Max[Column (4), Column (5)] x Column (6)
If Column (6) change from TMDL Load is negative, Column (7) = Min[Column (4), Column (5)] x Column (6)

Table 3 shows example calculations for an increase in Kaiser TP load. A 0.1 lb/day increase in Kaiser TP, multiplied by the most restrictive slope of -0.001835, results in an average dissolved oxygen decrease of 0.0001835. A decrease in IEP loading of 0.0889 lb/day, multiplied by the most restrictive slope of -0.002065, results in an average dissolved oxygen increase of 0.0001835 mg/l, which offsets the Kaiser decrease. The ratio of 0.1 lb of Kaiser load increase being equivalent to 0.0889 pounds of IEP load decrease can also be expressed as 1 lb of IEP load decrease being equivalent to 1.1 pounds of Kaiser load increase (i.e. 0.1/0.0889.)

Table 3. Example Compliance Table for the TP Bubble – Kaiser Increase

(1) Index (Discharge)	(2) Discharger	(3) Pollutant	(4) $IOEF_{i,j}$ Increase (mg/L)/(lb/day)	(5) $IOEF_{i,j}$ Decrease (mg/L)/(lb/day)	(6) Change from TMDL Load (lbs/day)	(7)* ΔDO (mg/L)
1	IEP	TP	-0.002804	-0.002065	-.0889	0.0001835
2	Kaiser	TP	-0.000828	-0.001835	0.10	-0.0001835
(positive number is in compliance, negative number is out of compliance)					Sum	0.0000

* If Column (6) change from TMDL Load is positive, Column (7) = Max[Column (4), Column (5)] x Column (6)
If Column (6) change from TMDL Load is negative, Column (7) = Min[Column (4), Column (5)] x Column (6)

The results from Tables 2 and 3 show "trading ratios" (i.e. pounds of Kaiser load needed to offset a pound of IEP load) of 1.1:1 for IEP decreases and 3.4:1 for IEP increases that will be protective of Avista-averaged dissolved oxygen concentrations while considering a factor of safety. The magnitude of the safety factor inherent in these calculations can be estimated by considering the "best-fit" slopes shown previously in Figure 1. The effect of IEP loading on dissolved oxygen had a best-fit slope of -0.002636 (mg/L)/(lb/day), the effect of Kaiser loading on dissolved oxygen had a best-fit slope of -0.001148 (mg/L)/(lb/day). This indicates that a best fit trading ratio is approximately 2.3:1 (i.e. -0.002636/-0.001148), meaning that one pound of IEP load is equivalent to 2.3 pounds of Kaiser load. The proposed trading ratios of 1.1 for Kaiser increases, and 3.4:1 for IEP increases add a safety factor ranging from 48% (3.4:1 is 48% larger than 2.3:1) to 109% (2.3:1 is 109% larger than 1.1:1).

Analysis Excluding Kaiser 25% TP Load Reduction Results

An analysis similar to the one above was conducted excluding the potentially anomalous Kaiser 25% reduction simulation. Linear regressions TP load reduction results were developed between ΔDO_i and ΔL_i for each discharge. Regressions across all load sensitivities are shown in Figure 4 for IEP and Kaiser. Note that the IEP results are not impacted by this change.

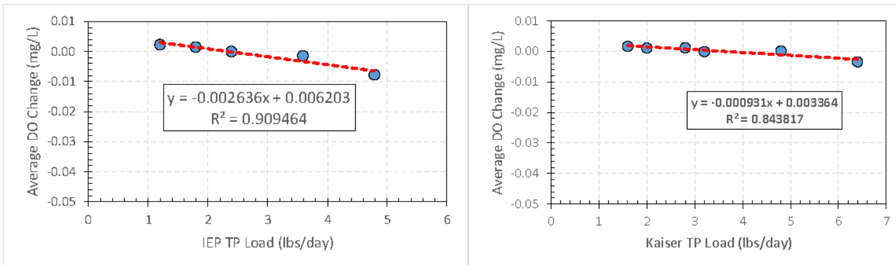

Figure 4. Linear Regressions for All TP Loading Sensitivity Runs (Potentially Anomalous Run Excluded)

Following the same safety factor approach, separate slopes were developed for the decreased load sensitivity and increased load sensitivity runs. Regressions were derived to force a zero intercept with respect to the TDML (i.e. zero change from TMDL load results in zero effect on DO). The resulting regressions are shown in Figure 5 for load reductions and Figure 6 for load increases. Note that the correlation coefficient for Kaiser reduction runs increases from 0.48 to 0.89 by excluding the potentially anomalous result.

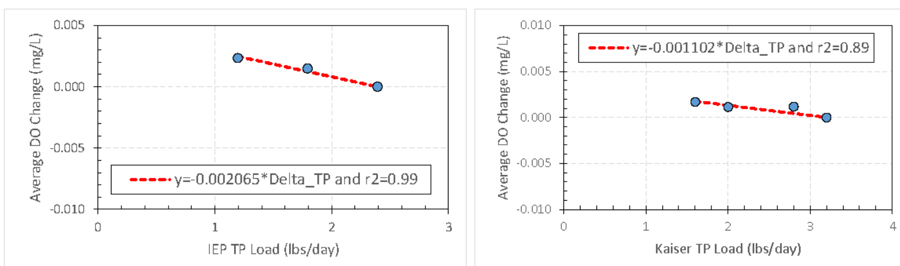

Figure 5. Linear Regressions for Decreased TP Loading Sensitivity Runs (Potentially Anomalous Run Excluded)

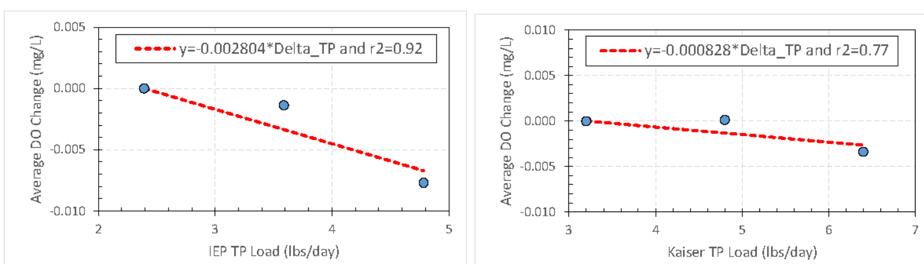

Figure 6. Linear Regression for Increased TP Loading Sensitivity Runs

The slopes from Figures 5 and 6 are contained in Table 4 to demonstrate bubble permit calculations. An 0.10 lb/day increase in IEP TP, multiplied by the most restrictive slope of -0.002804 (mg/l)/(lbs.day), results in an average dissolved oxygen decrease of -0.00028 mg/l. A decrease in Kaiser loading of 0.34 lb/day, multiplied by the most restrictive slope of -0.000828 results in an average dissolved oxygen increase 0.00028 mg/l, which offsets the IEP decrease.

The ratio of 0.1 lb of IEP load increase being equivalent to 0.34 pounds of Kaiser load can also be expressed as 1 lb of IEP load increase being equivalent to 3.4 pounds of Kaiser load.

Table 4. Example Compliance Table for the TP Bubble– IEP Increase

(1) Index (Discharge)	(2) Discharger	(3) Pollutant	(4) IOEF$_{i,j}$ Increase (mg/L)/(lb/day)	(5) IOEF$_{i,j}$ Decrease (mg/L)/(lb/day)	(6) Change from TMDL Load (lbs/day)	(7)* ΔDO (mg/L)
1	IEP	TP	-0.002804	-0.002065	0.10	-0.00028
2	Kaiser	TP	-0.000828	-0.001102	-0.34	0.00028
(positive number is in compliance, negative number is out of compliance)					Sum	0.0000

* If Column (6) change from TMDL Load is positive, Column (7) = Max[Column (4), Column (5)] x Column (6)
If Column (6) change from TMDL Load is negative, Column (7) = Min[Column (4), Column (5)] x Column (6)

Table 5 shows example calculations for an increase in Kaiser TP load. A 0.1 lb/day increase in Kaiser TP, multiplied by the most restrictive slope of -0.001102, results in an average dissolved oxygen decrease of 0.0001102. A decrease in IEP loading of 0.053 lb/day, multiplied by the most restrictive slope of -0.002065, results in an average dissolved oxygen increase of 0.0001102 mg/l, which offsets the Kaiser decrease. The ratio of 0.1 lb of Kaiser load increase being equivalent to 0.06 pounds of IEP load decrease can also be expressed as 1 lb of IEP load decrease being equivalent to 1.87 pounds of Kaiser load increase (i.e. 0.1/0.053.)

Table 5. Example Compliance Table for the TP Bubble – Kaiser Increase

(1) Index (Discharge)	(2) Discharger	(3) Pollutant	(4) IOEF$_{i,j}$ Increase (mg/L)/(lb/day)	(5) IOEF$_{i,j}$ Decrease (mg/L)/(lb/day)	(6) Change from TMDL Load (lbs/day)	(7)* ΔDO (mg/L)
1	IEP	TP	-0.002804	-0.002065	-0.053	0.0001102
2	Kaiser	TP	-0.000828	-0.001102	0.10	-0.0001102
(positive number is in compliance, negative number is out of compliance)					Sum	0.0000

* If Column (6) change from TMDL Load is positive, Column (7) = Max[Column (4), Column (5)] x Column (6)
If Column (6) change from TMDL Load is negative, Column (7) = Min[Column (4), Column (5)] x Column (6)

The results from Tables 4 and 5 show "trading ratios" (i.e. pounds of Kaiser load needed to offset a pound of IEP load) of 1.87:1 for IEP decreases and 3.4:1 for IEP increases that will be protective of Avista-averaged dissolved oxygen concentrations while considering a factor of safety. The magnitude of the safety factor inherent in these calculations can be estimated by considering the "best-fit" slopes shown previously in Figure 1. The effect of IEP loading on dissolved oxygen had a best-fit slope of -0.002636 (mg/L)/(lb/day), the effect of Kaiser loading on dissolved oxygen had a best-fit slope of -0.000931 (mg/L)/(lb/day). This indicates that a best fit trading ratio is approximately 2.8:1 (i.e. -0.002636 / -0.000931), meaning that one pound of IEP load is equivalent to 2.8 pounds of Kaiser load. The proposed trading ratios of 1.87:1 for Kaiser increases, and 3.4:1 for IEP increases add a safety factor ranging from 21% (3.4:1 is 21% larger than 2.8:1) to 50% (2.8:1 is 50% larger than 1.87:1).

Protection of Segment/Time Specific DO

The ratios determined above were next applied to determine whether they were protective of dissolved oxygen in individual Avista-affected segments and time periods. The slopes used to calculate DO in each segment/time pair are presented in Tables B-3 and B-4 in Appendix B for IEP and Kaiser, respectively.

The metric of concern when evaluating TMDL equivalency for individual cells corresponds to whether there is a change in Avista responsibility in any cell, when rounded to nearest 0.1 mg/l. Because this metric does not behave in a directly linear fashion, a wide range of combinations of loads were tested to ensure that compliance will occur.

Table 6 shows the resulting calculations for IEP load increases. For a change in IEP load ranging from 1 to 30% of the existing TMDL (6 to 176lb/season), the number of segment/time pairs with increased responsibility is always less than the number of segment/time pairs with decreased responsibility, and the maximum DO decrease in any segment/time pair with increased responsibility is no greater than 0.008 mg/l and within the error of the model.

Table 6. Demonstration of Protectiveness in Individual Segment/Time Pairs for a Range of IEP Load Increases

Change in IEP Load (%)	Increase in IEP Load (lbs/season)	Decrease in Kaiser Load (lbs/season)	No. of Avista Segment/time pairs		Maximum decrease in DO (mg/l)
			Increased responsibility	Decreased responsibility	
1	5.9	19.8	3	5	0.000
2	11.7	39.7	3	5	0.001
5	29.3	99.2	3	4	0.001
10	58.6	198.5	3	4	0.003
25	146.5	496.2	3	4	0.007
30	175.8	595.4	3	4	0.008

Table 7 shows similar calculations for Kaiser load increases with all runs considered, while Table 8 shows results when excluding the potentially anomalous run (using slopes to calculate DO in each segment/time pair in Table B-5 for and Kaiser. For a change in Kaiser load ranging from 1 to 30% (8 to 235 lb/season), the number of segment/time pairs with increased responsibility is always less than the number of segment/time pairs with decreased responsibility, and the maximum DO decrease in any segment/time pair with increased responsibility is no greater than 0.01 mg/l (0.008 mg/l if the potentially anomalous result is excluded). These impacts are well within the error of the model.

Table 7. Demonstration of Protectiveness in Individual Segment/Time Pairs for a Range of Kaiser Load (Increases All Runs Included)

Change in Kaiser Load (%)	Increase in Kaiser Load (lbs/season)	Decrease in IEP Load (lbs/season)	Responsibility Change - Number of Avista Segment/time pairs		Maximum decrease in DO (mg/l)
			Increased	Decreased	
1	7.8	7.0	3	5	0.000
2	15.7	14.0	3	5	0.001
5	39.2	35.1	3	5	0.002
10	78.4	70.2	3	5	0.003
25	196.0	175.5	3	4	0.009
30	235.2	210.6	3	4	0.010

Table 8. Demonstration of Protectiveness in Individual Segment/Time Pairs for a Range of Kaiser Load Increases (Potentially Anomalous Run Excluded)

Change in Kaiser Load (%)	Increase in Kaiser Load (lbs/season)	Decrease in IEP Load (lbs/season)	Responsibility Change - Number of Avista Segment/time pairs		Maximum decrease in DO (mg/l)
			Increased	Decreased	
1	7.8	4.2	3	5	0.000
2	15.7	8.4	3	5	0.001
5	39.2	20.9	3	5	0.001
10	78.4	41.9	3	4	0.003
25	196.0	104.7	3	4	0.007
30	235.2	125.6	3	4	0.008

These results indicate (for a range of IEP load increases up to 176 pounds per season, and a range of Kaiser load increases up to 235 pounds per season) that the safety factors used to calculate IOEF slopes protective of average DO across all Avista-affected segments and times are also protective of DO in individual Avista-affected segments and times. A bubble permit that reflects these slopes will be protective of the TMDL.

References

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Washington Department of Ecology and U.S. EPA, 2011. Evaluation of Alternative Effluent Limits for Consistency with the Spokane River TMDL and Compliance with Washington Water Quality Standards. http://www.spokaneriver.net/wp-content/uploads/2012/04/Final_EPA_Ecology_Basis_for_Equivalence_2011_v3.pdf

Appendix A: Table 7 from TMDL

Table 7. TMDL Scenario #1 dissolved oxygen concentrations (*italics*) *are compared with No Source scenario concentrations (bold) for June 1 through September 15. Avista's responsibility (mg/L DO) for each segment is quantified in the shaded cells.*

Segment	June 1-15			June 15-30			July 1-15			July 16-31			Aug 1-15			Aug 16-31			Sept 1-15		
157	**9.23**	*9.40*	_	**9.44**	*9.66*	_	**8.94**	*9.46*	_	**8.93**	*9.43*	_	**9.06**	*9.55*	_	**9.22**	*9.93*	_	**9.40**	*9.96*	_
158	**9.42**	*9.66*	_	**9.42**	*9.79*	_	**9.06**	*9.49*	_	**9.11**	*9.60*	_	**9.14**	*9.65*	_	**9.31**	*9.84*	_	**9.46**	*9.99*	_
159	**9.54**	*9.84*	_	**9.46**	*9.86*	_	**9.13**	*9.53*	_	**9.19**	*9.62*	_	**9.19**	*9.63*	_	**9.32**	*9.78*	_	**9.47**	*9.93*	_
160	**9.57**	*9.88*	_	**9.45**	*9.85*	_	**9.12**	*9.47*	_	**9.19**	*9.58*	_	**9.18**	*9.56*	_	**9.30**	*9.70*	_	**9.44**	*9.87*	_
161	**9.56**	*9.87*	_	**9.51**	*9.94*	_	**9.16**	*9.52*	_	**9.19**	*9.57*	_	**9.19**	*9.55*	_	**9.30**	*9.68*	_	**9.45**	*9.84*	_
162	**9.56**	*9.89*	_	**9.55**	*10.01*	_	**9.16**	*9.53*	_	**9.18**	*9.59*	_	**9.18**	*9.53*	_	**9.26**	*9.61*	_	**9.41**	*9.79*	_
163	**9.58**	*9.96*	_	**9.59**	*10.06*	_	**9.18**	*9.56*	_	**9.17**	*9.63*	_	**9.17**	*9.53*	_	**9.18**	*9.52*	_	**9.31**	*9.73*	_
164	**9.61**	*10.03*	_	**9.58**	*10.08*	_	**9.15**	*9.52*	_	**9.14**	*9.62*	_	**9.13**	*9.47*	_	**9.10**	*9.37*	_	**9.20**	*9.62*	_
165	**9.62**	*10.05*	_	**9.57**	*10.10*	_	**9.06**	*9.38*	_	**9.09**	*9.53*	_	**9.07**	*9.36*	_	**8.96**	*9.12*	_	**9.11**	*9.50*	_
166	**9.59**	*10.03*	_	**9.51**	*10.03*	_	**8.87**	*9.07*	_	**8.98**	*9.30*	_	**8.97**	*9.15*	_	**8.82**	*8.85*	_	**9.07**	*9.38*	_
167	**9.59**	*10.03*	_	**9.48**	*9.98*	_	**8.73**	*8.87*	_	**8.84**	*9.07*	_	**8.87**	*8.97*	_	**8.69**	*8.63*	_	**9.01**	*9.27*	_
168	**9.61**	*10.10*	_	**9.43**	*9.91*	_	**8.52**	*8.58*	_	**8.55**	*8.63*	_	**8.66**	*8.57*	_	**8.44**	*8.20*	0.0	**8.95**	*9.11*	_
169	**9.62**	*10.16*	_	**9.37**	*9.82*	_	**8.41**	*8.41*	_	**8.36**	*8.37*	_	**8.47**	*8.31*	_	**8.25**	*7.92*	0.1	**8.85**	*8.91*	_
170	**9.60**	*10.18*	_	**9.28**	*9.72*	_	**8.37**	*8.36*	_	**8.27**	*8.23*	_	**8.37**	*8.17*	_	**8.13**	*7.71*	0.2	**8.69**	*8.66*	_
171	**9.58**	*10.17*	_	**9.23**	*9.66*	_	**8.40**	*8.39*	_	**8.23**	*8.17*	_	**8.31**	*8.07*	0.0	**8.04**	*7.55*	0.3	**8.57**	*8.43*	_
172	**9.50**	*10.08*	_	**9.08**	*9.46*	_	**8.23**	*8.17*	_	**7.96**	*7.80*	_	**7.98**	*7.63*	0.2	**7.70**	*7.07*	0.4	**8.35**	*8.06*	0.1
173	**9.40**	*9.96*	_	**8.96**	*9.31*	_	**8.12**	*8.00*	_	**7.80**	*7.55*	0.0	**7.80**	*7.36*	0.2	**7.51**	*6.78*	0.5	**8.15**	*7.75*	0.2
174	**9.29**	*9.80*	_	**8.81**	*9.12*	_	**7.96**	*7.79*	_	**7.59**	*7.27*	0.1	**7.56**	*7.05*	0.3	**7.26**	*6.42*	0.6	**7.85**	*7.34*	0.3
175	**9.20**	*9.68*	_	**8.69**	*8.99*	_	**7.86**	*7.66*	_	**7.46**	*7.09*	0.2	**7.40**	*6.84*	0.4	**7.09**	*6.21*	0.7	**7.62**	*7.04*	0.4
176	**9.12**	*9.59*	_	**8.63**	*8.91*	_	**7.83**	*7.60*	0.0	**7.41**	*6.99*	0.2	**7.39**	*6.79*	0.4	**7.06**	*6.13*	0.7	**7.55**	*6.91*	0.4
177	**8.93**	*9.31*	_	**8.35**	*8.54*	_	**7.50**	*7.19*	0.1	**6.99**	*6.46*	0.3	**6.92**	*6.22*	0.5	**6.56**	*5.54*	0.8	**7.01**	*6.24*	0.6
178	**8.85**	*9.21*	_	**8.27**	*8.42*	_	**7.44**	*7.10*	0.1	**6.92**	*6.34*	0.4	**6.88**	*6.15*	0.5	**6.51**	*5.47*	0.8	**6.89**	*6.06*	0.6
179	**8.79**	*9.14*	_	**8.24**	*8.37*	_	**7.42**	*7.07*	0.1	**6.88**	*6.27*	0.4	**6.86**	*6.11*	0.6	**6.51**	*5.44*	0.9	**6.81**	*5.92*	0.7
180	**8.73**	*9.05*	_	**8.19**	*8.30*	_	**7.38**	*7.02*	0.2	**6.83**	*6.19*	0.4	**6.81**	*6.03*	0.6	**6.49**	*5.42*	0.9	**6.67**	*5.75*	0.7
181	**8.66**	*8.95*	_	**8.15**	*8.21*	_	**7.36**	*6.97*	0.2	**6.78**	*6.08*	0.5	**6.74**	*5.89*	0.6	**6.47**	*5.36*	0.9	**6.52**	*5.53*	0.8
182	**8.67**	*8.95*	_	**8.16**	*8.21*	_	**7.41**	*7.01*	0.2	**6.84**	*6.13*	0.5	**6.78**	*5.92*	0.7	**6.56**	*5.46*	0.9	**6.53**	*5.52*	0.8
183	**8.55**	*8.78*	_	**8.00**	*7.98*	_	**7.26**	*6.85*	0.2	**6.70**	*5.97*	0.5	**6.58**	*5.69*	0.7	**6.37**	*5.29*	0.9	**6.29**	*5.27*	0.8
184	**8.54**	*8.75*	_	**7.98**	*7.94*	_	**7.30**	*6.88*	0.2	**6.77**	*6.01*	0.6	**6.63**	*5.71*	0.7	**6.43**	*5.33*	0.9	**6.30**	*5.34*	0.8
185	**8.47**	*8.63*	_	**7.94**	*7.87*	_	**7.29**	*6.88*	0.2	**6.78**	*6.00*	0.6	**6.58**	*5.64*	0.7	**6.42**	*5.29*	0.9	**6.23**	*5.27*	0.8
186	**8.34**	*8.44*	_	**7.84**	*7.74*	_	**7.18**	*6.76*	0.2	**6.63**	*5.84*	0.6	**6.37**	*5.41*	0.8	**6.24**	*5.08*	1.0	**5.96**	*4.93*	0.8
187	**8.31**	*8.40*	_	**7.85**	*7.75*	_	**7.23**	*6.79*	0.2	**6.66**	*5.83*	0.6	**6.36**	*5.35*	0.8	**6.27**	*5.05*	1.0	**5.96**	*4.90*	0.9
188	**8.20**	*8.25*	_	**7.67**	*7.56*	_	**7.10**	*6.65*	0.2	**6.53**	*5.71*	0.6	**6.15**	*5.17*	0.8	**6.07**	*4.88*	1.0	**5.73**	*4.68*	0.8

Table 7 (continued). TMDL Scenario #1 dissolved oxygen concentrations (*italics*) *are compared with No Source scenario concentrations (bold) for September 16 through December 31. Avista's responsibility (mg/L DO) for each segment is quantified in the shaded cells.*

Segment	Sept 16-30			Oct 1-15			Oct 16-31			Nov 1-15			Nov 16-30			Dec 1-15			Dec 16-31		
157	**9.58**	*9.90*	_	**9.81**	*10.07*	_	**10.40**	*10.49*	_	**10.59**	*10.83*	_	**10.82**	*10.79*	_	**11.41**	*11.50*	_			_
158	**9.63**	*9.91*	_	**9.99**	*10.08*	_	**10.49**	*10.55*	_	**10.67**	*10.85*	_	**10.80**	*10.80*	_	**11.43**	*11.49*	_	**11.50**	*11.54*	_
159	**9.62**	*9.85*	_	**10.01**	*10.09*	_	**10.51**	*10.56*	_	**10.70**	*10.89*	_	**10.83**	*10.81*	_	**11.43**	*11.49*	_	**11.51**	*11.58*	_
160	**9.60**	*9.79*	_	**10.01**	*10.10*	_	**10.52**	*10.56*	_	**10.69**	*10.90*	_	**10.82**	*10.78*	_	**11.43**	*11.48*	_	**11.50**	*11.59*	_
161	**9.60**	*9.77*	_	**10.02**	*10.10*	_	**10.52**	*10.54*	_	**10.69**	*10.88*	_	**10.83**	*10.77*	_	**11.43**	*11.48*	_	**11.49**	*11.57*	_
162	**9.58**	*9.74*	_	**10.04**	*10.12*	_	**10.55**	*10.57*	_	**10.67**	*10.83*	_	**10.82**	*10.73*	_	**11.43**	*11.46*	_	**11.49**	*11.57*	_
163	**9.52**	*9.72*	_	**10.01**	*10.12*	_	**10.57**	*10.60*	_	**10.66**	*10.80*	_	**10.81**	*10.70*	_	**11.42**	*11.45*	_	**11.49**	*11.56*	_
164	**9.41**	*9.66*	_	**9.91**	*10.06*	_	**10.55**	*10.60*	_	**10.65**	*10.79*	_	**10.80**	*10.66*	_	**11.40**	*11.41*	_	**11.48**	*11.54*	_
165	**9.30**	*9.59*	_	**9.77**	*10.00*	_	**10.47**	*10.54*	_	**10.65**	*10.79*	_	**10.81**	*10.64*	_	**11.39**	*11.38*	_	**11.47**	*11.53*	_
166	**9.26**	*9.47*	_	**9.70**	*9.91*	_	**10.42**	*10.48*	_	**10.60**	*10.70*	_	**10.78**	*10.59*	_	**11.37**	*11.33*	_	**11.45**	*11.49*	_
167	**9.20**	*9.36*	_	**9.63**	*9.85*	_	**10.37**	*10.42*	_	**10.59**	*10.67*	_	**10.79**	*10.58*		**11.36**	*11.30*	_	**11.43**	*11.48*	_
168	**9.15**	*9.23*	_	**9.56**	*9.78*	_	**10.28**	*10.36*	_	**10.59**	*10.64*	_	**10.80**	*10.57*		**11.34**	*11.27*	_	**11.43**	*11.47*	_
169	**9.10**	*9.13*	_	**9.49**	*9.70*	_	**10.17**	*10.28*	_	**10.61**	*10.66*	_	**10.79**	*10.55*		**11.27**	*11.11*	_	**11.41**	*11.43*	_
170	**9.03**	*9.01*	_	**9.40**	*9.60*	_	**10.04**	*10.17*	_	**10.56**	*10.63*	_	**10.79**	*10.51*		**11.20**	*10.92*		**11.38**	*11.37*	_
171	**8.96**	*8.86*	_	**9.31**	*9.48*	_	**9.91**	*10.06*	_	**10.48**	*10.54*	_	**10.75**	*10.44*		**11.20**	*10.92*		**11.36**	*11.31*	_
172	**8.86**	*8.65*	0.0	**9.26**	*9.40*	_	**9.82**	*9.99*	_	**10.37**	*10.41*	_	**10.72**	*10.40*		**11.29**	*11.06*		**11.43**	*11.39*	_
173	**8.75**	*8.46*	0.1	**9.21**	*9.31*	_	**9.77**	*9.91*	_	**10.29**	*10.29*	_	**10.68**	*10.35*		**11.29**	*11.03*		**11.46**	*11.41*	_
174	**8.56**	*8.16*	0.2	**9.17**	*9.18*	_	**9.75**	*9.85*	_	**10.27**	*10.24*	_	**10.66**	*10.33*		**11.27**	*10.97*		**11.45**	*11.38*	_
175	**8.37**	*7.92*	0.3	**9.09**	*9.06*	_	**9.73**	*9.80*	_	**10.24**	*10.19*	_	**10.64**	*10.32*		**11.26**	*10.95*		**11.46**	*11.37*	_
176	**8.27**	*7.77*	0.3	**8.95**	*8.87*	_	**9.67**	*9.72*	_	**10.16**	*10.08*	_	**10.60**	*10.30*		**11.24**	*10.90*		**11.50**	*11.39*	_
177	**7.79**	*7.15*	0.4	**8.66**	*8.46*	0.0	**9.69**	*9.70*	_	**10.15**	*10.05*	_	**10.58**	*10.29*		**11.21**	*10.86*		**11.50**	*11.37*	_
178	**7.60**	*6.88*	0.5	**8.50**	*8.23*	0.1	**9.68**	*9.67*	_	**10.12**	*10.00*	_	**10.55**	*10.27*		**11.19**	*10.83*		**11.52**	*11.37*	_
179	**7.53**	*6.75*	0.6	**8.44**	*8.13*	0.1	**9.65**	*9.63*	_	**10.08**	*9.93*	_	**10.52**	*10.25*		**11.18**	*10.80*		**11.58**	*11.40*	_
180	**7.36**	*6.51*	0.7	**8.30**	*7.92*	0.2	**9.62**	*9.57*	_	**10.06**	*9.88*	_	**10.50**	*10.23*		**11.17**	*10.78*		**11.61**	*11.40*	
181	**7.18**	*6.24*	0.7	**8.12**	*7.64*	0.3	**9.54**	*9.43*	_	**10.04**	*9.84*	_	**10.48**	*10.20*		**11.16**	*10.76*		**11.59**	*11.35*	
182	**7.03**	*6.04*	0.8	**7.97**	*7.47*	0.3	**9.41**	*9.25*	_	**10.04**	*9.83*		**10.48**	*10.19*		**11.15**	*10.74*		**11.56**	*11.31*	
183	**6.66**	*5.63*	0.8	**7.59**	*7.01*	0.4	**9.28**	*9.09*	_	**10.02**	*9.79*		**10.47**	*10.17*		**11.15**	*10.74*		**11.59**	*11.30*	
184	**6.50**	*5.50*	0.8	**7.29**	*6.69*	0.4	**9.14**	*8.88*	0.1	**10.01**	*9.76*		**10.46**	*10.16*		**11.14**	*10.73*		**11.59**	*11.29*	
185	**6.31**	*5.29*	0.8	**7.02**	*6.35*	0.5	**8.90**	*8.56*	0.1	**10.00**	*9.74*		**10.46**	*10.16*		**11.13**	*10.71*		**11.59**	*11.26*	
186	**5.94**	*4.89*	0.8	**6.66**	*5.82*	0.6	**8.64**	*8.26*	0.2	**9.96**	*9.68*		**10.46**	*10.15*		**11.11**	*10.67*		**11.55**	*11.21*	
187	**5.88**	*4.81*	0.9	**6.39**	*5.52*	0.7	**8.51**	*8.14*	0.2	**9.94**	*9.63*		**10.44**	*10.12*		**11.09**	*10.64*		**11.52**	*11.18*	
188	**5.57**	*4.52*	0.8	**5.88**	*5.12*	0.6	**7.96**	*7.52*	0.2	**9.91**	*9.52*		**10.40**	*10.08*		**11.07**	*10.61*		**11.55**	*11.19*	

Appendix B: Model Results for TP Calculations

Table B-1 Incremental Dissolved Oxygen Changes in Response to Changes in IEP TP Load

	July 1 - 15					July 16 - 31					August 1 - 15					August 15 - 31				
	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x
IEP TP Change (mg/L)	-0.035	-0.018	0	0.035	0.07	-0.035	-0.018	0	0.035	0.07	-0.035	-0.018	0	0.035	0.07	-0.035	-0.018	0	0.035	0.07
Segment																				
158	0.008	0.002	0.000	0.018	0.003	-0.004	-0.004	0.000	-0.001	-0.004	-0.002	-0.002	0.000	0.000	0.003	0.003	0.001	0.000	0.000	0.001
159	0.016	0.001	0.000	0.016	-0.001	-0.002	-0.003	0.000	0.000	-0.004	-0.001	-0.002	0.000	0.000	-0.002	0.002	0.000	0.000	0.002	0.000
160	0.020	0.001	0.000	0.020	-0.005	-0.002	-0.002	0.000	-0.001	-0.002	-0.002	-0.002	0.000	0.000	-0.002	0.002	0.000	0.000	0.002	0.000
161	0.022	0.002	0.000	0.022	-0.004	-0.001	-0.001	0.000	-0.001	-0.002	-0.002	-0.001	0.000	0.000	-0.002	0.002	0.000	0.000	0.001	0.000
162	0.024	0.002	0.000	0.018	-0.002	-0.001	0.000	0.000	-0.001	-0.002	-0.002	-0.001	0.000	0.000	-0.002	0.002	0.000	0.000	0.002	0.000
163	0.011	0.004	0.000	0.013	-0.003	0.000	0.003	0.000	0.000	-0.001	-0.001	0.000	0.000	0.001	-0.001	0.002	0.000	0.000	0.002	0.001
164	0.007	0.007	0.000	0.014	-0.006	0.002	0.004	0.000	0.002	0.001	0.000	0.000	0.000	0.001	-0.001	0.002	0.000	0.000	0.002	-0.001
165	0.011	0.011	0.000	0.014	-0.010	0.001	0.005	0.000	0.003	0.004	0.001	-0.001	0.000	-0.001	-0.002	0.002	-0.001	0.000	0.000	-0.004
166	0.015	0.014	0.000	0.006	-0.012	0.002	0.006	0.000	0.001	0.001	0.000	0.000	0.000	-0.001	-0.004	0.001	-0.002	0.000	-0.002	-0.006
167	0.024	0.014	0.000	0.012	-0.011	0.002	0.005	0.000	-0.004	-0.009	0.000	0.000	0.000	0.000	-0.005	0.001	-0.002	0.000	-0.002	-0.007
168	0.031	0.018	0.000	0.008	-0.010	0.006	0.006	0.000	-0.007	-0.014	-0.005	0.005	0.000	0.000	-0.005	-0.001	-0.002	0.000	-0.005	-0.011
169	0.043	0.021	0.000	0.018	-0.009	0.009	0.006	0.000	-0.008	-0.016	-0.006	0.007	0.000	0.001	-0.005	0.002	0.000	0.000	-0.005	-0.011
170	0.040	0.019	0.000	0.020	-0.008	0.011	0.006	0.000	-0.007	-0.014	-0.005	0.008	0.000	0.001	-0.004	0.002	0.001	0.000	-0.006	-0.012
171	0.024	0.017	0.000	0.016	-0.016	0.012	0.006	0.000	-0.004	-0.011	-0.004	0.008	0.000	0.000	-0.003	0.002	0.000	0.000	-0.005	-0.011
172	0.025	0.021	0.000	0.015	-0.016	0.015	0.008	0.000	-0.002	-0.009	-0.002	0.010	0.000	0.001	-0.004	0.003	0.001	0.000	-0.005	-0.012
173	0.023	0.021	0.000	0.015	-0.009	0.018	0.009	0.000	-0.002	-0.007	0.002	0.011	0.000	0.001	-0.005	0.002	0.000	0.000	-0.005	-0.013
174	0.018	0.018	0.000	-0.003	-0.010	0.014	0.010	0.000	-0.002	-0.005	0.004	0.010	0.000	0.000	-0.006	0.002	0.000	0.000	-0.004	-0.013
175	0.011	0.015	0.000	-0.006	-0.011	0.015	0.010	0.000	-0.002	-0.005	0.005	0.010	0.000	0.000	-0.006	0.003	0.001	0.000	-0.003	-0.012
176	0.003	0.011	0.000	-0.003	-0.010	0.013	0.008	0.000	-0.001	-0.005	0.006	0.010	0.000	0.000	-0.008	0.003	0.001	0.000	-0.003	-0.012
177	0.015	0.009	0.000	0.009	0.006	0.013	0.008	0.000	0.000	-0.004	0.008	0.010	0.000	0.001	-0.007	0.005	0.001	0.000	-0.002	-0.012
178	0.013	0.005	0.000	0.009	0.005	0.010	0.006	0.000	0.001	-0.004	0.007	0.008	0.000	0.000	-0.007	0.005	0.000	0.000	-0.002	-0.011
179	0.007	0.003	0.000	0.003	0.002	0.007	0.004	0.000	0.001	-0.003	0.007	0.007	0.000	-0.001	-0.009	0.005	0.001	0.000	-0.001	-0.011
180	0.001	0.002	0.000	0.004	0.003	0.005	0.003	0.000	0.002	-0.003	0.007	0.005	0.000	-0.001	-0.010	0.005	0.002	0.000	-0.001	-0.011
181	-0.002	0.003	0.000	0.008	-0.003	0.002	0.002	0.000	0.003	-0.002	0.007	0.003	0.000	-0.002	-0.011	0.005	0.002	0.000	0.000	-0.011
182	-0.003	0.008	0.000	0.006	-0.008	0.001	0.002	0.000	0.004	-0.002	0.006	0.002	0.000	-0.002	-0.012	0.005	0.003	0.000	0.000	-0.010
183	-0.008	0.008	0.000	0.000	-0.011	0.001	0.001	0.000	0.004	-0.002	0.006	0.001	0.000	-0.002	-0.011	0.005	0.002	0.000	0.000	-0.010
184	-0.004	0.002	0.000	0.000	-0.010	0.001	0.000	0.000	0.005	-0.003	0.006	-0.001	0.000	-0.002	-0.012	0.005	0.001	0.000	0.000	-0.010
185	-0.008	0.000	0.000	-0.002	-0.012	0.001	-0.001	0.000	0.006	-0.005	0.006	-0.003	0.000	0.000	-0.012	0.004	0.000	0.000	-0.001	-0.011
186	-0.009	0.001	0.000	-0.002	-0.014	0.002	-0.001	0.000	0.007	-0.005	0.006	-0.002	0.000	0.002	-0.010	0.005	0.001	0.000	-0.001	-0.009
187	-0.007	0.002	0.000	0.001	-0.017	0.001	0.000	0.000	0.007	-0.005	0.005	-0.003	0.000	0.003	-0.010	0.005	0.002	0.000	-0.002	-0.008
188	-0.002	0.001	0.000	0.002	-0.012	0.000	-0.003	0.000	0.006	-0.008	0.004	-0.005	0.000	0.003	-0.011	0.004	-0.002	0.000	-0.002	-0.012

	September 1 - 15					September 16 - 30					October 1 - 15					October 16 - 31				
	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x	0.5x	0.75x	1x	1.5x	2x
IEP TP Change (mg/L)	-0.035	-0.018	0	0.035	0.07	-0.035	-0.018	0	0.035	0.07	-0.035	-0.018	0	0.035	0.07	-0.035	-0.018	0	0.035	0.07
Segment																				
158	0.001	0.001	0.000	0.003	0.004	-0.004	-0.002	0.000	0.000	0.003	-0.004	-0.002	0.000	0.000	0.001	-0.003	-0.001	0.000	-0.001	-0.001
159	0.002	0.001	0.000	0.001	0.002	-0.004	-0.002	0.000	0.000	0.003	-0.004	-0.001	0.000	0.000	0.001	-0.003	0.000	0.000	-0.001	0.000
160	0.002	0.000	0.000	0.000	0.001	-0.003	-0.001	0.000	0.001	0.004	-0.004	-0.002	0.000	0.000	0.001	-0.003	0.000	0.000	-0.001	0.000
161	0.002	0.000	0.000	0.001	0.001	-0.003	-0.002	0.000	0.000	0.003	-0.005	-0.003	0.000	0.000	0.001	-0.003	0.000	0.000	-0.001	0.000
162	0.002	0.001	0.000	0.001	0.001	-0.002	-0.001	0.000	0.000	0.002	-0.004	-0.002	0.000	0.001	0.002	-0.004	0.000	0.000	-0.001	0.000
163	0.002	0.001	0.000	0.001	0.002	-0.002	-0.001	0.000	0.000	0.002	-0.004	-0.002	0.000	0.000	0.001	-0.004	0.000	0.000	-0.002	0.000
164	0.002	0.002	0.000	0.001	0.001	-0.002	-0.001	0.000	0.000	0.002	-0.003	-0.001	0.000	0.001	0.003	-0.004	0.001	0.000	-0.001	0.001
165	0.003	0.002	0.000	0.002	0.002	-0.001	0.000	0.000	0.000	0.003	-0.002	0.000	0.000	0.002	0.003	-0.004	0.000	0.000	-0.001	0.000
166	0.003	0.002	0.000	0.002	0.001	-0.001	0.000	0.000	0.000	0.002	-0.003	-0.001	0.000	0.001	0.003	-0.004	0.000	0.000	-0.001	0.000
167	0.003	0.000	0.000	0.001	0.000	-0.002	-0.001	0.000	-0.001	0.002	-0.002	-0.001	0.000	0.001	0.003	-0.004	0.001	0.000	-0.001	0.001
168	0.003	0.000	0.000	0.000	-0.002	-0.002	0.000	0.000	-0.001	0.001	-0.002	-0.001	0.000	0.001	0.003	-0.003	0.001	0.000	0.000	0.001
169	0.003	0.002	0.000	-0.001	-0.005	-0.001	0.000	0.000	-0.001	0.000	-0.002	-0.001	0.000	0.001	0.003	-0.003	0.000	0.000	0.000	0.001
170	0.006	0.004	0.000	-0.001	-0.005	-0.001	-0.001	0.000	-0.001	-0.001	-0.002	-0.001	0.000	0.001	0.003	-0.003	0.001	0.000	0.000	0.002
171	0.008	0.006	0.000	0.005	-0.004	-0.001	-0.001	0.000	-0.002	-0.002	-0.001	-0.001	0.000	0.000	0.002	-0.002	0.001	0.000	0.001	0.002
172	0.009	0.010	0.000	0.006	-0.007	-0.004	-0.003	0.000	-0.005	-0.008	-0.002	-0.001	0.000	0.000	0.002	-0.002	0.001	0.000	0.001	0.002
173	0.007	0.009	0.000	0.001	-0.009	-0.005	-0.005	0.000	-0.008	-0.009	-0.002	-0.001	0.000	0.000	0.001	-0.002	0.001	0.000	0.001	0.002
174	0.006	0.010	0.000	-0.004	-0.012	-0.008	-0.008	0.000	-0.011	-0.012	-0.003	-0.002	0.000	-0.001	0.000	-0.002	0.001	0.000	0.000	0.002
175	0.007	0.009	0.000	-0.003	-0.011	-0.009	-0.007	0.000	-0.012	-0.014	-0.005	-0.003	0.000	-0.002	-0.001	-0.002	0.001	0.000	0.001	0.002
176	0.006	0.007	0.000	-0.004	-0.012	-0.008	-0.005	0.000	-0.011	-0.012	-0.005	-0.003	0.000	-0.002	-0.002	-0.002	0.001	0.000	0.001	0.002
177	0.006	0.005	0.000	-0.006	-0.013	-0.008	-0.006	0.000	-0.012	-0.015	-0.007	-0.004	0.000	-0.004	-0.004	-0.002	0.001	0.000	0.000	0.001
178	0.006	0.003	0.000	-0.007	-0.014	-0.005	-0.008	0.000	-0.009	-0.012	-0.007	-0.004	0.000	-0.004	-0.004	-0.002	0.001	0.000	0.000	0.001
179	0.006	0.001	0.000	-0.007	-0.012	-0.004	-0.001	0.000	-0.003	-0.012	-0.007	-0.004	0.000	-0.005	-0.006	-0.002	0.001	0.000	0.000	0.001
180	0.005	-0.001	0.000	-0.005	-0.011	-0.003	-0.001	0.000	-0.008	-0.013	-0.007	-0.004	0.000	-0.005	-0.006	-0.002	0.001	0.000	0.000	0.000
181	0.004	-0.003	0.000	-0.003	-0.010	-0.001	0.001	0.000	-0.007	-0.013	-0.008	-0.005	0.000	-0.006	-0.007	-0.003	0.002	0.000	0.000	0.001
182	0.004	-0.003	0.000	-0.003	-0.010	0.002	0.001	0.000	-0.006	-0.013	-0.006	-0.004	0.000	-0.005	-0.007	-0.003	0.002	0.000	-0.001	0.001
183	0.008	-0.004	0.000	-0.002	-0.010	0.006	0.002	0.000	-0.003	-0.011	-0.007	-0.005	0.000	-0.006	-0.007	-0.003	0.001	0.000	-0.001	0.000
184	0.008	-0.004	0.000	-0.001	-0.009	0.010	0.002	0.000	0.001	-0.006	-0.003	-0.008	0.000	-0.003	-0.006	-0.004	0.002	0.000	-0.002	0.000
185	0.008	-0.003	0.000	-0.001	-0.007	0.011	0.008	0.000	0.003	-0.003	-0.001	-0.002	0.000	-0.002	-0.004	-0.005	0.003	0.000	-0.002	0.002
186	0.004	-0.002	0.000	0.000	-0.006	0.011	0.002	0.000	0.004	-0.002	-0.001	-0.002	0.000	-0.003	-0.006	-0.006	0.001	0.000	-0.003	-0.001
187	0.004	0.000	0.000	0.000	-0.006	0.011	0.002	0.000	0.003	-0.002	-0.002	-0.004	0.000	-0.002	-0.006	-0.006	0.001	0.000	-0.003	-0.001
188	0.004	-0.001	0.000	0.000	-0.006	0.009	0.002	0.000	0.003	0.000	0.000	0.000	0.000	0.000	-0.003	-0.004	0.002	0.000	-0.002	0.002

Table B-2. Incremental Dissolved Oxygen Changes in Response to Changes in Kaiser TP Load

	July 1 - 15							July 16 - 31						
	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x
Kaiser TP Change (mg/L)	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025
Segment														
158	-0.003	-0.002	0.009	0.000	0.000	0.002	0.004	-0.007	-0.004	-0.006	-0.004	0.000	0.001	0.002
159	-0.002	-0.002	0.017	-0.001	0.000	0.001	0.003	-0.007	-0.005	-0.004	-0.005	0.000	0.002	0.002
160	-0.003	-0.002	0.022	-0.002	0.000	0.001	0.000	-0.005	-0.002	-0.002	-0.003	0.000	0.001	0.004
161	-0.002	0.000	0.024	-0.001	0.000	0.003	0.001	-0.005	-0.002	-0.001	-0.003	0.000	0.001	0.005
162	-0.002	-0.001	0.025	-0.001	0.000	0.003	0.003	-0.004	-0.002	0.000	-0.002	0.000	0.001	0.004
163	0.000	0.001	0.013	0.002	0.000	0.005	0.001	-0.001	0.000	0.002	0.000	0.000	0.002	0.006
164	0.002	0.003	0.009	0.003	0.000	0.006	-0.004	-0.001	0.003	0.003	0.001	0.000	0.003	0.006
165	0.005	0.006	0.018	0.006	0.000	0.012	-0.008	0.000	0.004	0.005	0.001	0.000	0.003	0.008
166	0.007	0.008	0.018	0.007	0.000	0.014	-0.007	-0.002	0.004	0.005	0.000	0.000	0.002	0.007
167	0.005	0.009	0.027	0.007	0.000	0.012	0.000	-0.002	0.002	0.003	-0.002	0.000	0.001	-0.002
168	0.004	0.012	0.034	0.008	0.000	0.011	0.000	-0.003	0.004	0.007	-0.002	0.000	0.001	-0.006
169	0.004	0.015	0.047	0.009	0.000	0.011	0.000	-0.002	0.004	0.010	-0.001	0.000	0.000	-0.007
170	0.005	0.013	0.043	0.009	0.000	0.012	0.000	-0.002	0.005	0.012	-0.001	0.000	0.001	-0.006
171	0.006	0.012	0.028	0.010	0.000	0.012	-0.009	0.000	0.005	0.013	0.001	0.000	0.002	-0.004
172	0.006	0.015	0.031	0.011	0.000	0.012	-0.011	0.001	0.008	0.017	0.003	0.000	0.002	-0.002
173	0.006	0.015	0.030	0.010	0.000	0.011	-0.010	0.002	0.009	0.018	0.004	0.000	0.003	-0.001
174	0.003	0.012	0.027	0.006	0.000	0.010	-0.011	0.003	0.010	0.020	0.005	0.000	0.003	0.000
175	0.002	0.009	0.021	0.005	0.000	0.010	-0.012	0.003	0.009	0.019	0.005	0.000	0.004	0.000
176	0.002	0.006	0.013	0.005	0.000	0.010	-0.012	0.003	0.008	0.017	0.005	0.000	0.005	-0.001
177	0.001	0.004	0.028	0.006	0.000	0.010	0.004	0.004	0.008	0.019	0.007	0.000	0.005	0.000
178	0.002	0.001	0.025	0.007	0.000	0.011	0.004	0.005	0.007	0.017	0.008	0.000	0.005	0.000
179	0.002	-0.001	0.018	0.006	0.000	0.011	0.003	0.004	0.005	0.013	0.006	0.000	0.005	-0.001
180	0.003	-0.001	0.011	0.006	0.000	0.011	0.003	0.004	0.003	0.011	0.006	0.000	0.006	-0.001
181	0.005	0.001	0.008	0.007	0.000	0.012	0.003	0.005	0.002	0.008	0.006	0.000	0.007	-0.002
182	0.004	0.001	0.006	0.006	0.000	0.010	0.003	0.005	0.001	0.006	0.006	0.000	0.007	-0.002
183	0.004	0.002	0.002	0.006	0.000	0.009	0.002	0.005	0.001	0.007	0.006	0.000	0.007	-0.001
184	0.002	0.001	0.003	0.003	0.000	0.007	0.002	0.003	0.000	0.004	0.003	0.000	0.006	-0.003
185	0.000	0.000	-0.005	-0.002	0.000	0.005	0.003	0.002	-0.001	0.000	-0.001	0.000	0.006	-0.005
186	0.001	0.001	-0.005	0.000	0.000	0.006	-0.001	0.002	0.000	0.001	0.000	0.000	0.006	-0.004
187	0.002	0.002	-0.003	0.001	0.000	0.006	0.000	0.002	0.000	0.001	0.000	0.000	0.007	-0.003
188	-0.001	0.001	-0.006	-0.006	0.000	0.007	-0.002	-0.002	-0.002	-0.007	-0.008	0.000	0.006	-0.007

	August 1 - 15							August 15 - 31						
	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x
Kaiser TP Change (mg/L)	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025
Segment														
158	-0.006	-0.004	-0.002	-0.004	0.000	-0.001	0.005	0.000	0.002	0.001	0.002	0.000	0.002	0.003
159	-0.004	-0.004	-0.002	-0.004	0.000	0.001	0.004	0.000	0.002	0.000	0.001	0.000	0.002	0.002
160	-0.005	-0.003	-0.003	-0.005	0.000	0.001	0.004	0.001	0.002	0.000	0.001	0.000	0.002	0.002
161	-0.005	-0.003	-0.002	-0.004	0.000	0.001	0.004	0.000	0.001	0.000	0.001	0.000	0.002	0.003
162	-0.004	-0.002	-0.002	-0.004	0.000	0.002	0.004	0.001	0.002	0.000	0.001	0.000	0.003	0.002
163	-0.002	-0.001	0.000	-0.002	0.000	0.002	0.005	0.001	0.002	0.001	0.001	0.000	0.003	0.003
164	-0.001	0.000	0.000	-0.001	0.000	0.003	0.005	0.002	0.002	0.001	0.001	0.000	0.003	0.002
165	0.000	0.002	0.000	0.000	0.000	0.003	0.003	0.002	0.001	-0.001	0.000	0.000	0.003	0.000
166	0.000	0.002	-0.001	-0.002	0.000	0.005	0.003	-0.001	-0.002	-0.002	-0.001	0.000	0.001	-0.002
167	-0.005	-0.002	-0.001	-0.003	0.000	0.002	0.003	-0.003	-0.005	-0.002	-0.002	0.000	-0.001	-0.003
168	-0.026	-0.036	-0.002	-0.011	0.000	-0.016	0.005	-0.013	-0.011	-0.003	-0.004	0.000	-0.010	-0.005
169	-0.030	-0.041	0.000	-0.012	0.000	-0.020	0.006	-0.011	-0.011	-0.002	-0.002	0.000	-0.011	-0.005
170	-0.026	-0.039	0.000	-0.012	0.000	-0.020	0.006	-0.008	-0.010	-0.001	-0.003	0.000	-0.008	-0.006
171	-0.020	-0.036	0.001	-0.010	0.000	-0.019	0.006	-0.005	-0.010	0.000	-0.003	0.000	-0.005	-0.005
172	-0.017	-0.026	0.005	-0.009	0.000	-0.019	0.006	-0.006	-0.012	0.001	-0.003	0.000	-0.007	-0.005
173	-0.012	-0.015	0.009	-0.005	0.000	-0.014	0.004	-0.009	-0.014	0.001	-0.004	0.000	-0.010	-0.006
174	-0.007	-0.007	0.011	-0.003	0.000	-0.011	0.002	-0.010	-0.014	0.003	-0.003	0.000	-0.012	-0.006
175	-0.004	-0.002	0.014	-0.001	0.000	-0.009	0.002	-0.008	-0.013	0.004	-0.003	0.000	-0.011	-0.006
176	0.000	0.005	0.015	0.001	0.000	-0.006	0.000	-0.006	-0.012	0.005	-0.003	0.000	-0.010	-0.006
177	0.003	0.010	0.018	0.004	0.000	-0.004	0.000	-0.006	-0.011	0.008	-0.001	0.000	-0.010	-0.005
178	0.005	0.013	0.017	0.005	0.000	-0.002	-0.001	-0.004	-0.009	0.008	0.000	0.000	-0.009	-0.005
179	0.007	0.014	0.015	0.005	0.000	0.000	-0.004	-0.002	-0.007	0.008	0.000	0.000	-0.008	-0.006
180	0.008	0.015	0.013	0.005	0.000	0.002	-0.006	0.001	-0.002	0.008	0.000	0.000	-0.006	-0.006
181	0.009	0.015	0.012	0.005	0.000	0.004	-0.008	0.005	0.005	0.009	0.001	0.000	-0.004	-0.007
182	0.009	0.014	0.010	0.005	0.000	0.005	-0.009	0.007	0.008	0.009	0.002	0.000	-0.003	-0.007
183	0.008	0.012	0.010	0.006	0.000	0.004	-0.009	0.007	0.009	0.010	0.003	0.000	-0.002	-0.007
184	0.006	0.008	0.005	0.003	0.000	0.004	-0.010	0.006	0.008	0.007	0.001	0.000	-0.001	-0.009
185	0.004	0.005	0.001	-0.001	0.000	0.004	-0.011	0.006	0.009	0.003	-0.002	0.000	-0.001	-0.011
186	0.004	0.004	0.002	0.000	0.000	0.005	-0.009	0.008	0.011	0.005	0.001	0.000	0.000	-0.010
187	0.004	0.004	0.002	0.000	0.000	0.006	-0.009	0.011	0.012	0.007	0.004	0.000	0.001	-0.009
188	0.000	0.000	-0.008	-0.008	0.000	0.006	-0.012	0.004	0.007	-0.004	-0.007	0.000	0.001	-0.015

	September 1 - 15							September 16 - 30						
	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x
Kaiser TP Change (mg/L)	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025
Segment														
158	-0.001	0.000	0.000	0.002	0.000	0.004	0.006	-0.003	-0.004	-0.003	-0.002	0.000	0.007	0.009
159	-0.001	0.001	-0.002	0.001	0.000	0.001	0.004	-0.002	-0.004	-0.002	-0.002	0.000	0.008	0.010
160	-0.001	0.000	-0.001	0.001	0.000	0.001	0.003	-0.004	-0.003	-0.001	-0.002	0.000	0.007	0.012
161	-0.001	0.000	-0.001	0.001	0.000	0.002	0.004	-0.003	-0.004	-0.001	-0.003	0.000	0.007	0.010
162	0.000	0.001	0.000	0.001	0.000	0.002	0.004	-0.003	-0.003	-0.001	-0.003	0.000	0.007	0.010
163	0.000	0.002	0.002	0.001	0.000	0.003	0.005	-0.004	-0.003	-0.002	-0.003	0.000	0.006	0.009
164	0.000	0.002	0.002	0.002	0.000	0.002	0.004	-0.003	-0.003	-0.001	-0.002	0.000	0.005	0.008
165	0.002	0.003	0.003	0.002	0.000	0.003	0.004	-0.002	-0.002	0.000	-0.002	0.000	0.005	0.008
166	0.002	0.003	0.003	0.002	0.000	0.002	0.003	-0.003	-0.002	-0.001	-0.002	0.000	0.005	0.007
167	0.001	0.002	0.002	0.001	0.000	0.001	0.002	-0.002	-0.002	-0.001	-0.002	0.000	0.004	0.005
168	0.002	0.003	0.001	0.000	0.000	0.001	0.000	-0.001	-0.001	-0.001	-0.002	0.000	0.004	0.004
169	0.005	0.004	-0.001	0.000	0.000	0.001	-0.004	0.000	-0.001	-0.001	-0.002	0.000	0.003	0.002
170	0.008	0.009	0.002	0.003	0.000	0.002	-0.004	-0.001	-0.001	-0.002	-0.002	0.000	0.003	0.001
171	0.011	0.013	0.005	0.005	0.000	0.004	-0.002	-0.001	-0.001	-0.002	-0.003	0.000	0.003	0.000
172	0.015	0.016	0.006	0.006	0.000	0.005	-0.005	-0.002	-0.004	-0.006	-0.007	0.000	0.003	-0.004
173	0.015	0.015	0.005	0.005	0.000	0.004	-0.007	-0.004	-0.007	-0.009	-0.009	0.000	0.004	-0.005
174	0.015	0.014	0.003	0.005	0.000	0.003	-0.009	-0.004	-0.010	-0.013	-0.012	0.000	0.004	-0.008
175	0.015	0.015	0.006	0.006	0.000	0.002	-0.007	-0.004	-0.010	-0.015	-0.013	0.000	0.004	-0.009
176	0.013	0.013	0.005	0.006	0.000	0.000	-0.008	-0.002	-0.007	-0.011	-0.011	0.000	0.003	-0.008
177	0.010	0.010	0.006	0.007	0.000	-0.004	-0.008	-0.001	-0.008	-0.013	-0.012	0.000	0.003	-0.009
178	0.007	0.007	0.005	0.007	0.000	-0.006	-0.008	0.002	-0.003	-0.007	-0.006	0.000	0.002	-0.007
179	0.005	0.005	0.006	0.005	0.000	-0.007	-0.008	0.004	-0.002	-0.006	-0.005	0.000	0.002	-0.009
180	0.002	0.001	0.006	0.003	0.000	-0.007	-0.006	0.005	0.000	-0.004	-0.003	0.000	-0.001	-0.010
181	-0.001	-0.003	0.006	0.001	0.000	-0.007	-0.006	0.008	0.003	-0.002	0.000	0.000	-0.003	-0.012
182	-0.001	-0.005	0.006	0.000	0.000	-0.007	-0.006	0.008	0.006	0.002	0.003	0.000	-0.006	-0.013
183	-0.002	-0.005	0.006	-0.001	0.000	-0.007	-0.005	0.010	0.009	0.006	0.006	0.000	-0.006	-0.010
184	-0.001	-0.004	0.004	-0.002	0.000	-0.005	-0.005	0.010	0.012	0.010	0.008	0.000	-0.005	-0.005
185	0.000	-0.002	0.003	-0.002	0.000	-0.004	-0.003	0.009	0.014	0.014	0.010	0.000	-0.005	0.001
186	0.002	0.000	0.008	0.002	0.000	-0.004	-0.001	0.009	0.013	0.019	0.014	0.000	-0.005	0.004
187	0.004	0.004	0.011	0.006	0.000	-0.003	0.000	0.008	0.011	0.022	0.016	0.000	-0.005	0.005
188	0.004	0.005	0.008	0.003	0.000	-0.001	0.000	0.006	0.009	0.024	0.018	0.000	-0.004	0.012

	October 1 - 15							October 16 - 31						
	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x	0.5x	0.625x	0.75x	0.875x	1x	1.5x	2x
Kaiser TP Change (mg/L)	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025	-0.013	-0.009	-0.006	-0.003	0	0.0125	0.025
Segment														
158	-0.006	-0.005	-0.003	-0.003	0.000	0.004	0.006	-0.004	-0.004	-0.001	-0.003	0.000	0.001	0.003
159	-0.006	-0.005	-0.002	-0.003	0.000	0.004	0.007	-0.004	-0.004	-0.001	-0.003	0.000	0.003	0.005
160	-0.007	-0.006	-0.003	-0.004	0.000	0.004	0.008	-0.004	-0.004	0.000	-0.002	0.000	0.003	0.006
161	-0.008	-0.007	-0.004	-0.005	0.000	0.004	0.008	-0.004	-0.004	0.000	-0.003	0.000	0.003	0.006
162	-0.007	-0.006	-0.003	-0.004	0.000	0.005	0.009	-0.005	-0.005	0.000	-0.003	0.000	0.004	0.007
163	-0.007	-0.006	-0.003	-0.004	0.000	0.005	0.009	-0.005	-0.006	-0.001	-0.004	0.000	0.004	0.008
164	-0.006	-0.004	-0.002	-0.003	0.000	0.006	0.010	-0.005	-0.005	0.000	-0.003	0.000	0.005	0.009
165	-0.005	-0.003	-0.002	-0.002	0.000	0.005	0.009	-0.005	-0.005	-0.001	-0.004	0.000	0.005	0.009
166	-0.005	-0.004	-0.002	-0.002	0.000	0.004	0.008	-0.005	-0.005	-0.001	-0.004	0.000	0.005	0.009
167	-0.005	-0.003	-0.002	-0.002	0.000	0.004	0.008	-0.005	-0.005	0.000	-0.003	0.000	0.006	0.009
168	-0.005	-0.003	-0.002	-0.002	0.000	0.004	0.007	-0.004	-0.004	0.000	-0.003	0.000	0.006	0.010
169	-0.004	-0.003	-0.002	-0.002	0.000	0.003	0.007	-0.004	-0.005	0.000	-0.003	0.000	0.006	0.009
170	-0.004	-0.003	-0.001	-0.001	0.000	0.003	0.006	-0.003	-0.004	0.000	-0.002	0.000	0.006	0.009
171	-0.003	-0.002	-0.001	-0.001	0.000	0.003	0.005	-0.003	-0.003	0.000	-0.002	0.000	0.005	0.008
172	-0.003	-0.002	-0.001	-0.002	0.000	0.003	0.005	-0.003	-0.003	0.001	-0.002	0.000	0.005	0.008
173	-0.003	-0.002	-0.002	-0.002	0.000	0.003	0.005	-0.002	-0.003	0.001	-0.001	0.000	0.005	0.008
174	-0.004	-0.003	-0.003	-0.004	0.000	0.003	0.003	-0.002	-0.003	0.001	-0.002	0.000	0.005	0.008
175	-0.005	-0.003	-0.006	-0.007	0.000	0.004	0.002	-0.002	-0.003	0.001	-0.001	0.000	0.005	0.007
176	-0.004	-0.003	-0.006	-0.006	0.000	0.005	0.001	-0.001	-0.002	0.001	-0.001	0.000	0.004	0.007
177	-0.005	-0.005	-0.009	-0.009	0.000	0.005	-0.002	-0.002	-0.003	0.001	-0.001	0.000	0.004	0.007
178	-0.005	-0.005	-0.008	-0.009	0.000	0.004	-0.002	-0.002	-0.003	0.001	-0.002	0.000	0.004	0.007
179	-0.005	-0.005	-0.009	-0.009	0.000	0.004	-0.003	-0.002	-0.003	0.001	-0.002	0.000	0.004	0.006
180	-0.004	-0.004	-0.007	-0.008	0.000	0.004	-0.003	-0.002	-0.003	-0.001	-0.003	0.000	0.004	0.005
181	-0.004	-0.005	-0.010	-0.011	0.000	0.004	-0.006	0.000	-0.002	0.004	0.002	0.000	0.004	0.007
182	-0.003	-0.004	-0.010	-0.010	0.000	0.003	-0.005	0.000	-0.001	0.006	0.004	0.000	0.003	0.007
183	-0.003	-0.004	-0.009	-0.010	0.000	0.003	-0.006	-0.001	-0.002	0.002	0.000	0.000	0.003	0.005
184	-0.001	-0.001	-0.007	-0.009	0.000	0.002	-0.004	0.000	-0.001	0.005	0.003	0.000	0.004	0.005
185	0.002	0.002	0.002	0.001	0.000	0.001	0.001	0.002	0.001	0.014	0.011	0.000	0.004	0.009
186	0.003	0.003	0.006	0.005	0.000	0.000	0.000	0.000	-0.002	0.009	0.005	0.000	0.005	0.004
187	0.002	0.004	0.007	0.006	0.000	-0.001	-0.001	0.000	-0.002	0.009	0.005	0.000	0.004	0.005
188	0.005	0.004	0.020	0.018	0.000	-0.001	0.004	0.002	0.001	0.030	0.027	0.000	0.003	0.011

Table B-3. Individual Segment/Time-Specific Slopes for IEP

	July 1 - 15			July 16 - 31			August 1 - 15			August 15 - 31			September 1 - 15			September 16 - 30			October 1 - 15			October 16 - 31		
	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc
IEP TP Change (mg/L)	-0.035	0	0.07	-0.035	0	0.07	-0.035	0	0.07	-0.035	0	0.07	-0.035	0	0.07	-0.035	0	0.07	-0.035	0	0.07	-0.035	0	0.07
Segment																								
158	0.00E+0	-2.26E-1	0.00E+0	-3.35E-3	0.00E+0	-6.14E-2	0.00E+0	0.00E+0	0.00E+0	-9.70E-3	-8.57E-2	0.00E+0	0.00E+0	-3.71E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.43E-2
159	-1.49E-2	-3.71E-1	0.00E+0	-2.40E-2	0.00E+0	-4.91E-2	-2.74E-3	0.00E+0	-1.60E-2	0.00E+0	-5.37E-2	0.00E+0	0.00E+0	-5.14E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.71E-3
160	-5.10E-2	-4.81E-1	0.00E+0	-1.03E-2	0.00E+0	-2.57E-2	-9.14E-4	0.00E+0	-2.00E-2	-3.20E-3	-5.71E-2	0.00E+0	0.00E+0	-4.00E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.71E-3
161	-4.23E-2	-5.27E-1	0.00E+0	-1.14E-2	0.00E+0	-2.34E-2	-2.74E-3	0.00E+0	-2.06E-2	0.00E+0	-4.00E-2	0.00E+0	0.00E+0	-4.11E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.71E-3
162	-4.96E-2	-5.79E-1	0.00E+0	-1.60E-2	0.00E+0	-2.46E-2	-3.20E-3	0.00E+0	-1.71E-2	0.00E+0	-4.34E-2	0.00E+0	0.00E+0	-4.69E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.71E-3
163	-2.83E-2	-3.02E-1	0.00E+0	-5.26E-3	-3.09E-2	0.00E+0	-2.97E-3	0.00E+0	-6.86E-3	0.00E+0	-5.37E-2	0.00E+0	0.00E+0	-5.14E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.14E-2
164	-4.43E-2	-2.47E-1	0.00E+0	0.00E+0	-9.60E-2	0.00E+0	-1.19E-2	-1.14E-2	-1.20E-2	-1.28E-2	-4.80E-2	-4.00E-3	0.00E+0	-5.94E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
165	-1.04E-1	-3.79E-1	-3.49E-2	0.00E+0	-9.14E-2	0.00E+0	-2.58E-2	-8.00E-3	-3.03E-2	-4.07E-2	-2.29E-2	-4.51E-2	0.00E+0	-8.69E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.71E-3
166	-1.82E-1	-5.07E-1	-1.01E-1	-1.19E-2	-1.17E-1	0.00E+0	-3.61E-2	0.00E+0	-4.63E-2	-6.29E-2	0.00E+0	-7.89E-2	-2.29E-4	-8.11E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.71E-3
167	-1.90E-1	-6.99E-1	-6.29E-2	-1.21E-1	-1.04E-1	-1.25E-1	-4.37E-2	0.00E+0	-5.54E-2	-7.38E-2	0.00E+0	-9.43E-2	-1.26E-2	-6.51E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
168	-2.39E-1	-9.14E-1	-7.03E-2	-2.03E-1	-2.10E-1	-2.02E-1	-3.34E-2	0.00E+0	-6.00E-2	-1.11E-1	0.00E+0	-1.50E-1	-2.70E-2	-6.17E-2	-1.83E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
169	-2.14E-1	-1.23E+0	0.00E+0	-2.32E-1	-2.63E-1	-2.25E-1	-2.47E-2	0.00E+0	-4.57E-2	-1.32E-1	-3.43E-2	-1.56E-1	-6.47E-2	-8.80E-2	-5.89E-2	-2.48E-18	0.00E+0	-7.43E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
170	-2.07E-1	-1.13E+0	0.00E+0	-2.23E-1	-3.22E-1	-1.98E-1	-2.51E-2	0.00E+0	-3.83E-2	-1.49E-1	-5.49E-2	-1.73E-1	-7.36E-2	-1.83E-1	-4.63E-2	-1.03E-2	0.00E+0	-2.23E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
171	-2.20E-1	-7.47E-1	-8.80E-2	-1.91E-1	-3.51E-1	-1.51E-1	-3.34E-2	-2.29E-3	-4.11E-2	-1.38E-1	-6.06E-2	-1.58E-1	-6.81E-2	-2.56E-1	-2.11E-2	-2.38E-2	0.00E+0	-3.71E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
172	-2.42E-1	-8.18E-1	-9.83E-2	-1.80E-1	-4.46E-1	-1.13E-1	-4.71E-2	-7.54E-2	-4.00E-2	-1.43E-1	-7.54E-2	-1.60E-1	-1.09E-1	-3.11E-1	-5.89E-2	-5.53E-2	0.00E+0	-9.89E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
173	-1.64E-1	-7.62E-1	-1.43E-2	-1.67E-1	-4.66E-1	-9.20E-2	-7.29E-2	-1.61E-1	-5.09E-2	-1.46E-1	-4.11E-2	-1.72E-1	-1.38E-1	-2.71E-1	-1.05E-1	-7.86E-2	0.00E+0	-1.43E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
174	-2.22E-1	-6.07E-1	-1.26E-1	-1.50E-1	-4.77E-1	-6.86E-2	-9.74E-2	-2.03E-1	-7.09E-2	-1.46E-1	-5.60E-2	-1.69E-1	-1.75E-1	-2.41E-1	-1.59E-1	-1.11E-1	0.00E+0	-2.05E-1	0.00E+0	0.00E+0	-1.71E-3	0.00E+0	0.00E+0	0.00E+0
175	-2.15E-1	-4.24E-1	-1.63E-1	-1.46E-1	-4.54E-1	-6.91E-2	-1.03E-1	-2.40E-1	-6.91E-2	-1.42E-1	-7.77E-2	-1.58E-1	-1.66E-1	-2.61E-1	-1.42E-1	-1.24E-1	0.00E+0	-2.25E-1	0.00E+0	0.00E+0	-1.54E-2	0.00E+0	0.00E+0	0.00E+0
176	-1.71E-1	-2.00E-1	-1.63E-1	-1.33E-1	-3.94E-1	-6.80E-2	-1.09E-1	-2.50E-1	-7.43E-2	-1.46E-1	-8.69E-2	-1.61E-1	-1.73E-1	-2.27E-1	-1.59E-1	-1.19E-1	0.00E+0	-2.01E-1	0.00E+0	0.00E+0	-2.97E-2	0.00E+0	0.00E+0	0.00E+0
177	0.00E+0	-4.50E-1	0.00E+0	-1.15E-1	-3.82E-1	-4.86E-2	-1.17E-1	-2.95E-1	-7.26E-2	-1.46E-1	-1.33E-1	-1.50E-1	-1.92E-1	-1.99E-1	-1.90E-1	-1.39E-1	0.00E+0	-2.37E-1	-8.69E-3	0.00E+0	-6.34E-2	0.00E+0	0.00E+0	0.00E+0
178	0.00E+0	-3.51E-1	0.00E+0	-9.12E-2	-3.01E-1	-3.89E-2	-1.18E-1	-2.69E-1	-8.06E-2	-1.39E-1	-1.26E-1	-1.42E-1	-1.92E-1	-1.61E-1	-2.00E-1	-1.24E-1	0.00E+0	-1.89E-1	-1.58E-2	0.00E+0	-6.97E-2	0.00E+0	0.00E+0	0.00E+0
179	0.00E+0	-1.93E-1	0.00E+0	-6.97E-2	-2.07E-1	-3.54E-2	-1.28E-1	-2.42E-1	-1.00E-1	-1.37E-1	-1.26E-1	-1.39E-1	-1.73E-1	-1.44E-1	-1.81E-1	-1.26E-1	0.00E+0	-1.85E-1	-2.81E-2	0.00E+0	-8.51E-2	0.00E+0	0.00E+0	0.00E+0
180	0.00E+0	-4.11E-2	0.00E+0	-4.75E-2	-1.39E-1	-2.46E-2	-1.36E-1	-2.16E-1	-1.16E-1	-1.31E-1	-1.31E-1	-1.30E-1	-1.42E-1	-1.09E-1	-1.50E-1	-1.37E-1	0.00E+0	-1.89E-1	-3.02E-2	0.00E+0	-9.03E-2	0.00E+0	0.00E+0	0.00E+0
181	0.00E+0	-3.43E-3	0.00E+0	-1.74E-2	-6.63E-2	-5.14E-3	-1.50E-1	-1.98E-1	-1.38E-1	-1.26E-1	-1.47E-1	-1.21E-1	-1.23E-1	-7.09E-2	-1.35E-1	-1.48E-1	0.00E+0	-1.89E-1	-4.73E-2	0.00E+0	-1.16E-1	0.00E+0	0.00E+0	0.00E+0
182	-3.73E-2	0.00E+0	-5.43E-2	-9.14E-3	-4.80E-2	0.00E+0	-1.50E-1	-1.67E-1	-1.46E-1	-1.24E-1	-1.39E-1	-1.21E-1	-1.14E-1	-4.46E-2	-1.31E-1	-1.57E-1	-5.60E-2	-1.83E-1	-4.78E-2	0.00E+0	-1.07E-1	0.00E+0	0.00E+0	0.00E+0
183	-7.34E-2	0.00E+0	-1.27E-1	-5.49E-3	-3.66E-2	0.00E+0	-1.36E-1	-1.51E-1	-1.33E-1	-1.15E-1	-1.47E-1	-1.06E-1	-1.05E-1	-3.54E-2	-1.22E-1	-1.45E-1	-1.55E-1	-1.43E-1	-4.69E-2	0.00E+0	-1.14E-1	0.00E+0	0.00E+0	-8.57E-3
184	-7.66E-2	0.00E+0	-1.11E-1	-1.19E-2	-2.74E-2	-8.00E-3	-1.39E-1	-1.19E-1	-1.45E-1	-1.21E-1	-1.23E-1	-1.20E-1	-9.55E-2	-3.20E-2	-1.11E-1	-1.04E-1	-2.59E-1	-6.51E-2	-4.73E-2	0.00E+0	-8.86E-2	0.00E+0	0.00E+0	-7.43E-3
185	-8.18E-2	0.00E+0	-1.46E-1	-2.13E-2	-2.17E-2	-2.11E-2	-1.33E-1	-9.60E-2	-1.42E-1	-1.24E-1	-1.02E-1	-1.30E-1	-7.38E-2	-3.54E-2	-8.34E-2	-6.97E-2	-2.78E-1	-1.77E-2	-3.68E-2	0.00E+0	-5.89E-2	0.00E+0	0.00E+0	0.00E+0
186	-9.51E-2	0.00E+0	-1.68E-1	-2.03E-2	-3.09E-2	-1.77E-2	-1.01E-1	-9.71E-2	-1.02E-1	-1.15E-1	-1.17E-1	-1.15E-1	-6.90E-2	-6.40E-2	-7.03E-2	-5.71E-2	-2.88E-1	0.00E+0	-5.81E-2	0.00E+0	-8.23E-2	0.00E+0	0.00E+0	-2.80E-2
187	-1.23E-1	0.00E+0	-1.86E-1	-1.67E-2	-1.94E-2	-1.60E-2	-9.39E-2	-9.03E-2	-9.49E-2	-1.08E-1	-1.28E-1	-1.03E-1	-7.02E-2	-9.26E-2	-6.46E-2	-6.01E-2	-2.75E-1	-6.29E-3	-4.46E-2	0.00E+0	-7.60E-2	0.00E+0	0.00E+0	-2.69E-2
188	-9.17E-2	0.00E+0	-1.22E-1	-3.66E-2	0.00E+0	-5.03E-2	-9.49E-2	-2.86E-2	-1.11E-1	-1.30E-1	-6.74E-2	-1.46E-1	-6.54E-2	-7.54E-2	-6.29E-2	-3.15E-2	-2.17E-1	0.00E+0	-2.58E-2	-1.03E-2	-2.97E-2	0.00E+0	0.00E+0	0.00E+0

DRAFT: TP Bubble Permit Calculation for IEP and Kaiser

January 22, 2020

Table B-4A. Individual Segment/Time-Specific Slopes for Kaiser (Includes Potentially Anomalous 25% TP load reduction results)

	July 1 - 15			July 16 - 31			August 1 - 15			August 15 - 31			September 1 - 15			September 16 - 30			October 1 - 15			October 16 - 31		
	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc
Kaiser TP Change (mg/L)	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025
Segment																								
158	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.92E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
159	0.00E+0	-1.92E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-9.39E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
160	-5.59E-2	-2.77E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.07E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
161	-6.52E-2	-4.05E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-4.80E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
162	-1.86E-2	-4.44E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-9.60E-2	0.00E+0	0.00E+0	-4.59E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
163	-3.78E-3	-3.21E-1	0.00E+0	0.00E+0	-7.47E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.11E-1	0.00E+0	0.00E+0	-1.14E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
164	-1.17E-1	-3.86E-1	-1.60E-2	0.00E+0	-1.27E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.82E-1	0.00E+0	0.00E+0	-1.17E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
165	-2.53E-1	-7.88E-1	-5.28E-2	0.00E+0	-2.23E-1	0.00E+0	0.00E+0	-2.40E-2	0.00E+0	0.00E+0	-7.36E-2	0.00E+0	0.00E+0	-2.73E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
166	-2.78E-1	-1.02E+0	0.00E+0	0.00E+0	-1.28E-1	0.00E+0	0.00E+0	-8.00E-3	0.00E+0	0.00E+0	0.00E+0	-4.96E-2	0.00E+0	-2.47E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
167	-1.61E-1	-1.14E+0	0.00E+0	-3.29E-2	-1.39E-2	-4.00E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.09E-1	0.00E+0	-1.81E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
168	-2.51E-1	-1.38E+0	0.00E+0	-1.68E-1	-1.51E-1	-1.74E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-3.20E-1	-5.15E-2	-2.02E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
169	-3.34E-1	-1.74E+0	0.00E+0	-2.44E-1	-2.51E-1	-2.42E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-3.28E-1	-1.76E-1	-3.05E-1	-1.28E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
170	-3.20E-1	-1.66E+0	0.00E+0	-2.16E-1	-3.30E-1	-1.73E-1	0.00E+0	0.00E+0	0.00E+0	-3.64E-2	0.00E+0	-3.01E-1	-2.57E-1	-7.13E-1	-8.64E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
171	-4.33E-1	-1.34E+0	-9.28E-2	-1.82E-1	-4.39E-1	-8.48E-2	0.00E+0	0.00E+0	0.00E+0	-3.32E-2	0.00E+0	-2.59E-1	-2.99E-1	-1.07E+0	-1.12E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
172	-5.28E-1	-1.52E+0	-1.55E-1	-2.01E-1	-6.94E-1	-1.60E-2	0.00E+0	0.00E+0	0.00E+0	-3.75E-2	0.00E+0	-2.91E-1	-4.39E-1	-1.37E+0	-9.12E-2	0.00E+0	0.00E+0	-6.24E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
173	-5.11E-1	-1.47E+0	-1.52E-1	-2.14E-1	-8.06E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-2.65E-2	0.00E+0	-3.58E-1	-4.60E-1	-1.28E+0	-1.52E-1	0.00E+0	0.00E+0	-1.06E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
174	-4.56E-1	-1.13E+0	-2.03E-1	-2.20E-1	-9.26E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.03E-2	0.00E+0	-3.84E-1	-5.19E-1	-1.24E+0	-2.50E-1	0.00E+0	0.00E+0	-2.16E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
175	-3.94E-1	-8.59E-1	-2.19E-1	-1.98E-1	-8.71E-1	0.00E+0	-7.59E-2	0.00E+0	0.00E+0	-7.01E-2	0.00E+0	-3.65E-1	-4.98E-1	-1.31E+0	-1.92E-1	0.00E+0	0.00E+0	-2.14E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
176	-3.31E-1	-5.92E-1	-2.34E-1	-1.80E-1	-7.94E-1	0.00E+0	-1.90E-1	0.00E+0	0.00E+0	-1.02E-1	0.00E+0	-3.63E-1	-4.90E-1	-1.12E+0	-2.53E-1	0.00E+0	0.00E+0	-2.21E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
177	-2.36E-2	-8.37E-1	0.00E+0	-1.81E-1	-8.99E-1	0.00E+0	-2.82E-1	-2.40E-1	0.00E+0	-1.19E-1	0.00E+0	-3.23E-1	-5.01E-1	-9.53E-1	-3.31E-1	0.00E+0	0.00E+0	-2.32E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
178	0.00E+0	-7.31E-1	0.00E+0	-1.66E-1	-8.51E-1	0.00E+0	-3.36E-1	-4.00E-1	-4.80E-2	-1.42E-1	0.00E+0	-3.01E-1	-4.63E-1	-7.25E-1	-3.65E-1	-8.35E-2	0.00E+0	-1.95E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
179	0.00E+0	-5.19E-1	0.00E+0	-1.33E-1	-6.66E-1	0.00E+0	-3.89E-1	-5.28E-1	-1.48E-1	-1.84E-1	0.00E+0	-3.02E-1	-4.14E-1	-5.25E-1	-3.73E-1	-1.69E-1	0.00E+0	-2.58E-1	0.00E+0	0.00E+0	-3.36E-2	0.00E+0	0.00E+0	0.00E+0
180	0.00E+0	-3.83E-1	0.00E+0	-1.07E-1	-5.71E-1	0.00E+0	-4.24E-1	-6.56E-1	-2.20E-1	-2.55E-1	-1.75E-1	-2.85E-1	-3.10E-1	-2.77E-1	-3.22E-1	-2.72E-1	-8.85E-2	-3.41E-1	0.00E+0	0.00E+0	-4.00E-2	0.00E+0	0.00E+0	0.00E+0
181	0.00E+0	-4.68E-1	0.00E+0	-9.22E-2	-4.92E-1	0.00E+0	-4.65E-1	-7.36E-1	-3.24E-1	-3.59E-1	-5.71E-1	-2.80E-1	-2.28E-1	-1.60E-2	-3.07E-1	-4.29E-1	-3.84E-1	-4.46E-1	0.00E+0	0.00E+0	-1.28E-1	0.00E+0	-4.16E-2	0.00E+0
182	0.00E+0	-4.18E-1	0.00E+0	-7.97E-2	-4.59E-1	0.00E+0	-4.60E-1	-7.28E-1	-3.72E-1	-4.07E-1	-7.37E-1	-2.83E-1	-1.99E-1	0.00E+0	-3.06E-1	-5.28E-1	-6.01E-1	-5.01E-1	0.00E+0	0.00E+0	-1.26E-1	0.00E+0	-1.46E-1	0.00E+0
183	0.00E+0	-3.07E-1	0.00E+0	-7.74E-2	-4.50E-1	0.00E+0	-4.32E-1	-6.64E-1	-3.60E-1	-4.04E-1	-8.23E-1	-2.46E-1	-1.66E-1	0.00E+0	-2.75E-1	-5.59E-1	-9.03E-1	-4.30E-1	0.00E+0	0.00E+0	-1.57E-1	0.00E+0	0.00E+0	0.00E+0
184	0.00E+0	-2.08E-1	0.00E+0	-6.46E-2	-2.75E-1	0.00E+0	-3.73E-1	-5.20E-1	-4.08E-1	-4.13E-1	-6.97E-1	-3.07E-1	-1.57E-1	0.00E+0	-2.59E-1	-4.78E-1	-1.11E+0	-2.40E-1	0.00E+0	0.00E+0	-1.10E-1	0.00E+0	-1.15E-1	0.00E+0
185	0.00E+0	0.00E+0	0.00E+0	-4.77E-2	-3.84E-2	-5.12E-2	-2.99E-1	-3.52E-1	-4.36E-1	-4.22E-1	-5.66E-1	-3.68E-1	-1.11E-1	0.00E+0	-1.60E-1	-3.81E-1	-1.24E+0	-5.76E-2	0.00E+0	-1.70E-1	0.00E+0	0.00E+0	-5.23E-1	0.00E+0
186	0.00E+0	0.00E+0	0.00E+0	-3.29E-2	-8.64E-2	-1.28E-2	-2.42E-1	-3.36E-1	-3.56E-1	-4.58E-1	-8.04E-1	-3.28E-1	-1.49E-1	-2.83E-1	-9.92E-2	-3.44E-1	-1.37E+0	0.00E+0	-1.01E-1	-4.07E-1	0.00E+0	0.00E+0	-1.94E-1	0.00E+0
187	0.00E+0	-9.39E-2	0.00E+0	-1.98E-2	-9.39E-2	0.00E+0	-2.28E-1	-3.44E-1	-3.52E-1	-4.88E-1	-1.03E+0	-2.83E-1	-1.98E-1	-6.02E-1	-4.64E-2	-3.10E-1	-1.33E+0	0.00E+0	-1.40E-1	-4.16E-1	-3.68E-2	0.00E+0	-1.65E-1	0.00E+0
188	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.07E-1	-1.54E-1	-1.60E-2	-4.92E-1	-3.89E-1	-2.36E-1	-4.46E-1	-1.49E-1	-5.28E-1	-6.40E-3	-1.06E-1	-1.26E+0	0.00E+0	-1.88E-1	-9.59E-1	0.00E+0	0.00E+0	-1.04E+0	0.00E+0

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Table B-5. Individual Segment/Time-Specific Slopes for Kaiser (Option B - excluding anomalous 25% TP load reduction results)

	July 1 - 15			July 16 - 31			August 1 - 15			August 15 - 31			September 1 - 15			September 16 - 30			October 1 - 15			October 16 - 31		
	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc	Overall	Dec	Inc
Kaiser TP Change (mg/L)	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025	-0.013	0	0.025
Segment																								
158	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.92E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
159	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.08E-1	0.00E+0	0.00E+0	########	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
160	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.18E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
161	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.29E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
162	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.03E-1	0.00E+0	0.00E+0	-4.55E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
163	0.00E+0	-6.28E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.08E-1	0.00E+0	0.00E+0	-9.48E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
164	-6.58E-2	-2.19E-1	-1.60E-2	0.00E+0	-8.00E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.93E-1	0.00E+0	0.00E+0	-9.35E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
165	-1.80E-1	-5.72E-1	-5.28E-2	0.00E+0	-1.39E-1	0.00E+0	0.00E+0	-2.40E-2	0.00E+0	0.00E+0	-9.97E-2	0.00E+0	0.00E+0	-2.34E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
166	-1.79E-1	-7.31E-1	0.00E+0	0.00E+0	-2.71E-2	0.00E+0	0.00E+0	-8.00E-3	0.00E+0	-5.13E-3	0.00E+0	-4.96E-2	0.00E+0	-2.17E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
167	-6.64E-3	-6.67E-1	0.00E+0	-1.66E-2	0.00E+0	-4.00E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-1.09E-1	0.00E+0	-1.65E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
168	-5.55E-2	-7.58E-1	0.00E+0	-1.30E-1	0.00E+0	-1.74E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-3.20E-1	-4.86E-2	-2.13E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
169	-6.49E-2	-8.60E-1	0.00E+0	-1.90E-1	-3.08E-2	-2.42E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-3.28E-1	-1.91E-1	-3.86E-1	-1.28E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
170	-7.03E-2	-8.43E-1	0.00E+0	-1.52E-1	-8.98E-2	-1.73E-1	0.00E+0	0.00E+0	0.00E+0	-4.14E-2	0.00E+0	-3.01E-1	-2.57E-1	-7.80E-1	-8.64E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
171	-2.81E-1	-8.62E-1	-9.28E-2	-1.12E-1	-1.94E-1	-8.48E-2	0.00E+0	0.00E+0	0.00E+0	-3.50E-2	0.00E+0	-2.59E-1	-2.78E-1	-1.10E+0	-1.12E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
172	-3.63E-1	-1.00E+0	-1.55E-1	-1.05E-1	-3.78E-1	-1.60E-2	0.00E+0	0.00E+0	0.00E+0	-3.17E-2	0.00E+0	-2.91E-1	-4.20E-1	-1.43E+0	-9.12E-2	0.00E+0	0.00E+0	-6.24E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
173	-3.47E-1	-9.49E-1	-1.52E-1	-1.11E-1	-4.78E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-2.32E-2	0.00E+0	-3.58E-1	-4.50E-1	-1.37E+0	-1.52E-1	0.00E+0	0.00E+0	-1.06E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
174	-3.10E-1	-6.40E-1	-2.03E-1	-1.10E-1	-5.88E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-3.47E-2	0.00E+0	-3.84E-1	-5.17E-1	-1.34E+0	-2.50E-1	0.00E+0	0.00E+0	-2.16E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
175	-2.80E-1	-4.66E-1	-2.19E-1	-9.21E-2	-5.43E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-4.68E-2	0.00E+0	-3.65E-1	-4.81E-1	-1.37E+0	-1.92E-1	0.00E+0	0.00E+0	-2.14E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
176	-2.65E-1	-3.61E-1	-2.34E-1	-8.51E-2	-5.00E-1	0.00E+0	-1.10E-1	0.00E+0	0.00E+0	-7.85E-2	0.00E+0	-3.63E-1	-4.76E-1	-1.16E+0	-2.53E-1	-4.44E-2	0.00E+0	-2.21E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
177	0.00E+0	-2.79E-1	0.00E+0	-7.46E-2	-5.75E-1	0.00E+0	-1.83E-1	-2.40E-1	0.00E+0	-7.43E-2	0.00E+0	-3.23E-1	-4.85E-1	-9.56E-1	-3.31E-1	-6.07E-2	0.00E+0	-2.32E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
178	0.00E+0	-2.25E-1	0.00E+0	-7.00E-2	-5.66E-1	0.00E+0	-2.45E-1	-4.00E-1	-4.80E-2	-9.81E-2	0.00E+0	-3.01E-1	-4.49E-1	-7.06E-1	-3.65E-1	-1.29E-1	0.00E+0	-1.95E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
179	0.00E+0	-1.44E-1	0.00E+0	-5.98E-2	-4.50E-1	0.00E+0	-3.12E-1	-5.28E-1	-1.48E-1	-1.42E-1	0.00E+0	-3.02E-1	-3.97E-1	-4.70E-1	-3.73E-1	-2.12E-1	-7.14E-2	-2.58E-1	0.00E+0	0.00E+0	-3.36E-2	0.00E+0	0.00E+0	0.00E+0
180	0.00E+0	-1.71E-1	0.00E+0	-4.74E-2	-4.00E-1	0.00E+0	-3.60E-1	-6.56E-1	-2.20E-1	-2.14E-1	0.00E+0	-2.85E-1	-2.87E-1	-1.80E-1	-3.22E-1	-3.09E-1	-2.10E-1	-3.41E-1	0.00E+0	0.00E+0	-4.00E-2	0.00E+0	0.00E+0	0.00E+0
181	0.00E+0	-3.34E-1	0.00E+0	-4.80E-2	-3.73E-1	0.00E+0	-4.11E-1	-7.36E-1	-3.24E-1	-3.17E-1	-4.30E-1	-2.80E-1	-1.99E-1	0.00E+0	-3.07E-1	-4.57E-1	-4.90E-1	-4.46E-1	0.00E+0	0.00E+0	-1.28E-1	0.00E+0	0.00E+0	0.00E+0
182	0.00E+0	-3.30E-1	0.00E+0	-4.35E-2	-3.69E-1	0.00E+0	-4.18E-1	-7.28E-1	-3.72E-1	-3.69E-1	-6.31E-1	-2.83E-1	-1.72E-1	0.00E+0	-3.06E-1	-5.39E-1	-6.56E-1	-5.01E-1	0.00E+0	0.00E+0	-1.26E-1	0.00E+0	-1.35E-2	0.00E+0
183	0.00E+0	-3.08E-1	0.00E+0	-3.92E-2	-3.52E-1	0.00E+0	-3.90E-1	-6.64E-1	-3.60E-1	-3.60E-1	-7.11E-1	-2.46E-1	-1.37E-1	0.00E+0	-2.75E-1	-5.46E-1	-9.00E-1	-4.30E-1	-1.21E-2	0.00E+0	-1.57E-1	0.00E+0	0.00E+0	0.00E+0
184	0.00E+0	-1.69E-1	0.00E+0	-4.47E-2	-2.26E-1	0.00E+0	-3.55E-1	-5.20E-1	-4.08E-1	-3.89E-1	-6.41E-1	-3.07E-1	-1.39E-1	0.00E+0	-2.59E-1	-4.33E-1	-1.03E+0	-2.40E-1	-3.11E-2	0.00E+0	-1.10E-1	0.00E+0	-2.2E-14	0.00E+0
185	0.00E+0	0.00E+0	0.00E+0	-5.19E-2	-5.42E-2	-5.12E-2	-3.07E-1	-3.52E-1	-4.36E-1	-4.21E-1	-5.85E-1	-3.68E-1	-9.42E-2	0.00E+0	-1.60E-1	-3.09E-1	-1.08E+0	-5.76E-2	0.00E+0	-1.49E-1	0.00E+0	0.00E+0	-2.51E-1	0.00E+0
186	0.00E+0	-1.07E-1	0.00E+0	-2.69E-2	-7.02E-2	-1.28E-2	-2.41E-1	-3.36E-1	-3.56E-1	-4.45E-1	-8.05E-1	-3.28E-1	-1.09E-1	-1.39E-1	-9.92E-2	-2.40E-1	-1.10E+0	0.00E+0	-7.00E-2	-3.30E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
187	0.00E+0	-1.94E-1	0.00E+0	-1.33E-2	-7.88E-2	0.00E+0	-2.27E-1	-3.44E-1	-3.52E-1	-4.64E-1	-1.02E+0	-2.83E-1	-1.38E-1	-4.21E-1	-4.64E-2	-1.88E-1	-9.87E-1	0.00E+0	-1.01E-1	-3.00E-1	-3.68E-2	0.00E+0	0.00E+0	0.00E+0
188	0.00E+0	0.00E+0	0.00E+0	-1.69E-2	0.00E+0	-1.07E-1	-2.06E-1	-1.60E-2	-4.92E-1	-4.30E-1	-3.78E-1	-4.46E-1	-1.07E-1	-4.17E-1	-6.40E-3	0.00E+0	-8.65E-1	0.00E+0	-7.58E-2	-6.19E-1	0.00E+0	0.00E+0	-4.69E-1	0.00E+0

Appendix F - Response to Comments

[Ecology will complete this section after the public notice of draft period.]