Technically Based Local Limits for the Camas Wastewater Treatment Plant

September 2019

City of Camas, Washington

Executive Summary

The United States Environmental Protection Agency (EPA) regulates compliance with the Clean Water Act (CWA), including Section 307(b) pretreatment standards. As part of this function, EPA issues National Pollutant Discharge Elimination System (NPDES) permits to publicly owned treatment works (POTWs). These permits contain provisions that require compliance with Title 40 of the *Code of Federal Regulations* Parts 403 through 471 (40 CFR 403–471) to ensure compliance with pretreatment standards by significant sources introducing pollutants subject to such standards to the POTW (cf, CWA 402(b)(8), 33 U.S.C. § 1342(b)(8) *et seq.*). Requirements to develop Technically Based Local Limits (TBLLs) are specified at 40 CFR 403.5 (c).

This TBLL evaluation has been prepared to meet NPDES requirements for the Camas Wastewater Treatment Plant (WWTP). These limits have been developed in accordance with EPA's Technical Support Document *Local Limits Development Guidance* (EPA, 2004) and in accordance with Section S6. Part F. of NPDES Permit No. WA-0020249. In response to these standards, conditions, and requirements, the local limits in Table ES-1 have been developed for the Camas WWTP.

The limits in this document are developed to be applied to the point the industries discharge into the City of Camas' collection system. The limits are protective of the Camas wastewater system, prevent treatment interference, protect the environment, and protect worker health and safety. The assumptions for fluoride are conservative and the data used to derive the fluoride limits apply to Camas only and are not intended to set standards for local limits developed for other jurisdictions.

Table ES-1. Local Limits Summary

Pollutant	City-wide Local Limit	Karcher[a]	Section
Antimony	1.62 mg/L	Same as City-Wide	[a]
Arsenic	0.14 mg/L	Same as City-Wide	[a]
Cadmium	0.025 mg/L	0.11 mg/L	[a]
Chromium (Total)	5.0 mg/L	5.0 mg/L	5.5
Chromium (Hexavalent)	No Limit Adopted	Same as City-Wide	4.1
Copper	0.438 mg/L	3.38 mg/L	[a]
Cyanide	0.116 mg/L	1.20 mg/L	[a]
Fluoride-Concentration	30.62 mg/L	Same as City-Wide	5.6.5
Fluoride-Mass			
Analog Devices	76.6 lb/d	NA	5.6.5
WaferTech	140.5 lb/d	NA	5.6.5
Lead	0.135 mg/L	1.20 mg/L	[a]
Mercury	0.007 mg/L	Same as City-Wide	[a]
Molybdenum	0.286 mg/L	Same as City-Wide	[a]
Nickel	0.461 mg/L	3.98 mg/L	[a]
NWTPH-Dx	No Limit Adopted	Same as City-Wide	4.1
NWTPH-Gx	No Limit Adopted	Same as City-Wide	4.1
Selenium	0.31 mg/L	Same as City-Wide	[a]
Silver	0.304 mg/L	0.43 mg/L	[a]
Sulfate	No Additional Limit Adopted	Same as City-Wide	5.7
TDS	No Additional Limit Adopted	Same as City-Wide	5.8
Zinc	0.403 mg/L	2.61 mg/L	[a]
Flow	No Limit Adopted	Same as City-Wide	6.1

Table ES-1. Local Limits Summary

Pollutant	City-wide Local Limit	Karcher[a]	Section
BOD_5	No Limit Adopted	Same as City-Wide	6.2
TSS	No Limit Adopted	Same as City-Wide	6.2
pH	5.5–11.0 SU	Same as City-Wide	6.4
Ammonia	No Limit Adopted	Same as City-Wide	6.3
Oils and Grease	100 mg/L total O&G	Same as City-Wide	6.5
Temperature	40°C (104°F) at POTW; 60°C (140°F) at discharge point from SIU	Same as City-Wide	6.6
Flammability	Specified as no material with a closed cup flashpoint <140 (°F) AND No two consecutive readings at ≥5% LEL, and no reading of ≥10% LEL allowed	Same as City-Wide	6.7

Local Limits shall apply to all users except as delineated for Karcher North America in this column

[a] See Appendix C, Local Limits Calc Page 2.

Notes:

BOD_5 = 5-day biochemical oxygen demand

lb/d = pounds per day

LEL = lower explosive limit

mg/L = milligrams per liter

POTW = publicly owned treatment works

SIU = significant industrial user

SU = standard units

TDS = total dissolved solids

TSS = total suspended solids

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Abbreviations and Acronyms

ACGIH	American Conference of Government Industrial Hygienists
AHL	allowable headworks loading
BMP	best management practice
BOD_5	5-day biochemical oxygen demand
BPJ	best professional judgement
BPT	best practicable technology
CFR	Code of Federal Regulations
CWA	Clean Water Act
EC_{50}	median effective concentration (concentration that causes 50% effect)
EPA	United States Environmental Protection Agency
ft	foot (feet)
gpd	gallon(s) per day
HH	human health (criteria)
IPP	Industrial Pretreatment Program
lb/d	pound(s) per day
LC_{50}	median lethal concentration (concentration that causes 50% mortality)
LEL	lower explosive limit
MAHL	maximum allowable headworks loading
MAIL	maximum allowable industrial loading
MCL	maximum contaminant level
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mgd	million gallon(s) per day-G
ML	minimum level
NH_3-N	ammonia-nitrogen
NPDES	National Pollutant Discharge Elimination System
NWTPH-Dx	Northwest Total Petroleum Hydrocarbon - diesel
NWTPH-Gx	Northwest Total Petroleum Hydrocarbon - gasoline
O&G	oils and grease
POC	pollutants of concern
POTW	publicly owned treatment work
ppm	parts per million
PSES	pretreatment standards for existing sources
PSNS	pretreatment standards for new sources
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
SIU	significant industrial user

TBLL	technically based local limit
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TSS	total suspended solids
TTO	total toxic organics
WQC	water quality criteria
WWTP	wastewater treatment plant

1. Introduction

This local limits development has been prepared by CH2M HILL Engineers, Inc., a wholly-owned subsidiary of Jacobs Engineering Group Inc. under contract and in cooperation with the City of Camas, Washington, for submittal to the Washington State Department of Ecology. These Local limits have been developed in accordance with United States Environmental Protection Agency's (EPA's) 2004 Technical Support Document *Local Limits Development Guidance*, Washington State Department of Ecology (2010) *Guidance Manual Using NEWLL11.xlsm to Develop Local Discharge Limitations* (Knight, 2010), and in accordance with National Pollutant Discharge Elimination System (NPDES) Permit No. WA-0020249.

Section 402(b) of the Clean Water Act (CWA) provides for EPA to authorize a state to administer its own NPDES permit program. To be authorized, a state program must include adequate authority to issue permits that ensure compliance with the CWA including Section 307(b) pretreatment standards. The program must ensure that permits issued to publicly owned treatment works (POTWs) include a program to ensure compliance with pretreatment standards by significant sources introducing pollutants subject to such standards to the POTW (cf, CWA 402(b)(8), 33 U.S.C. § 1342(b)(8) *et seq.*).

EPA authorized the State of Washington authority to administer the NPDES permit program and designated the State as the Approval Authority to implement the Industrial Pretreatment Program (IPP) in the State. The Washington State Department of Ecology is responsible for implementation of the State's IPP. The City of Camas, Washington, working in cooperation with Washington State Department of Ecology, has developed these Technically Based Local Limits (TBLLs) to meet the requirements of the provision found in S6. F. of NPDES Permit No. WA-0020249.

The following appendices are provided:

- Appendix A, Guidance on the Selection of Pollutants of Concern
- Appendix B, Calculation of Fluoride Limit
- Appendix C, Data Sheets Used in "TBLL Calc-Camas.xlsm"
- Appendix D, Long-Hand Calculation of Arsenic Local Limits
- Appendix E, Definitions

2. Local Limits Development Methodology

2.1 Guidance Documents

The following guidance was used to develop the TBLLs presented in this document:

- *Local Limits Development Guidance* (EPA, 2004)
- *Guidance Manual on the Development and Implementation of Local Discharge Limitations under the Pretreatment Program*, EPA 833-B-87-202 (EPA, 1987)
- *Guidance Manual for Developing Local Discharge Limits Using NEWLL11.xlsm to Develop Local Limits Discharge Limitations* (Knight, 2010)

This document provides the rationale and legal support for local limits developed in relation to technically based environmental criteria using EPA-approved methodology. The methodology is intended to ensure full compliance at the treatment facility for all identified criteria. The following steps were taken to develop the Camas WWTP TBLLs:

1. Characterize the Camas WWTP treatment system in terms of regulatory requirements, plant capacity, treatment trains, unit processes, industrial users, and receiving stream characteristics.
2. Using the site characterization from step 1, select regulatory/operational criteria that apply to the specific treatment systems.
3. Select pollutants that should be considered for local limit development, referred to as pollutants of concern (POCs).[1] Selection is based on review of historic data and also includes a minimum list of EPA-required pollutants. Pollutants selected may be individual elements or compounds, such as metals or halogenated organic compounds that are discussed in Sections 4 through 6. Additionally, local limits may be aimed at controlling groups of substances that collectively exhibit negative characteristics, such as flammability or toxicity. This second category is discussed in Section 6, Other Limits and Concerns.
4. Upon selection of the POCs, collect historic test data or generate new data from sampling and analysis to develop the rationale for the maximum ability of the plant to treat these pollutants and remain compliant with all applicable criteria.
5. Compile test data and model the fate of the pollutants within the system using partitioning coefficients within the plant and physical properties, such as Henry's constants, in the collection system.
6. Conduct standard EPA-accepted calculations for individual elements and compounds discussed in Sections 4 through 6 to determine the maximum pollutant loading that can be allowed at the headworks (Allowable Headworks Loading [AHL]) and still maintain compliance with all applicable criteria.
7. After applying all calculations for all criteria, use the smallest mass that ensures that all NPDES permit criteria are met. This is referred to as the Maximum Allowable Headworks Loading (MAHL).
8. Subtract a safety and growth factor from the MAHL; the remaining allowable pollutant loading is the Maximum Allowable Industrial Loading (MAIL) available to industry.

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[1] The EPA *Local Limits Development Guidance Manual* (2004) define and use the technical term "Pollutants of Concern (POC)" throughout the document. Consequently, to avoid confusion during the regulatory review process of the TBLL, the term "Pollutants", "Pollutants of Concern", and POC/POCs are used throughout this document when referring to pollutants considered for local limits development.

9. Once the MAIL has been calculated, allocate the mass to the industries based on one of the prescribed methods found in the EPA *Local Limits Development Guidance* (EPA, 2004). These allocations then form the basis of the local limits for these pollutants.

10. Develop criteria based on limitations that restrict the magnitude of the negative characteristics exhibited by each type of group for collective groups of pollutants in Section 6.

3. System Characterization, Industrial Users, Receiving Stream, and Applicable Criteria

3.1 Treatment System

The Camas WWTP is permitted to discharge a maximum daily flow limit of 10.04 million gallons per day (mgd) and is designed to handle a peak instantaneous flow of 13.44 mgd. Currently, the average daily flow is approximately 2.74 mgd. Table 3-1 lists the as-built design capabilities as established in the recent plant upgrade.

Table 3-1. Camas WWTP As-Built Design Capacities

Item	Annual Average[a]	Maximum Month[a]	Peak Day[a]	Peak Hour[a]	Current Annual Average
Flow (mgd)	5.30	6.10	10.04	13.44	2.74[b,c]
BOD_5 (lb/d)	4,009	5,616	--	--	2,018[c]
TSS (lb/d)	5,883	8,001	--	--	2,152[c]
NH_3-N (lb/d)	1,389	1,956	--	--	--
Total Kjeldahl Nitrogen (lb/d)	1,917	2,573	--	--	--

[a] Source: Gray & Osborne Consulting Engineers Inc., 2015

[b] Flow data are annual daily average from 2016.

[c] Flow, BOD and TSS annual data show very small variance for the 4 years from 2015 to 2018.

Notes:

BOD_5 = 5-day biochemical oxygen demand

lb/d = pounds per day

NH_3-N = ammonia-nitrogen

TSS = totals suspended solids

The treatment process begins with a Parshall flume and two automatic perforated plate fine screens; the system also has an overflow with manual bar screen as an option if a screen becomes unavailable. From the headworks, the flow proceeds to primary clarification. The primary sludge goes through grit classification prior to biosolids treatment. The flow from the primary clarifier then proceeds to activated waste treatment in three parallel aeration basins that contain seven compartments each to create biological selector zones. After the aeration basins, the flow proceeds through secondary clarifiers, effluent flow measurement (using a magnetic flow meter), cloth disk filters, and ultraviolet disinfection. Discharge to the Columbia River is via gravity when the river is low and via vertical propeller pumps when the river level rises (up to 13 mgd). Final discharge occurs from a diffuser with 16 vertical risers designed to increase mixing.

The sludge-handling facilities consist of the primary sludge being sent to a gravity thickener (after treatment in a grit classifier), and the secondary sludge being sent to a rotary drum thickener. The thickened primary and secondary sludges are then sent to two primary anaerobic digesters. The anaerobically digested sludge is then dewatered by centrifuging and finally treatment is in a sludge dryer to produce Class A sludge.

The block diagram included in Figure 3-1 makes identification of the partition coefficient (removal factor) more apparent and shows why two partitioning coefficients (sludge removal after primary clarification and overall plant removal) were used to develop limits for this system.

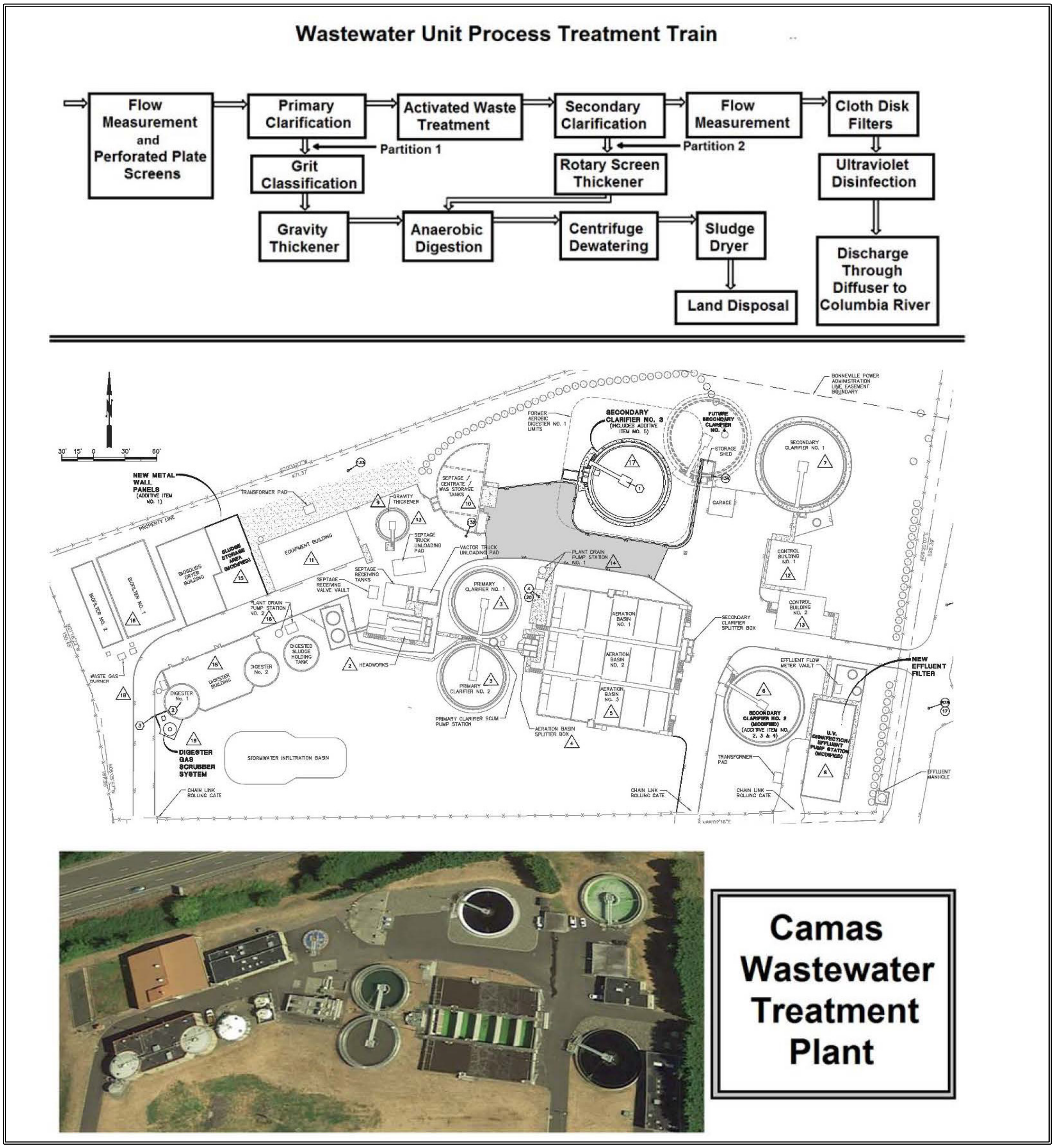

Figure 3-1. Camas Wastewater Treatment Train, Unit Processes, and Site Aerial

3.2 Industrial Users

Washington State Department of Ecology (hereafter, “Ecology”) has issued permits to four significant industrial users (SIUs) that contribute flow to the Camas WWTP. Data for these SIUs along with the permitted flow limits are described in this section.

1. WaferTech is a semiconductor integrated circuit fabrication facility subject to Categorical Pretreatment Standards under 40 CFR 469, and its discharge makes up a significant portion (16 to 27 percent) of the influent at the Camas WWTP. The flow limit for this facility found in the Ecology-issued permit is 1,437,500 gallons per day (gpd).

2. Analog Devices (formerly Linear Technology Corporation) is a semiconductor wafer production facility subject to Categorical Pretreatment Standards under 40 CFR 469. The flow limit for this facility found in the Ecology-issued permit is 367,500 gpd.

3. Karcher North America (hereafter, “Karcher”) manufactures industrial and commercial water cleaning systems including pressure washing equipment, automatic parts washers, evaporators, and wastewater treatment/recycle systems. Because of the coating (phosphating and coloring) process, Karcher is a subject to Categorical Pretreatment Standards under 40 CFR 433.17. The flow limit for this facility found in the Ecology-issued permit is 9,999 gpd. The current categorical limits in the Karcher are based on the best practicable technology (BPT) for cadmium, chromium (T), copper, cyanide, lead, nickel, silver, and zinc. Therefore, this local limits derivation sets the limits to the greater of the current categorical limits or derived local limits by allocating the MAIL to Karcher before using the uniform allocation method to allocate loadings to all other users.

4. Sharp Labs of America, Inc. (SLA) performs research and development related to integrated circuits and liquid crystal display technology. SLA may be subject to categorical effluent limitations (40 CFR 469). However, it is the City of Camas’ understanding that because SLA is a research and development facility, the Categorical Pretreatment Standards do not apply to this SIU. The flow limit for this facility in the Ecology-issued permit is 48,000 gpd. This facility, however, has been almost completely shut down and is not in operation. Although SLA still has a permit, the flow for April 2019 was only 129 gallons. Consequently, the flow limit in this permit is not used in the local limits calculations.

Bodycoat treats metal to remove occlusions but is not considered at this time to be a significant industrial user by the Ecology pretreatment program. Flow from this facility has not been used in the calculations of local limits.

The total flow used in the calculations of all limits, except fluoride, has been selected as the maximum that the three permitted and operational industries can discharge in a single day (1,814,999 gpd).

For fluoride, the developed limit is issued as mass (lb/d)-based limits and the available capacity has been given to the two semiconductor industries (WaferTech and Analog Devices) using the contributory mass proportion basis.

3.3 Receiving Stream

The Camas WWTP effluent is discharged to the Columbia River at an outfall that extends approximately 850 feet (ft) south into the Columbia River channel. The diffuser portion of the outfall is located along the outer 150 ft of the pipe. The existing outfall includes 16 vertical risers that discharge effluent perpendicular to the flow of the Columbia River. This results in considerable turbulence and good dilution in the mixing zone. Consequently, the dilution factor in the discharge permit is 23 for acute Water Quality Criteria (WQC), 121 for chronic WQC, and 185 for human health (HH) criteria.

3.4 Applicable Criteria

Using the site characterization, industrial base, and regulatory/operational considerations applicable to this treatment system, the Camas WWTP is subject to the following criteria:

- Water quality standards
- NPDES permit limits
- Biosolids regulations for disposal
- Worker health and safety (toxicity, flammability, explosivity)
- Plant capacity
- Other applicable criteria based on best professional judgment (BPJ)

These criteria were used to select the POCs and are further discussed in Section 4.

4. POC Selection, Sampling, and Analysis

4.1 POC Selection

Toxic pollutants selected for these derivations consist of the EPA national pollutant-mandated list of 11 required metals plus cyanide. Additionally, EPA lists BOD_5, TSS, and ammonia as pollutants that should be discussed. Flow; pH; flammability; temperature; and, oil and grease (O&G) are discussed in relation to protecting the treatment works, the collection system, and workers.

The NPDES permit contains language that requires the evaluation of POCs that are not typically included in local limits development but were required for testing at the Camas WWTP. These include antimony, fluoride, sulfate, total dissolved solids (TDS) hexavalent chromium, and total petroleum hydrocarbons (TPH) for gasoline and TPH diesel. The metal antimony has been calculated in a like manner to the other required metals.

Hexavalent chromium and both gasoline and diesel TPH are almost not present in the influent at the Camas WWTP and are all below detect in the effluent. Consequently, a local limit is not adopted for these POCs.

Fluoride, sulfates, and TDS are pollutants that are in the Camas WWTP system above normal levels. Contributors of these POCs include two semiconductor industries that discharge these three pollutants, likely because of the nature of their industrial process. Both industries are listed under categorical standards found in 40 CFR 469. Each of these three pollutants are discussed and the limits for fluoride are hand-calculated in Attachment B.

Additionally, in the selecting POCs, 3 years of historical test data points were reviewed for the Camas WWTP effluent and sludge samples taken from January 1, 2009, to July 31, 2014. This review included testing for priority pollutants and metals. The priority pollutant scans did not identify additional pollutants that required local limits. Table 4-1 provides the full list of pollutants selected for evaluation.

Table 4-1. Pollutants Selected for This Local Limits Evaluation

Antimony	NWTPH Gx -Gasoline Total Petroleum Hydrocarbon	Zinc
Arsenic	Lead	BOD_5
Cadmium	Mercury	TSS
Chromium, Total	Molybdenum	Ammonia
Chromium, Hexavalent	Nickel	pH
Copper	Selenium	Fats, Oils, and Grease (O&G)
Cyanide	Silver	Temperature
Fluoride	Sulfate	Flammability
NWTPH Dx -Diesel Total Petroleum Hydrocarbon	Total Dissolved Solids	Flow

4.2 Sampling and Analysis

Sampling was conducted quarterly during 2018 according to the *Final Local Limits Sampling and Evaluation Plan* (CH2M, 2017) that was submitted to Ecology in September 2017 to fulfill NPDES provision “Special Conditions S6”. Sampling was conducted to develop site-specific partition coefficients (removal factors) for the non-conventional pollutants in Table 4-1. The objective of this sampling was to determine how the pollutants are either moved into the sludge or discharged into the receiving waters. This ratio of removal is known as *removal rate*, *removal coefficient*, or *partitioning coefficient*.

Concurrent sampling in the Camas WWTP treatment system was conducted for 3 days each quarter, as shown in Table 4-2.

Table 4-2. Sample Schedule

2018 Sampling Dates	Location	Sample Schedule Each Sampling Period		
		Day 1	Day 2	Day 3
March 5, 6 and 7 May 16, 17 and 18 September 10, 11 and 12 November 29, 30, and December 1	Influent	1	1	
	Primary Effluent	1	1	
	Effluent		1	1
	Sludge		1	
	Industry		1	

Grab samples were taken for cyanide, chromium IV, mercury, NWTPH-Dx, and NWTPH-Gx during the first day at intervals. All other samples were composite sampling and collected approximately 9 a.m. on the day registered and collected at 9 a.m. on the following day. Effluent was collected 24 hours after influent for each data set to account for plant retention time. Table 4-3 lists the pollutants included in the testing regimen. Laboratory analytical methods with the appropriate sensitivity and quality assurance and quality control (QA/QC) were requested to provide useable data. The laboratory analytical reports not only met, but exceeded, all data reporting requirements. Where the best testing methods available were insufficient to generate removal factors, the EPA's *Local Limits Development Guidance* document (EPA, 2004), which provides default values (book values), was used as an alternative. Instances where book values were used are noted and discussed. The reference values are also highlighted in a blue background in the Excel spreadsheet "TBLL Calc-Camas.xlsm".

Table 4-3. Pollutants Tested for in Each Sample

Pollutant	Sample Location				
	Influent	Primary Clarifier	Effluent	Sludge	Industry
Antimony	X	X	X	X	X
Arsenic	X	X	X	X	X
Cadmium	X	X	X	X	X
Chromium, Total	X	X	X	X	X
Chromium, Hexavalent	X	X	X		
Copper	X	X	X	X	X
Cyanide	X	X	X		
Fluoride	X	X	X		X
NWTPH-Dx	X	X	X		
NWTPH-Gx	X	X	X		
Lead	X	X	X	X	X
Mercury	X	X	X	X	X
Molybdenum	X	X	X	X	X
Nickel	X	X	X	X	X
Selenium	X	X	X	X	X
Silver	X	X	X	X	X
Sulfate	X	X	X		X
TDS	X	X	X		
Zinc	X	X	X	X	X
% Solids				X	

Cyanide and chromium VI were not tested for in the sludge samples because of the non-conservative nature of cyanide and the lack of a sludge disposal criterion for both cyanide and chromium.[2] Additionally, fluoride and TPH testing were not conducted on the sludge.

Table 4-4 lists the laboratories that conducted the testing.

[2] Cyanide does not collect in the sludge. Instead, cyanide reduction in the wastewater treatment process occurs because some micro-biota can use it as a food source. When cyanide predominates over time, these organisms proliferate and the plant acclimatizes to the presence of cyanide, allowing for treatment of this toxic material. For this reason, 40 CFR 503 does not list a cyanide limit in its disposal criteria.

Table 4-4. Laboratories Used for Testing

Pollutants	Laboratory
Metals	Eurofins-Frontier Global Sciences
All other Analytes	ALS Environmental

5. Data Compilation and Analysis

5.1 Data Compilation

Test data generated from each laboratory were reviewed and verified using data qualifiers and laboratory data QA/QC documentation. All data above the minimum level (ML) were used to develop estimated removal efficiencies. If any data point for either the influent or the effluent was below the ML, one-half the ML was used. The lab reports a reporting limit (RL) for each pollutant. Under this TBLL development, the laboratory that performed the analyses confirmed that the reported RLs followed the exact methodology to produce valid MLs using standards at the levels specified. Domestic sampling typically is taken from low-flow areas, which are not representative of flow entering the plant. As an alternative, the test data from the influent are used to represent domestic contributions. In this method, referred to as "domestic approximation", the data used for domestic flow consist of all dischargers including domestic, commercial, and industrial. Using the influent data is a conservative assumption. The exception for using this approximation was for fluoride because of the industrial contribution of this pollutant. For fluoride, domestic contribution was calculated mathematically to be the influent value in mass minus the industrial value and mass. This quantity was then used as the domestic contribution. The data for cyanide (four grab samples per day per site) were entered into a spreadsheet to calculate average values for the sample day. These data, along with data on other pollutants, were then entered into a spreadsheet titled "TBLL Calc-Camas.xlsm"[3] that automates the calculation of limits as described below. Appendix C provides all pages used from the "TBLL Calc-Camas.xlsm".

5.2 Removal Efficiency

The Camas WWTP requires the calculation of two removal factors: one for the sludge removal during primary clarification and one for overall plant removal. Removal factors for each pollutant are automatically calculated in the "TBLL Calc-Camas.xlsm" file. Each day's data points for influent, primary effluent, final effluent, and (for days available) sludge are entered as separate sample set pairs in the "TBLL Calc-Camas.xlsm" file on the Sample Data page. The spreadsheet then calculates the removal efficiency on a pollutant-by-pollutant basis across the primary clarifiers and across the full treatment plant. Average removal efficiencies are shown on line 4 and 5 of the Data Summary page of the spreadsheet provided in Appendix C. Some data entered in the portion of the "TBLL Calc- Camas.xlsm" section that calculates removal efficiencies are near the ML, which reduces the accuracy of the calculated value. Where the influent values are above the RL and the effluent value is below the RL(ML), the guidance from EPA (2004) is used and one-half the RL(ML) is used for the effluent.

The reasonableness of each calculated removal factor must be considered; therefore, the resulting values were compared to the EPA (2004) book values shown in Tables 5-1 and 5-2 as a cross check.

Table 5-1. Pollutant Percent Removal Efficiencies (%) Through Primary Clarification

Pollutant	Median[a]	Generated by "TBLL Calc-Camas.xlsm"	Adopted Removal Factor
Antimony	NP	11.2	11.2
Arsenic	NP	Cannot Calculate	2.0[b]
Cadmium	15	36.04	36.0
Chromium, Total	27	16.27	16.3
Chromium, Hex	NP	NC	NC
Copper	22	7.6	7.6
Cyanide	27	Cannot Calculate	27[c]
Fluoride	NP	4.64	4.6
Lead	57	34.59	34.6

[3] The original spreadsheet model was produced by David J. Knight, P.E., Washington State Dept. of Ecology.

Table 5-1. Pollutant Percent Removal Efficiencies (%) Through Primary Clarification

Pollutant	Median[a]	Generated by "TBLL Calc-Camas.xlsm"	Adopted Removal Factor
Mercury	10	41.63	41.6
Molybdenum	NP	9.12	9.1
Nickel	14	8.78	8.8
NWTPH-DX	NP	36	36.0
NWTPH-Gx	NP	Cannot Calculate	NC
Selenium	NP	Cannot Calculate	10.0[b]
Silver	20	22.8	22.8 [c]
Sulfate	NP	9.39	9.4
TDS	NP	Cannot Calculate	NC
Zinc	27	33.50	33.5

[a] Book value from *Local Limits Development Guidance* (EPA, 2004)

[b] Value is average is one-third of overall plant removal.

[c] Reference value adopted from Guidance Manual

Notes:
NP = Book value not published or available
NC = Limit was not calculated

Table 5-2. Pollutant Percent Removal Efficiencies (%) Through Activated Sludge Treatment

Pollutant	Second Decile[a]	Median[a]	Eight Decile[a]	Generated by "TBLL Calc-Camas"	Adopted Removal Factor
Antimony	NP	NP	NP	7.09	7.1
Arsenic	31	45	53	6.37	6.4
Cadmium	33	67	91	60.24	60.2
Chromium, Total	68	82	91	76.40	76.4
Chromium, Hex	NP	NP	NP	NC	NC
Copper	67	86	95	75.51	75.5
Cyanide	41	69	84	Cannot Calculate	69.0
Fluoride	NP	NP	NP	5.52	5.5
Lead	39	61	76	85.31z	85.3
Mercury	50	60	79	96.57	96.6
Molybdenum	NP	NP	NP	8.17	8.2
Nickel	25	42	62	33.48	33.5
NWTPH-DX	NP	NP	NP	NC	NC
NWTPH-Gx	NP	NP	NP	NC	NC
Selenium	33	50	67	12.22	12.2
Silver	50	75	88	87.18	87.2
Sulfate	NP	NP	NP	NC	NC
TDS	NP	NP	NP	NC	NC
Zinc	64	79	88	50.95	51.0

[a] Book value from *Local Limits Development Guidance* (EPA, 2004)
Notes:
NP = Book value not published or available
NC = Limit was not calculated

The laboratory QA/QC documentation is reviewed in calculating removal factors. The data pairs are then input into the "TBLL Calc-Camas.xlsm" file, which calculates a removal factor for each data pair. When a data pair contains at least one non-detect, or when the effluent is higher than the influent, the spread-sheet indicates that a removal factor cannot be calculated. The data pairs for which a removal factor can be calculated are then averaged for the final removal factor used in later calculations.

The average values of the individual data pair removal factors are shown in line 5 of the Sample Data Page 1 of Appendix C. For many metals, the removal is less than average and in some cases much less than reference values. For TDS, there is an increase in TDS likely because of the addition of magnesium hydroxide. Antimony and arsenic show a pattern of the influent concentration often being lower than the effluent. This is thought to potentially be caused by contaminants in the magnesium oxide and this chemical was tested but did not result in elevated levels of metals.

5.3 Calculation of Allowable Headworks Loadings

Using the adopted removal factors, the standard methodology from EPA's *Local Limits Development Guidance* (EPA, 2004) along with Ecology's *Guidance Manual for Developing Local Discharge Limits* (Knight, 2011) and spreadsheet (which has been renamed "TBLL-Camas.xlsm") was used to calculate the highest quantity of each pollutant that can be received at the headworks to the treatment plant and still comply with applicable criteria. Each criterion is explained below in relation to water quality and sludge quality requirements.

5.3.1 Water Quality Criteria

To protect receiving stream water quality, federal water quality standards were used to set metals limits. The water quality standards are derived from natural log functions that vary with water hardness. The formulas are similar to the translators as described in Appendix J of EPA's 2nd Edition of the *Water Quality Standards Handbook* (EPA, 1994). The standards were calculated automatically on the POTW Limits page of the spreadsheet. The standards are shown on rows 24 and 25 of the local limits page of "TBLL-Camas.xlsm". Row 26 on this page is used to calculate human health criteria for receiving streams. However, human health was found to not be the most stringent criteria for any POC considered in this development. Hardness was set at 62.4 parts per million (ppm), which was taken from test data gathered for the Camas receiving water study submitted in response to Part S10 of the Camas NPDES permit under separate cover.

The allowable headworks loadings (AHL) for Water Quality Criteria are calculated as follows:

$$Lwq = \frac{(8.34)(Cwq)(Qpotw)(DF)}{(1-Rpotw)}$$

where:

Lwq = Maximum allowable headworks loading (lb/d) based on water quality criteria.

Cwq = Chronic or Acute Criteria (mg/L)

Qpotw = POTW average flow (mgd)

DF = Dilution factor (as specified in the NPDES permit)

Rpotw = POTW removal efficiency (as a decimal)

5.3.2 NPDES Criteria

NPDES permit limits for metals are typically developed based on water quality criteria and follow the same equation as given under the water quality section, except that the *Cwq* is replaced by the NPDES permit limit. The current NPDES permit for the Camas WWTP does not include any effluent limits for metals because the discharge achieves high dilutions and does not require water-quality-based effluent limits for metals.

5.3.3 Sludge Quality

Treatment plants are required to prohibit nondomestic discharges in amounts that cause violation of applicable sludge disposal criteria, or to use regulations or restrict the plant from using its chosen sludge disposal option. Currently, the sludge from the Camas WWTP is extensively processed to create a high-quality Class A biosolid suitable for both field and residential soil amendment.

To maintain this classification, the total metals in the sludge must meet Table 3 of 40 CFR 503.13, which specifies pollutant concentrations as total metals. The equation below is used to calculate AHLs based on Table 3 criteria. Table 3 is replicated in row 29 of the Local Limits Page 1 of “TBLL-Camas.xlsm” and is used to calculate local limits based on Sludge Disposal.

$$\text{Lin} = \frac{(8.34)(\text{Cslcrit})(\text{PS}/100)(\text{Qsldg})}{\text{Rpotw}}$$

where:

PS = Percent solids in the sludge to disposal (%)

Qsldg = Sludge flow to disposal (mgd)

Cslcrit = Limiting sludge criteria (milligrams per kilogram [mg/kg])

Rpotw = POTW removal efficiency (as a decimal)

The data associated with sludge testing are one of the most reliable sources when considering local limits for conservative pollutants such as metals. Sludge accumulation and treatment concentrates incoming pollutants and averages the pollutants received by the plant over time. Consequently, these data often provide the best estimate of the long-term average pollutant levels in the collection system. At the Camas WWTP, sludge concentration is a small fraction of the Biosolids Class A (Table 3) limits, which is an indicator that these pollutants are present in low levels throughout the entire waste collection system.

5.3.4 Impact on Wastewater Treatment Plant

Treatment plants must protect against nondomestic discharges that inhibit the treatment processes or operations. Local limits are based on known or estimated inhibitory concentrations of toxic pollutants that may be received in the treatment process. These inhibitory concentration levels are taken from reference data available in the EPA (2004) *Local Limits Development Guidance*. For the Camas WWTP, calculation of inhibitory AHLs must be conducted for secondary treatment inhibition (activated sludge) and anaerobic sludge digestion. Activated waste inhibition levels are found on row 27 of the Local Limits of “TBLL-Camas.xlsm”. Anaerobic sludge digestion reference values are found on row 28 of the same spreadsheet page. The following equations are used to calculate inhibitory AHLs.

Secondary Treatment Inhibition:

$$\text{Linhib2} = \frac{(8.34)(\text{Ccrit})(\text{Qpotw})}{(1-\text{Rprim})}$$

where:

Linhib2 = Maximum allowable headworks loading (lb/d) based on inhibition of secondary process

Ccrit = Inhibition level (mg/L)

Rprim = Primary removal efficiency (decimal); because primary removal is not available, the denominator in the equation is 1

Qpotw = POTW average flow

Anaerobic Digestion Inhibition:

$$Linhibdgstr = \frac{(8.34)*(Ccrit)(Qdig)}{Rpotw}$$

where:

Linhibdgstr = Maximum allowable headworks loading (lb/d) based on inhibition of Anaerobic Digestion

Ccrit = Inhibition level (mg/L) for Anaerobic Digestion

Qdig = Sludge flow to disposal (mgd)

Rpotw = POTW removal efficiency (as a decimal)

5.4 Limit Selection

The "TBLL Calc-Camas.xlsm" spreadsheet automates the calculation of limits so that a limit is generated for each criterion. Table 5-3 displays the MAHL[4] selection process, followed by calculation of the MAIL as mass loadings. This format facilitates verification that the smallest AHL has been selected.

Table 5-3 presents the AHLs calculated in pounds for each limiting criterion considered. The smallest of the AHLs is referred to as the MAHL because it is the highest loading that may be seen at the headworks for which all criteria will be met. Table 5-3 also presents the current domestic loading, which is subtracted from the MAHL to calculate the MAIL. Table 5-3 indicates the pounds set aside for industrial growth, which is further subtracted from the MAIL. Additionally, a 10-percent safety factor has been subtracted from the MAHL. The mass remaining is used along with known industrial discharge to calculate the maximum concentrations that can be discharged.

Table 5-3. Selection Table Using AHL, MAHL, and MAIL

Pollutant	Water Quality Acute (lb/d)	Water Quality Chronic (lb/d)	Human Health (lb/d)	Inhibition Activated Waste (lb/d)	Sludge Based on Table 3 40 CFR 503 (lb/d)	Anaerobic Digestion Inhibition	Domestic Loading (lb/d)	MAIL[a] (lb/d)	Basis
Antimony	5,091.5	4,761.9	27.3	NA	NA	NA	0.002	24.6	HH
Arsenic	190.8	443.0	NA	2.3	4.0	8.6	0.008	2.1	Inhib
Cadmium	26.2	6.0	106.3	35.7	0.4	11.4	0.001	0.4	SD
Chromium	2,627.9	1,647.9	895.6	272.9	NA	11.4	0.012	245.6	Inhib
Copper	26.4	96.6	93.3	24.7	7.6	18.2	0.245	7.6	SD
Cyanide	37.3	48.2	122.7	3.1	NA	2.0	0.039	1.7	Inhib
Fluoride	277.2	NA	NA	2,499.4	NA	248.4	6.48	217.1	Inhib

4 The MAHL is shown in line 63 of the Local Limits Calc Page 2 Appendix C, but the spreadsheet calculates a concentration limit for each AHL and selects the smallest value.

Table 5-3. Selection Table Using AHL, MAHL, and MAIL

Pollutant	Water Quality Acute (lb/d)	Water Quality Chronic (lb/d)	Human Health (lb/d)	Inhibition Activated Waste (lb/d)	Sludge Based on Table 3 40 CFR 503 (lb/d)	Anaerobic Digestion Inhibition	Domestic Loading (lb/d)	MAIL[a] (lb/d)	Basis
Lead	160.2	32.9	1,438.7	34.9	2.3	136.6	0.005	2.0	SD
Mercury	36.8	0.97	246.4	3.9	0.1	NA	0.000	0.11	SD
Molybdenum	NA	NA	NA	NA	4.9	NA	0.042	4.3	SD
Nickel	751.9	439.8	NA	25.1	7.8	10.2	0.030	7.0	SD
Selenium	12.0	15.8	NA	NA	5.2	NA	0.014	4.7	SD
Silver	7.4	NA	NA	7.4	NA	5.1	0.001	4.6	Inhib
Zinc	84.1	400.7	NA	7.3	24.5	269.1	0.486	6.1	Inhib

[a] The MAIL in this column has had 10% of the MAHL subtracted.
Notes:
NA = Not Applicable
WQS = Water Quality Standard
Inhib = Inhibition of treatment plant process
SD = Sludge Disposal
HH = Human Health Criteria

5.5 Uniform Allocation to Permitted Industrial Users After Distribution to Karcher

Local limits presented herein are based on allocations that follow a two-step process.

1) A portion of the MAIL is allocated to industries based on their processes if they need additional capacity to discharge specific pollutants. This follows the allocation based on the mass proportion allocation method found on page 6-11 of the EPA's *Local Limits Guidance Manual*.

   Table 5-4 lists the limits for Karcher that are currently in its permit. The Karcher limits are derived from BPT and consequently have been judged by EPA to be the lowest that the industrial processes can achieve within economical constraints. Therefore, after the mass-based MAIL has been determined for the Camas WWTP, enough mass has been used from the MAIL to provide Karcher with the concentration-based limits currently in its permit. This is accomplished by first calculating the mass that would be discharged at maximum day Karcher limits, which is found on row 83 of the local limits page of the local limits spreadsheet (see Appendix C). This mass is then subtracted from the mass-based MAIL for each POC in the Karcher permit and the remaining MAIL is allocated using the uniform allocation method. These calculations are shown on rows 79 to 92 of the local limits page of the Ecology's local limits spreadsheet.

Table 5-4. Karcher Permit Incorporated Categorical Limits

Pollutant	Karcher Avg Monthly Limit	Karcher Maximum Day Limit
Cadmium	0.07 mg/L	0.11 mg/L
Chromium (Total)	1.71 mg/L	2.77 mg/L
Copper	2.07 mg/L	3.38 mg/L
Cyanide	0.65 mg/L	1.20 mg/L
Lead	0.43 mg/L	0.69 mg/L
Nickel	2.38 mg/L	3.98 mg/L
Silver	0.24 mg/L	0.43 mg/L
Zinc	1.48 mg/L	2.61 mg/L

For the semiconductor industries, fluoride, sulfate, and TDS are allocated as discussed below.

2) For all other limits, the uniform allocation method is used to calculate limits. In this method, the mass (remaining after the allocation described in step #1) of a regulated pollutant is distributed equally to industrial flow, and each industry receives the same concentration-based limits. Derivation of uniform limits is driven by inputs for industrial flow on line 13 of the Basic Data page "TBLL-Camas.xlsm" and the MAIL on line 64 on the Local Limits Calc Page 2 of Appendix C. Table 5-5 presents the selected limits found in line 69 of the Local Limits Calc Page 2 of Appendix C. These limits are developed using flow at the discharge point, which includes all flow from an industry at the point the flow is discharged to the City collection system in accordance with EPA's *Local Limits Development Manual* (2004).[5]

Table 5-5. Adopted Local Limits

Pollutant	Adopted City-Wide Local Limit	Karcher Local Limit
Antimony	1.62 mg/L	Same as City-Wide
Arsenic	0.14 mg/L	Same as City-Wide
Cadmium	0.025 mg/L	0.11 mg/L
Chromium (Total)	5.0 mg/L[a]	5.0 mg/L
Chromium (Hexavalent)	No Limit Adopted	Same as City-Wide
Copper	0.438 mg/L	3.38 mg/L
Cyanide	0.116 mg/L	1.20 mg/L
Fluoride-Concentration	30.62 mg/L	Same as City-Wide
Fluoride-Mass		
Analog Device	76.6 lb/d	NA
WaferTech	140.5 lb/d	NA
Lead	0.135 mg/L	1.20 mg/L
Mercury	0.007 mg/L	Same as City-Wide
Molybdenum	0.286 mg/L	Same as City-Wide
Nickel	0.461 mg/L	3.98 mg/L
NWTPH-Dx	No Limit Adopted	Same as City-Wide
NWTPH-Gx	No Limit Adopted	Same as City-Wide
Selenium	0.31 mg/L	Same as City-Wide
Silver	0.304 mg/L	0.43 mg/L
Sulfate	No Additional Limit Adopted	Same as City-Wide
TDS	No Additional Limit Adopted	Same as City-Wide
Zinc	0.403 mg/L	2.61 mg/L
Flow	No Limit Adopted	Same as City-Wide
BOD_5	No Limit Adopted[b]	Same as City-Wide
TSS	No Limit Adopted[b]	Same as City-Wide
pH	5.5 –11.0 SU	Same as City-Wide
Ammonia	No Limit Adopted	Same as City-Wide
O&G	100 mg/L	Same as City-Wide
Temperature	40°C (104°F) at the POTW, 60°C (140°F) at discharge point from SIU[c]	Same as City-Wide

[5] Page 1-4 Table 1-1.

Table 5-5. Adopted Local Limits

Pollutant	Adopted City-Wide Local Limit	Karcher Local Limit
Flammability	Specified as no material with a closed cup flashpoint <140 (°F) and No two consecutive readings at ≥5% LEL, and no reading of ≥10% LEL allowed [d]	Same as City-Wide

[a] The calculated limit is 16.2 mg/L. The Resource Conservation and Recovery Act (RCRA) sets a limit of 5.0 mg/L for chromium, which is not technically based but statutorily is classified as hazardous waste. While wastewater is not covered by RCRA because of the Domestic Sewer Exclusion, the City elects to not allow the discharge of waste that would otherwise be classified as "hazardous" and, therefore, a limit of 5.0 mg/L is adopted.

[b] The City of Camas reserves the right to institute surcharge levels for pollutants discharged by SIUs at concentrations or mass levels above domestic strength based on cost to treat pollutants for which treatment cost can be established. These pollutants include but are not limited to BOD and TSS.

[c] cf. 40 CFR 403.5(b)(5)

[d] As per guidance in EPA Model Pretreatment Ordinance

5.6 Fluoride

The local limit for fluoride is one of the most important pollutants examined in this development because of its importance in the process of microchip fabrication. While sampling for fluoride followed the sampling plan as discussed below, the criteria needed to technically develop the limit required research into both national and international studies on this element and its compounds. The limits currently in the IPP permits for the semiconductor industries as established by Washington State are first discussed as a backdrop to the developed criteria.

For fluoride compounds generated in the production of semiconductors, the 40 CFR 469 contains limits tables for:

1) Pretreatment standards for existing sources (PSES)
2) Pretreatment standards for new sources (PSNS)
3) New source performance standards (NSPS)

Each of these categories are applied based on the discharge status of the industry.

PSES is designated for existing industries that discharge to a publicly owned treatment system at the time the regulation became effective. The standard is applicable to industries operating before July 1, 1984. The only categorical limit in this category is for total toxic organics (TTO) limited at 1.37 mg/L. The category does not contain a limit for fluoride.

PSNS is designated for industries that discharge to a publicly owned treatment system that were built or modified after the time the regulation became effective. The standard is applicable to industries operating after July 1, 1984. As with PSES, the only standard in this category is for TTO limited at 1.37 mg/L. The category does not contain a limit for fluoride.

NSPS is designated for point source discharges (direct discharge to a receiving stream). This standard applies to industries that are not co-mingled with domestic waste and then treated at a treatment plant before discharge. Consequently, the limits are used when issuing NPDES permits to industries discharging directly to a river, lake, or ocean. This standard contains limits for TTO of 1.37 mg/L and fluoride limits of 32.0 mg/L maximum for highest day and monthly average of 17.4 mg/L for 30 consecutive days. The fluoride limits are based on the best available technology economically achievable and consequently have not been technically derived based on protection of systems, environmental harm, treatability, or effect on any criteria in the downstream system/ecosystem. Local limits must be derived based on each of these criteria and then selecting the criteria found to be the most stringent.

5.6.1 Criteria Examined for Fluoride

Table 5-6 lists the criteria that had potential to be affected by fluoride. For many of these criteria, the only action is to confirm that they are not present, while for other criteria extensive literature research was conducted.

Table 5-6. Criteria Reviewed for Possible Need to Develop a Fluoride Limit

NPDES Permit Limit	Anaerobic Treatment Inhibition	Worker Health and Safety
Regulatory Water Quality Criteria	Sludge Disposal	Effect on River Fauna and Flora
Aerobic Treatment Inhibition	Equipment Corrosion	

Review of the NPDES permit, the Washington state water quality criteria, and sludge disposal regulations does not show limitations or guidance on fluoride. The local limits guidance manual references fluoride regarding being present in drinking water (fluoridation treatment), landfill leachate, domestic waste, and the fact that fluoride is limited in some categorical standards. The guidance does not otherwise offer advice on fluoride. The limits in the document are intended to protect the Camas wastewater system, prevent treatment interference, protect the environment, and protect worker health and safety. The assumptions are conservative and the data used apply to Camas only and are not intended to set standards for local limits developed for other jurisdictions.

5.6.2 Corrosion

Increases in corrosion were considered as a criterion because fluorine is more electronegative than chloride and consequently might be an aggressive agent in metal corrosion. Most information found regarding fluoride corrosion was conducted on piping in water systems that deliberately practice fluoridation and are in general agreement regard lack of accelerated corrosion. While there is some evidence from the oil industry that indicates that high concentrations of fluoride can increase corrosion in mild steel in cooling towers, mild steel is generally not used in contact situations within a wastewater treatment plant because of other corrosive elements present. According to Zatkalíková et al. (2016), stainless steel was exposed with up to 0.5 percent (50,000 mg/L) sodium fluoride along with 0.9 percent sodium chloride for 42 days and then measured in terms of the effects both by weight and by microscopic examination. The results indicated that solutions containing fluoride (even high levels) showed less corrosion than solutions of sodium chloride alone. The authors stated that the "fluoride inhibitive effect on local corrosion of stainless steel could be based on formation of stable metal-fluoride complexes (with higher equilibrium constants than for metal-chloride complexes) which may strengthen the surface passive film and prevent its breakdown." Other papers are available that confirm this reduction in corrosion including one that indicates the deliberate addition of calcium fluoride to reduce corrosion. Given this information and the lack of information to form standards, corrosion has not been used as a factor in the derivation of a local limits.

5.6.3 Aerobic and Anaerobic Inhibition

Review of data and research on the influence fluoride has on the biological processes at higher concentrations were not readily available except at lower fluoride concentrations caused by drinking water fluoridation. The one exception is a study conducted at the University of Arizona. In a study titled "Toxicity of fluoride to microorganisms in biological wastewater treatment systems", Ochoa-Herera et al. (2009) studied the influence of fluoride using concentrations ranging from 0 to 800 mg/L. The study evaluated the inhibitory effect that fluoride has on microbial populations that remove organics and nutrients in wastewater treatment processes. The study used healthy samples of activated waste and anaerobic sludge from three different treatment systems and then made additions of fluoride along with the principal chemical classes that are broken down in aerobic and anaerobic treatment processes including nitrification/denitrification. From the results of the study, the authors concluded:

> "Fluoride is inhibitory towards microbial populations involved in various metabolic steps in anaerobic digestion processes, i.e., mesophilic and thermophilic acetoclastic methanogens, as well as propionate- and butyrate-degraders, at concentrations lower than those found in some fluoride-containing industrial effluents. In contrast, very high concentrations of soluble fluoride (>500 mg/L) can be tolerated by microbial communities involved in the aerobic activated sludge and in denitrification processes without significant inhibitory impact. Nitrification processes are somewhat more sensitive, but they appear to acclimate rapidly to fluoride. In conclusion, the high susceptibility of key microbial populations involved in the anaerobic metabolism of volatile fatty acids towards inhibition by fluoride indicates that measures to reduce the concentration of this ion (e.g., pretreatment of the wastewater using ion exchange or precipitation with calcium(II), wastewater dilution, etc.) may be required to prevent microbial inhibition during the anaerobic treatment of fluoride-containing streams."

The Ochoa-Herera et al. study was intended to determine fluoride inhibition for various treatment processes and compounds typically broken down in each process (see Table 5-7). From this table, the processes closest to the Camas WWTP were selected. The lowest IC_{20} for aerobic nitrification of ammonia at IC_{20} is 104.3 mg/L. The lowest mesophilic anaerobic inhibitions IC_{20} is for acetates is 40 mg/L. This is conservative because inhibition drops off at an increasing rate as organisms habituate to higher concentrations over time, as shown in Figure 5-1 and the biological processes at the Camas WWTP have adapted to higher concentrations of fluoride.

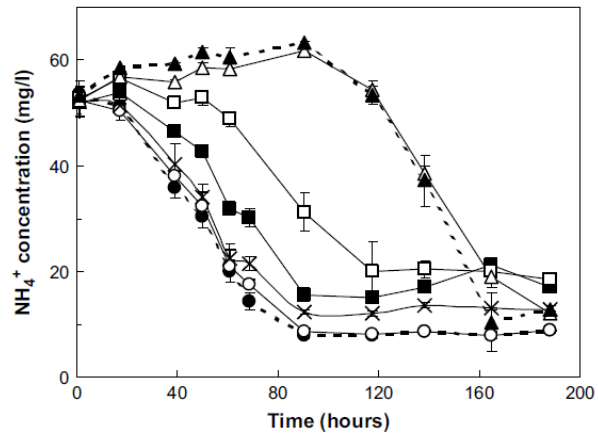

Fig. 1 – Time course of ammonium consumption by a mixed microbial culture obtained form the nitrification stage of a municipal wastewater treatment plant in the presence of increasing fluoride concentrations (in mg/L): (●) 0,(○) 50,(✳) 90,(■) 130,(□) 180,(△) 230, and (▲) 300.

Figure 5-1. Fluoride Inhibition of Ammonium in Municipal Wastewater

Source: Ochoa-Herera et al. (2009)

Table 5-7. Fluoride Inhibition Effect Study

Source: Ochoa-Herera et al. (2009)

Table 2 – Inhibitory effect of sodium fluoride on the key microbial populations in biological wastewater treatment systems. IC_{20}, IC_{50} and IC_{80} are the concentrations of fluoride causing 20%, 50% and 80% decrease in the activity of the target microbial population, respectively.

Substrate	Redox conditions	Inhibitory effect	Inoculum[a]	1st feeding (mg/L)			2nd feeding (mg/L)		
				IC_{20}	IC_{50}	IC_{80}	IC_{20}	IC_{50}	IC_{80}
Mesophilic methanogens									
Acetate	Anaerobic	Methanogenesis	Eerbeek granular sludge	40.0	160.0	500.0	15.0	30.3	60.0
Acetate	Anaerobic	Methanogenesis	Ina Road sludge	17.5	34.5	93.0	12.4	25.8	35.7
H_2	Anaerobic	Methanogenesis	Eerbeek granular sludge	815.0	>815.0	>815.0	520.0	645.0	795.0
H_2	Anaerobic	Methanogenesis	Ina Road sludge	30.0	82.0	390.0	805.0	1005.0	1125.0
Thermophilic methanogens									
Acetate	Anaerobic	Methanogenesis	Hyperion sludge	7.2	18.1	39.2	29.5	42.6	62.9
H_2	Anaerobic	Methanogenesis	Hyperion sludge	218.6	432.6	>600.0	>600.0	>600.0	>600.0
Anaerobic propionate-utilizing microorganisms									
Propionate	Anaerobic	Propionate degradation	Eerbeek granular sludge	10.5	36.5	62.0			
Anaerobic butyrate-utilizing microorganisms									
Butyrate	Anaerobic	Butyrate degradation	Eerbeek granular sludge	17.5	25.5	34.8			
Denitrification									
Nitrate	Anoxic	Nitrate reduction	Eerbeek granular sludge	>800.0[b]	>800.0[b]	>800.0[b]			
Nitrification									
Ammonium	Aerobic	NH_4^+ oxidation	Randolph Park I	104.3	148.8	179.8			
Heterotrophic aerobes									
Glucose	Aerobic	Glucose degradation	Randolph Park II	>539.0[c]	>539.0[c]	>539.0[c]			
Glucose fermenters									
Glucose	Anaerobic	Glucose degradation	Aviko granular sludge	150.5	>539.0	>539.0			
Glucose	Anaerobic	Glucose degradation	Enrichment culture	87.0	325.0	539.0			

a All inocula used consisted of dispersed biomass unless otherwise indicated.
b Not toxic at the highest concentration tested, i.e., 800 mg/L.
c Not toxic at the highest concentration tested, i.e., 539 mg/L.

The inhibition observed was calculated as shown below. The initial concentrations of fluoride causing 20%, 50% and 80% reduction in activity compared to an uninhibited control were referred to as IC_{20}, IC_{50} and IC_{80}, respectively.

$$\text{Inhibition}\cdot(\%) = 100 - \left[100\cdot\frac{\text{Maximum Specific Activity at the Tested Concentration}}{\text{Maximum Specific Activity of the Control}}\right]$$

5.6.4 Worker Health and Safety

The health effects of fluoride are a complicated subject. The clearest toxicological data are for fluoride that is inhaled. These data, however, are not used in the development of these local limits because fluoride salts are not volatile, and headworks analysis, which is typically used in limits development, to protect worker health is not appropriate. Therefore, review of data was confined to ingestion and skin absorption.

On first review, ingestion would not appear to be an issue. Many communities deliberately add fluoride to drinking water and toothpaste has significant levels of fluoride. According to the National Center for Biotechnology Information (NCBI), fluoridated toothpaste accounts for 80 percent of all toothpaste sales, with concentrations averaging approximately 1,000 ppm (see Table 5-8). Consequently, many people are often exposed to fluoride as result of personal choice.

Toxicology of fluoride was only available from U.S. sources (such as the Center for Disease Control) for animal studies that developed a Lethal Dose (LD50), which is not relevant for this document. Information made available by the German government in the form of background for developing MAKs[6] provides information from all international sources including the EPA. According to the MAK development for fluoride, the lethal dose for adults was estimated to be 5 to 10 grams (g) fluoride (fluoride doses of 32 to 64 mg/kg body weight) and a dose of approximately 5 mg/kg body weight was the calculated dose to become toxic in a one-time exposure (Agency for Toxic Substances and Disease Registry, 2003). While this document provides this information as a dose for ingestion it applies to absorption without regards to the metabolic route (ingestion, absorption, inhalation).

Regarding systemic toxicity, the induction of skeletal fluorosis is the most important effect of all fluoride compounds. According to the MAK development this is because fluoride in the blood system is eliminated in a matter of hours, but fluoride absorbed in bone tissue will remain for 8 to 20 years. Consequently, the fluoride intake must not exceed the fluoride outtake in bone structures.

EPA (1985) prescribes an upper limit of 10 mg per day. This value is based on the observation that no skeletal fluorosis has occurred in the U.S. at a fluoride concentration in drinking water of 4 mg/L, which corresponds to a dose of 8 mg with an intake of 2 liters drinking water per day.

In drinking water, the maximum contaminant level (MCL) for fluoride is 4.0 mg/L, or 4.0 ppm. EPA has set this level of protection based on the best available science to prevent potential health problems. EPA has set an enforceable regulation for fluoride. MCLs are set as close to the health goals as possible, such as prevention of tooth decay without causing other health problems.

EPA has also set secondary maximum contaminant levels for fluoride at 2.0 mg/L, or 2.0 ppm. Secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply.

Because 10 mg per day is a long-term average and ingestion of influent at 20 mg/L would require routine consumption of greater than 0.5 liters per day, a limit is not set on the plant for worker safety and health. The secondary standard for drinking water is included in the water quality criteria at the acute mixing zone dilution factor discussed in the next section.

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[6] The MAK value ("maximale Arbeitsplatz-Konzentration": maximum workplace concentration) is defined as the maximum concentration of a chemical substance (as gas, vapor, or particulate matter) in the workplace air that generally does not have known adverse effects on the health of the employee nor cause unreasonable annoyance (for example, by a nauseous odor) even when the person is repeatedly exposed during long periods, usually for 8 hours daily but assuming on average a 40-hour work week.

Table 5-8. NCBI Fluoride Study

Source: Sebastian and Siddanna (2015)

National Center for Biotechnology Information
[Table/Fig-1]:

Toothpastes analysed. Codes for blind analysis and information provided by the manufacturers

Commercial Brand	Code	Fluoridated Agent	Fluoride expected	Abrasive agent	Mean TF Analysed	Mean TSF Analysed
Colgate Total 12	A	NaF	1000 ppm	Silica	1224 ppm	1216 ppm
Colgate Sensitive	B	NaMFP	1000 ppm	$CaCO_3$	977 ppm	868 ppm
Close up Deep action	C	NaF	1000 ppm	Silica	942 ppm	933 ppm
Colgate Gel	D	NaMFP	1000 ppm	Silica	948 ppm	935 ppm
Pepsodent Germicheck	E	NaMFP	1000 ppm	$CaCO_3$	977 ppm	864 ppm
Pepsodent Gumcare	F	NaF	1000 ppm	Silica	965 ppm	957 ppm
Cibaca	G	NaMFP	1000 ppm	$CaCO_3$	921 ppm	841 ppm
Anchor	H	NaMFP	1000 ppm	$CaCO_3$	940 ppm	825 ppm
Sensodyne	I	NaMFP	1000 ppm	Silica	978 ppm	970 ppm
Sensodent- KF	J	NaMFP	924 ppm	Not mentioned	971 ppm	966 ppm
Parodontax	K	NaF	1000 ppm	Not mentioned	981 ppm	982 ppm
Senquel-F	L	NaMFP	917 ppm	Not mentioned	1217 ppm	1203 ppm

5.6.5 Water Quality Criteria Based on Research on River Fauna and Flora

Water quality criteria (WQC) for fluoride is not published by EPA. The EPA WQC list has a relatively limited subset (several hundred) compounds of the many thousands of toxic chemicals. To develop limits for fluoride, therefore, requires review of research and literature searches to establish a level that reasonably protects the environment. Many studies were reviewed for the effects of fluoride in the receiving stream. This document relies principally on a worldwide literature review on the toxicity of fluoride prepared by Steven Fliess at the University of Gothenburg, as shown in Table 5-9.[7]

Table 5-9. Summary of Species Sensitivity Distributions (Lower 95^{th} Percentiles) and Sub-lethal Effects of Fluoride

Source: Fliess (2011)

Species Group	Exposure	Endpoint	Concentration
Invertebrate	Chronic	95^{th} % LC_{50}	12.34 mg/L
	Acute	95^{th} % LC_{50}	26.08 mg/L
	Acute	95^{th} % LC_{50}	19.2 mg/L
Fish	Chronic	95^{th} % LC_{50}	2.62 mg/L
	Acute	95^{th} % LC_{50}	15.98 mg/L
Salmon Species	Chronic	Significant disruption of migration	0.5 mg/L
Algae	Chronic [a]	Lowest EC_{50}	82 mg/L

[a] Algal studies longer than 3 days are considered long term.

Notes:

LC_{50} = median lethal concentration (concentration that causes 50% mortality); 4-day exposure
EC_{50} = median effective concentration (concentration that causes 50% effect)

The Gothenburg review is prepared from information from many studies and international regulatory requirements. The strictest limit found is for salmon migration of 0.5 mg/L, which is applicable to the Camas WWTP's discharge point. This level is less than the drinking water SMLC of 2.0 mg/L. This level is also below most naturally occurring receiving stream concentrations. The 0.5 mg/L limit will, therefore, be used to derive a water quality limit. Because this level is not lethal, the appropriate dilution factor would likely be 121 established in the NPDES permit for the chronic mixing zone boundary. To be more conservative, however, this development uses the NPDES permit's 23 acute zone dilution factor. Because all studies reviewed indicated (or are silent on the subject) that organisms adapt to the background fluoride concentration, the 0.5 mg/L limit is not adjusted by the receiving stream background concentrations in this document's calculations. Appendix B provides the calculations for fluoride. Two limits are derived in Appendix B. The first is a concentration-based limit that uses actual maximum daily flow instead of permitted flow to calculate a uniform concentration-based limit of 30.62 mg/L. Because using the actual flows from the industries is less than the permitted flows, this approach could result in exceeding the Maximum Allowable Industrial Loading. Consequently, a mass-based limit has also been developed that applies to each industry, as follows:

- WaferTech shall not discharge more than 140.5 lb/d.
- Analog Devices shall not discharge more than 76.6 lb/d.

[7] According to Academic Ranking of the World Universities, the University of Gothenburg places well in local and global rankings and is usually positioned among the world's best for life sciences and medicine. It was ranked 2nd in Sweden, 11th in Europe and 40th in the world in the subjects of biological and life sciences by AWRU-Shanghai 2018 world ranking.

A 10-percent safety factor has been applied to both the concentration-based and mass-based local limits. Unlike categorical standards that apply at the end of the categorical process, these limits apply to the full discharge from each facility.

5.7 Sulfate

Sulfate (SO_4) does not exhibit a strong toxicity. The World Health Organization list waters up to 1,000 mg/L that are used for human consumption. Additionally, both acute and chronic toxicity are in very high ranges. The U.S. Geological Survey has provided a document for select organisms (both vertebrate and invertebrate) with levels in the thousands of mg/L. The only state to set a water quality limit for sulfate is Illinois, which expresses its standard in several forms including log function based on hardness similar to many metals. This state standard also sets an easier to understand limit for water less than 100 mg/L hardness of sulfate at 500 mg/L. Using this standard, the local limit calculated for aquatic toxicity is high enough (110,00 mg/L) to not need a limit for aquatic toxicity limit in the Camas system.

Protecting the collection system is a key factor when limiting sulfate. Anaerobes in the collection system convert sulfate to sulfide (H_2S). When this compound is dissociated into H+ and HS- (sulfide), H_2S remains in solution and is relatively non-toxic and non-corrosive. At lower pH and higher temperatures, these ions recombine to become H_2S (undissociated sulfide) that is toxic in aqueous solutions and also evolves as toxic gases into confined spaces. Sulfide is typically generated in the collection system and is generated from almost all types of wastewater. The formation of sulfide occurs when microbes consume all elemental oxygen and the waste stream become anaerobic. At this point, anaerobic organisms begin to use chemically bound oxygen first from nitrogen compounds, such as nitrate and nitrite. After the nitrogen compounds have been consumed, the anaerobes remove oxygen from sulfur compounds, with the principal source being sulfate. Once the oxygen is removed, the sulfur remains as sulfide (S^{-2}) which then combines with available hydrogen in the aqueous solution to become H_2S, HS-, and almost no S^{-2} (except at very high pH levels).

In addition to generating toxic gases that build up to dangerous levels, sulfide also presents an additional problem for the collection system because any point of potential oxidation will convert the sulfide back to sulfate in the form of sulfuric acid, which corrodes pipes and concrete surfaces. Once sulfide enters the treatment plant, it is typically removed if the plant is equipped with aerobic treatment (such as activated waste or trickling filter) usually at greater than 97 percent.

During this aerobic bio-treatment, H_2S is oxidized by bacteria as an energy source to SO_4^{2-}. Sulfide is also easily and quickly removed by the addition of ferric chloride ($FeCl_3$), but ferric must be added in carefully controlled doses to prevent the chloride from unduly contributing to TDS in the final discharge of a treatment facility.

The design of the collection system affects the ability of sulfides to form. The design of the Camas WWTP collection system leads to significant detention times, which result in sulfide generation. The City controls sulfide using chemical additions, special coatings, and sulfide-resistant materials.

Based on the City's extensive chemical/materials management plan for sulfides, a local limit will not be set except for the current limits already set in the semiconductor industries. These limits were set by Ecology because of the large amounts of sulfuric acid needed for their waste treatment systems. For these industries, the current Washington permit limits are adopted along with required best management practices (BMPs), which will be developed in cooperation with industry and applied as a local limit to minimize sulfate.

5.8 Total Dissolved Solids

TDS is defined as solids that pass through a 2-micrometer filter. This definition may allow some small colloidal materials to contribute to the final result. Dissolved solids may be inorganic as in the case of salts or be composed of organic materials, such as sugars. A true value for TDS may require prolonged drying time because some constituents are hydroscopic and hold the water tightly. TDS are not known to be toxic until they reach very high levels, at which point they can be toxic to plant life when used for irrigation. TDS also does not inhibit treatment plant processes when the concentration is held constant or does not rapidly change. As an example, an activated waste membrane filtration plant, designed by CH2M HILL (now Jacobs) is operated in Bahrain with a TDS of greater than 35,000 mg/L. TDS, however, may have an effect from osmotic shock if the concentration is suddenly changed. This is caused when the solute (TDS) surrounding a cell is suddenly changed. In these conditions, water will quickly enter a cell if the concentration suddenly is significantly lower or exit the cell if the concentration suddenly and significantly increases. If the TDS decrease of the surrounding water of a cell is sufficient, cells may actually burst (osmotic lysis). Early studies focused on comparison of concentration changes to cell effect (Eisenberg and Corner, 1973). The effect, however, largely depends on the type of microbe undergoing the change, with some microbes highly susceptible and some highly tolerant.

During large storms, the Camas WWTP experiences a fast rise in flow with the increase entirely resulting from precipitation that has low dissolved solids. Additionally, the plant is designed to discharge from the primary clarifiers into a small section of the aeration basins, which constitutes the anoxic zone needed to remove nitrogen. This cordoned-off area prevents the incoming flow from mixing well with the full contents of the aeration basin and increases the osmotic effect on the treatment biota. Because of this treatment arrangement, reducing the TDS from industry will likely not eliminate the potential for osmotic shock. Instead, recent efforts to prevent inflow and infiltration promise to have the highest impact. Consequently, the current Ecology limits set in pretreatment permits are adopted for each facility because osmotic shock has not been positively proven at these levels. Operational measures may also be beneficial such as increasing the return activated sludge rate as soon as possible when storms quickly increase flow to assure that the low TDS water is mixing into the full plant contents. BMPs are needed at the semiconductor sites. A BMP to keep TDS as low as possible will be requested to be developed in partnership with the industries. Additionally, a BMP will specify what the discharge must be and to ensure that it is at a steady rate. These BMPs will be applied as local limits.

6. Other Limits and Concerns

In keeping with EPA recommendations, the need for local limits for flow, BOD_5, TSS, pH, O&G, ammonia, and phosphorus was also evaluated. Worker health and safety limits for temperature, flammability, and toxicity were also considered. Table 6-1 summarizes resultant local limits for this second group of pollutants. A discussion of all evaluated pollutants/groups of compounds follows in this section.

Table 6-1. Local Limits for Other Pollutants

Pollutant	Minimum Limit	Maximum Limit
Temperature	NA	40°C (104°F) at the POTW, 60°C (140°F) at discharge point from SIU [a]
Flammability	NA	Specified as no material with a closed cup flashpoint <140 (°F) And No two consecutive readings at ≥5% LEL, and no reading of ≥10% LEL allowed [b]
pH	5.5 SU	11.0 SU
O&G	NA	100 mg/L

[a] cf. 40 CFR 403.5(b)(5)

[b] As per guidance in EPA Model Sewer Use Ordinance

6.1 Flow

The Camas WWTP is designed to treat a peak daily flow of 10.4 mgd. The plant currently receives a monthly average daily flow of approximately 2.74 mgd. Consequently, the Camas WWTP currently has additional capacity available for industrial use and local limits, beyond the limits currently present in Ecology IPP permits. Additional local limits for flow are not needed.

6.2 BOD_5 and TSS

The current industrial base does not have significant discharges of BOD and moderate discharges of TDS. Additionally, the current organic loading to the plant is less than average for POTWs (which may account for the lower than standard removal rates for metals that involves biological adsorption). Consequently, limits for BOD and TSS are not needed.

Local limits for BOD_5 and TSS using the uniform allocation method implies that discharges may not be accepted above such a limit, though capacity is available. Instead, the City reserves the right to establish a surcharge limit for all discharges greater than domestic strength waste (often established at greater than 250 mg/L BOD, and greater than 250 mg/L TSS).

6.3 WWTP Ammonia

Ammonia is listed by EPA as a POC that should be evaluated. The Camas WWTP treatment process is designed and operated to remove ammonia. The discharge of ammonia to the treatment plant does not follow local limits methodology because the sources are domestic wastes. The Camas WWTP uses operational controls to limit effluent ammonia and the current NPDES permit includes water-quality-based effluent ammonia limits to protect water quality and aquatic organisms.

6.4 pH

The local limits for pH established in the Camas Sewer Use Ordinance and currently used at the Camas WWTP are 5.5 to 9.0 (Camas Code of Ordinances, Chapter 13.68). The current Ecology pH limits for the permitted industries is 5.5 to 11.0. A review of the treatment plant operation indicates a higher pH limit will provide additional alkalinity and may assist with nitrogen removal. Therefore, the current City limits will be modified to 5.5 to 11.0 SU.

6.5 Oils and Grease

A limit has not been set in the current Camas Sewer Use Ordinance for O&G (Camas Code of Ordinances, Chapter 13.68). The most common limit found for cities with pretreatment programs that have been reviewed here is 100 mg/L. This limit is adopted for the Camas wastewater treatment system.

6.6 Temperature

Limits are set to protect the health and safety of the public and workers. Limits are also set to protect the collection system from high temperature damage and the treatment plant from interference with biological processes.

A 104°F (40°C) limit at the headworks of the sewage treatment plant is a specific requirement of the federal pretreatment regulations (cf. 40 CFR 403.5(b)(5)).

A 60°C (140°F) limit at the point of discharge into the Camas WWTP sanitary sewer system is applied in other wastewater systems and is protective of the collection system construction and worker health and safety.

6.7 Flammability

Local limits for flammability are adopted prohibiting any discharge with a closed-cup flashpoint less than 140°F (60°C). An additional LEL local limit is added in this document that prohibits two successive readings of an LEL meter in the headspace of the collection system below an industry's discharge into the sanitary sewer that exceed 5 percent, and no single LEL meter reading may be 10 percent or higher.

The closed-cup flashpoint limit is based on federal pretreatment regulations (CF, 40 CFR 403.5 (b)(1)). The LEL limits are established based on worker/community health and safety and are much easier to monitor in the system and consequently enforce than the closed-cup flashpoint limit.

7. Implementation of Local Limits

The new local limits will apply to all non-domestic users. It is the intent of this document that only users that have been issued industrial wastewater discharge permits, such as SIUs and other users with a potential to discharge pollutants for which local limits have been developed, will be required to routinely monitor for compliance with local limits. However, implementation of this is at the discretion of the Ecology Pretreatment Program.

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Appendix A
Guidance on the Selection of Pollutants of Concern

Guidance on the Selection of Pollutants of Concern

Guidance Manual on the Development and Implementation of Local Discharge Limitations

Under the Pretreatment Program, EPA 833-B-87-202, December 1987

Also, EPA guidance directs that a toxic pollutant may be classified as a POC if it meets the following screening criteria:

- *The maximum concentration of the pollutant in a grab sample from the POTWs influent is more than half the inhibition threshold for the biological process; or the maximum concentration of the pollutant in a 24-hour composite sample from the POTWs influent is more than one-fourth of the inhibition threshold for the biological process.*
- *The maximum concentration of the pollutant in the POTWs influent is more than 1/500* of the applicable sludge criteria.*
- *The maximum concentration of the pollutant in the POTWs influent is more than the maximum allowable effluent concentration.*
- *The maximum concentration of the pollutant in the POTW's effluent is more than one half the allowable effluent concentration.*
- *The maximum concentration of the pollutant in the POTW's sludge is more than one half of the allowable sludge concentration.*

The maximum measured concentration of the pollutant was greater than the ACGIH screening level for fume toxicity.

Appendix B
Calculation of Fluoride Limit

Camas, Washington

Long Hand Calculation of Local Limit - Fluoride

Allowable Headwork Loading (AHL) Based on Protection of Water Quality

The selected Criteria is the very conservative salmon migration value from Table 1.

NPDES dilution factor is from NPDES Permit # WA-0020249
The WQS dilution factor applied is the conservative acute toxicity factor = 23:1
This standard has been set based on a research study, this is not a set standard for industry and is based on only one study.

Table 1. Summary of SSDs (lower 95th Percentiles) and Sub-lethal Effects of Fluoride

Species Group	Exposure	Endpoint	Concentration
Invertebrate	Chronic	95th % LC50	12.34 mg/L
	Acute	95th % LC50	26.08 mg/L
	Acute	95th % EC50	19.2 mg/L
Fish	Chronic	95th % LC50	2.62 mg/L
	Acute	95th % LC50	15.98 mg/L
Salmon species	Chronic	Significant disruption of migration	0.5 mg/L
Algae	Chronic*	Lowest EC50	82 mg/L

*Algal studies longer than 3 days are considered long-term

Fluoride

The Allowable Headworks Loadings is using the following equation:

Lwqs = (8.34)(Ccrit)(Qpotw * Dilution Factor)

Where:

Lwqs = Maximum allowable headworks loading (lbs/day) based on NPDES permit limits or Water Quality Criteria
Ccrit= (NPDES effluent limits or WQ criteria expressed as mg/L) = 0.5 mg/L
Qpotw= (POTW average flow in MGD) = 2.74
Dilution Factor = 23:01
Rpotw = (Overall Removal Factor as a decimal) 0.0552

Fluoride

Calculation of AHL
Stringent WQS AHL

$$\text{Lwqs} = \frac{(8.34 \text{ lb/gal} \times 0.50000 \text{ mg/l} \times 2.74 \text{ MGD} \times 23:1)}{1 - 0.0552} = 277.2 \text{ lb/d}$$

Camas, Washington

Long Hand Calculation of Local Limit - Fluoride

Allowable Headwork Loading (AHL) Based On Inhibition **Fluoride**

Inhibition for Activated Waste and Anaerobic Digestion has been set based on a research study from the University of Arizona
This standard has been set based on a research study, this is not a set standard for industry
and is based on only one study.
The following equation was used to derive the allowable headwork loadings:

For Secondary Treatment Inhibition the equation is:

$$Linhib2 = \frac{(8.34)(Ccrit)(Qpotw)}{(1-Rprim)}$$

Where:

Linhib2 = Maximum allowable headworks loading (lbs/d)
based on inhibition of secondary process
Ccrit = Inhibition level (mg/l) for Activated Sludge = 104.3
Rprim = Primary removal efficiency as a decimal = 0.0464
Qpotw = POTW average flow =2.74

Fluoride

$$Linhib2 = \frac{(8.34\ lb/gal \quad X \quad 104.30\ mg/l \quad 2.74\ MGD)}{1 - 0.0464} = 2499.4\ lb/d$$

For Anaerobic Inhibition the equation is:

The following equation was used to derive the allowable headwork loadings based on Anaerobic Digestion

$$Linhibdgstr = \frac{(8.34)*(Ccrit)(Qdig)}{Rpotw}$$

Where:

Linhibdgstr = Maximum allowable headworks loading (lbs/d)
based on inhibition of Anaerobic Digestion
Ccrit = Inhibition level (mg/l) for Anaerobic Digestion = 40
Qdig = Sludge flow to disposal (MGD) =.041
Rpotw = POTW removal efficiency (as a decimal) = .0552

Fluoride

$$Linhibdgstr = \frac{(8.34\ lb/gal \quad X \quad 40\ mg/L \quad X \quad 0.041\ MGD)}{5.52\%} = 248.387\ lb/d$$

Camas, Washington
Long Hand Calculation of Local Limit - Fluoride
Fluoride

Selection of Lowest AHL Representing Maximum Allowable Headworks Loading (MAHL)

The smallest of the above calculated values is selected as the MAHL

Selection of MAHL lb/d				
	WQ Criteria from Study	Secondary Inhibition From Study	Anaerobic Inhibition From Study	Maximum Allowable Headworks Loading (MAHL)
Fluoride	277.200	2499.39	248.387	248.387

Calculation of the Maximum Allowable Industrial Loading (MAIL)

The domestic (uncontrollable) sources and a safety/growth factor are subtracted from the MAHL to calculate the MAIL as follows:

$$MAIL = (MAHL)(1-SF) - L_{unc})$$

Where:

MAIL = Maximum available industrial loading, lbs/day

	Fluoride
MAHL = Maximum allowable headworks loading, lbs/day	248.39
SF = Safety and Growth factor, as a decimal	10%
L_{unc} = Loadings from uncontrolled sources	6.480

Using conservative approach L_{unc} has been established using (domestic flow =average plant influent-permitted industrial flow) and average influent concentration as follows:

L_{unc} = (average Influent concentration in mg/L)(average domestic flow to POTW)(8.34)

Fluoride

L_{unc} = 840 ug/L./1000ug/mg* X 0.93 MGD X 8.34) = **6.480 lb/d**

MAIL = (248.39 X (1 - 10%) - 6.480 lb/d) = **217.07 lb/d**

* Domestic concentration has been taken from the attached spreadsheet that uses the plant influent and subtracts the contribution from the semiconductor industries.

Camas, Washington
Long Hand Calculation of Local Limit - Fluoride

Calculation of Industrial Local Limit mg/l using Uniform Allocation Method and Total Industry Specific Mass Limits

The uniform allocation method divides the MAIL by the industrial flow and a factor of 8.34 to convert to a concentration based limit using the following equation:

$$\text{Local Limit} = \frac{\text{MAIL lb/d}}{(8.34 \times Q_i)}$$

Q_i = Total Industrial Flow, MGD: 0.85 MGD

Fluoride

Concentration Based Limits

Fluoride **Local Limit =** 217.07 lb/d divided by (8.34 X 0.85 MGD) = **30.620 mg/l**

Mass Based Limits

Daily Average Actual Flows

Analog Device	Water Tech
0.3 MGD	0.55 MGD

Max Pounds based on ratio of actual flows using: 217.07 lb/d MAIL after 10% Safety Factor

Analog Device	76.6 lb/d	Fluoride
Wafer Tech	140.5 lb/d	Fluoride

Calculation of Individual Industry Contributions and Domestic

Flow in MGD

Date	3/5/2018	5/17/2018	9/11/2018	11/30/2018				
Treatment Plant Flow	**2.386**	**1.993**	**1.951**	**2.39**				
Wafer Tech Flow	**0.546**	**0.539**	**0.51**	**0.544**			0.546	0.55
Analog Devices	**0.22**	**0.25**	**0.287**	**0.288**	Averge	Max	0.288	0.3
	0.766	0.789	0.797	0.832	0.796			0.85

Record flows for 24 hours preceding the requested date.

Fluoride Conc

Treatment Plant	2.99 mg/L	3.52 mg/L	3.41 mg/L	2.68 mg/L
Wafer Tech	6.86 mg/L	7.91 mg/L	7.91 mg/L	5.82 mg/L
Analog Devices	**8.41 mg/L**	**8.41 mg/L**	8.71 mg/L	8.11 mg/L
Non-industrial mg/L	0.95 mg/L	0.54 mg/L	0.1 mg/L	0.58 mg/L

Sulfate Conc

Treatment Plant	159. mg/L	118. mg/L	194. mg/L	257. mg/L
Wafer Tech	467. mg/L	264. mg/L	452. mg/L	738. mg/L
Analog Devices	**767.5 mg/L**	**767.5 mg/L**	667. mg/L	868. mg/L

TDS Conc

Treatment Plant	621. mg/L	790. mg/L	791. mg/L	761. mg/L
Wafer Tech	1,920. mg/L	2,060. mg/L	1,910. mg/L	2,420. mg/L
Analog Devices	**1,405. mg/L**	**1,405. mg/L**	1,170. mg/L	1,640. mg/L
	76.72 mg/L	93.75 mg/L	202.21 mg/L	19.25 mg/L

Fluoride Mass

Treatment Plant	59.5 lb	58.51 lb	55.49 lb	53.42 lb
Wafer Tech	31.24 lb	35.56 lb	33.64 lb	26.41 lb
Analog Devices	15.43 lb	17.53 lb	20.85 lb	19.48 lb
Non-industrial lb/d	12.83 lb	5.42 lb	0.99 lb	7.53 lb
Non-industrial mg/l	0.644752724	1.204768089	0.414773519	1.085865385

Sulfate Mass

Treatment Plant	3,163.98 lb	1,961.35 lb	3,156.64 lb	5,122.68 lb
Wafer Tech	2,126.55 lb	1,186.75 lb	1,922.54 lb	3,348.28 lb
Analog Devices	1,408.21 lb	1,600.24 lb	1,596.52 lb	2,084.87 lb
	-370.78 lb	-825.63 lb	-362.41 lb	-310.46 lb

TDS Mass

Treatment Plant	12,357.43 lb	13,131.08 lb	12,870.63 lb	15,168.71 lb
Wafer Tech	8,742.99 lb	9,260.24 lb	8,123.99 lb	10,979.44 lb
Analog Devices	2,577.89 lb	2,929.43 lb	2,800.49 lb	3,939.15 lb
	1,036.55 lb	941.42 lb	1,946.15 lb	250.12 lb
	52.08968986	209.424861	813.069686	36.0456731

	Fluoride	Sulfate	TDS
	6.69 lb	**-467.32 lb**	**1,043.56 lb**
Domestic Concentration	0.84 mg/L		277.66 mg/L

Appendix C
Data Sheets Used in
“TBLL Calc-Camas.xlsm”

Basic Data

Name of Facility:	Camas, Washington	<--- For this color cells, input is optional
Point of Contact:	Wayne Heinemann	
Person Entering Data:	Same	
Reviewer:	Todd Rohach	
GENERAL INFORMATION:	(Data in colored cells below required)	
Receiving Water Hardness (if fresh)	**62.4**	<----- Number must be between 25 and 400
(M)arine, (F)resh, or (B)oth Discharges	**F**	<----- Enter only letters "M", "F", or "B"
Sludge: Class A (A) or (C)eiling level	**A**	<----- Enter only letters "A" or "C"
Plant: (A)ctivated sludge or (O)ther	**A**	<----- Enter only letters "A" or "O"
Total Plant Flow (in MGD)	**2.74 MGD**	<----- For flows typically the most critical situation (one that yields the lowest local limits) is the lowest flow month, but run several scenarios if there is any doubt. Adopt the lowest limits.
Domestic Flow (in MGD)	**0.926 MGD**	
Industrial Flow (in MGD)	**1.814 MGD**	
Infiltration/Inflow (by subtraction)		
Acute Dilution Factor	**23. : 1**	<----- From NPDES Permit Fact Sheet
Chronic Dilution Factor	**121. : 1**	<----- From NPDES Permit Fact Sheet
Dilution Factor for Human Health Based WQ	185. : 1	<----- Enter Chronic DF if not otherwise determined
Digester Flow (in MGD)	**0.0411 MGD**	<----- recommend: 0.0411 MGD @ 2% solids
Dry Sludge Production Rate (US Tons/day)	**3.428 T/D**	<----- recommend: 3.42774 T/D
Default Method for Calculating Limits	**Customize as needed for specific pollutants at "LOCLIMIT.XLS" Rows 45-49**	
Sampling Data Available (inf, eff, sludge) (Y/N)	**Y**	<--- "Y" if sampling data available, otherwise defaults presumed
Credit present loading of existing sources (Y/N)	**N**	<-- reduces influent concentration shown on "loclimit.xls" row 35 ba
Adjust for receiving water pollution (Y/N)	**N**	<-- requires receiving water data "Sampl Data" row 9 or "loclimit.xl
Use Observed Overall Removal Rate (Y/N)	**N**	<-- Always say "Y" if good data available from the POTW
Use Observed Primary Removal Rate (Y/N)	**N**	<-- If primary effluent sample data is obtained say "Y"
Fraction of Industrial Loading Capacity in reserve	**0.00%**	<-- (eg 0.1 for 10%) - This is proportion of MAIL in reserve
Fraction of Headworks Loading held in reserve	**10.00%**	<-- This reduces available MAHL for industries
Which Conservative Pollutants to Limit? (Bold = Required by EPA)		
Check (or Un-Check) for Each Pollutant	Develop Local Limit? (check for YES)	
Aluminum	☑	
Antimony	☑	
Arsenic	☑	
Cadmium	☑	
Chromium(+6)	☑	
Chromium (T)	☑	
Copper	☑	
Cyanide	☑	
Lead	☑	
Mercury	☑	

Basic Data

Molybdenum	☑
Nickel	☑
Selenium	☑
Silver	☑
Thallium	☑
TributylTin	☑
Zinc	☑
Add #1	☑
Add #2	☑
Add #3	☑
Add #4	☑
	☐

RECAP of how loadings were set:	(Don't enter data in below section)	**Sb**	**As**	**As5**	**Be**	**Cd**	**Cr6**	**Cu**	**Cu**	**CN**	**Pb**	**Hg**	**Mo**	**Ni**	**Se**	**Ag**	**Th**	**TBT**	**Zn**
Domestic Level from Sampling	Data to right is returned ->>	Y	Y	Y	###	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Compensate for Existing Sources	Data to right is returned ->>	N	N	N	###	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Adjust for background levels	Data to right is returned ->>	N	N	N	###	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Overall removal rate from sampling	Data to right is returned ->>	N	N	N	###	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Primary removal rate from sampling	Data to right is returned ->>	N	N	N	###	N	N	N	N	N	N	N	N	N	N	N	N	N	N

(For Contributing Flows Method, manually change row 11 of LOCLIM.xls spreadsheet to reflect the flow for which the pollutant will be allocated)

This "How to Allocate Loadings" section is used to understand how limits were derived at a later date or by a reviewer.

Sample Data											
SUMMARY DATA		Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
Ave. Influent Conc.		0.210 ug/L	1.100 ug/L	0.072 ug/L	1.596 ug/L	31.800 ug/L	5.000 ug/L	0.636 ug/L	0.020 ug/L	5.493 ug/L	3.918 ug/L
Ave. Effluent Conc.		0.239 ug/L	1.349 ug/L	0.029 ug/L	0.373 ug/L	7.964 ug/L	2.500 ug/L	0.088 ug/L	0.001 ug/L	5.330 ug/L	2.825 ug/L
Ave. Primary Removal		11.20%	2.00%	36.04%	16.27%	7.55%	27.00%	34.59%	41.63%	9.12%	8.78%
Ave. Overall Removal		7.09%	6.37%	60.24%	76.40%	75.51%	69.00%	85.31%	96.57%	8.17%	33.48%
Effluent Variation (COV)		0.07	0.23	0.48	0.34	1.19	#DIV/0!	0.44	0.80	0.20	0.32
Average Sludge Conc.		1.78 mg/kg	3.78 mg/kg	1.77 mg/kg	40.47 mg/kg	685.21 mg/kg	0. mg/kg	17.71 mg/kg	0.5 mg/kg	17.62 mg/kg	41.08 mg/kg
Ambient Receiving Water Conc.			0.998 ug/L	0.017 ug/L	0.418 ug/L	1.100 ug/L		0.230 ug/L	0.002 ug/L		0.870 ug/L
AVE Industrial Conc.		0.097 ug/L	4.060 ug/L	0.248 ug/L	3.575 ug/L	17.753 ug/L		0.049 ug/L	0.0003 ug/L	13.909 ug/L	7.095 ug/L
SUMMARY (ABOVE)											
SAMPLE 1											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
3/5/2018	Influent	0.164 ug/l	0.63 ug/l	0.043 ug/l	1.3 ug/l	18.1 ug/l	5. ug/l	0.431 ug/l	0.0216 ug/l	3.67 ug/l	3.76 ug/l
3/6/2018	Effluent	0.227 ug/l	1.05 ug/l	ND	0.32 ug/l	2.79 ug/l	2.5 ug/l	0.055 ug/l	0.0005 ug/l	4.5 ug/l	1.98 ug/l
3/5/2018	Prim._Clar.	0.111 ug/l	0.63 ug/l	0.137 ug/l	1.59 ug/l	26.3 ug/l	ND	0.502 ug/l	0.0162 ug/l	3.74 ug/l	3.25 ug/l
	Sludge										
	Detection_Limit	0.02 ug/l	0.61 ug/l	0.043 ug/l	0.2 ug/l	0.2 ug/l		0.081 ug/l	0.0051 ug/l	0.404 ug/l	0.2 ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	25.00%	Can't Do	13.56%
Overall Removal Rate		Can't Do	Can't Do	Can't Do	75.38%	84.59%	50.00%	87.24%	97.69%	Can't Do	47.34%
SAMPLE 2											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
3/6/2018	Influent	0.099 ug/l	0.89 ug/l	0.054 ug/l	1.66 ug/l	17.8 ug/l		0.417 ug/l	0.014 ug/l	3.9 ug/l	3.9 ug/l
3/7/2018	Effluent	0.221 ug/l	1.26 ug/l	0.028 ug/l	0.32 ug/l	3.46 ug/l		0.062 ug/l	0.0005 ug/l	4.96 ug/l	2.13 ug/l
3/6/2018	Prim._Clar.	0.115 ug/l	0.88 ug/l	0.58 ug/l	1.47 ug/l	24. ug/l		0.496 ug/l	0.026 ug/l	4.32 ug/l	3.66 ug/l
3/6/2019	Sludge	2.1 mg/kg	4.68 mg/kg	2.24 mg/kg	39.61 mg/kg	660.83 mg/kg	0. mg/kg	13.46 mg/kg	0.54 mg/kg	20.57 mg/kg	38.4 mg/kg
	Detection_Limit	0.02 ug/l	0.61 ug/l	0.054 ug/l	0.2 ug/l	0.2 ug/l		0.081 ug/l	0.0051 ug/l	0.404 ug/l	0.2 ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	11.45%	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	6.15%
Overall Removal Rate		Can't Do	Can't Do	48.15%	80.72%	80.56%	Can't Do	85.13%	96.43%	Can't Do	45.38%
SAMPLE 3											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
5/16/2018	Influent	0.264 ug/l	0.93 ug/l	0.082 ug/l	2.37 ug/l	35.2 ug/l		0.72 ug/l	0.0229 ug/l	7.44 ug/l	4.37 ug/l
5/17/2018	Effluent	0.255 ug/l	1.32 ug/l	0.026 ug/l	0.57 ug/l	25.7 ug/l		0.166 ug/l	0.0011 ug/l	6.63 ug/l	4.65 ug/l
5/16/2018	Prim._Clar.	0.303 ug/l	0.94 ug/l	0.162 ug/l	5.02 ug/l	49.3 ug/l		0.727 ug/l	0.012 ug/l	8.52 ug/l	6.34 ug/l
5/16/2018	Sludge	1.47 mg/kg	3.5 mg/kg	1.82 mg/kg	40.9 mg/kg	655. mg/kg		17.1 mg/kg	0.42 mg/kg	14. mg/kg	43.1 mg/kg
	Detection_Limit	.04/.018	0.61/0.20	.04/.004	0.2/.04	.20/.04		.081/.01	5.05/0.84	.404/.061	.20/.08
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do
Overall Removal Rate		3.41%	Can't Do	68.29%	75.95%	26.99%	Can't Do	76.94%	95.02%	10.89%	Can't Do
SAMPLE 4											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
5/17/2018	Influent	0.242 ug/l	1.06 ug/l	0.092 ug/l	2.35 ug/l	41. ug/l		0.652 ug/l	0.0356 ug/l	7.4 ug/l	4.59 ug/l
5/18/2018	Effluent	0.247 ug/l	1.53 ug/l	0.027 ug/l	0.56 ug/l	7.56 ug/l		0.117 ug/l	0.0014 ug/l	6.36 ug/l	3.27 ug/l
5/17/2018	Prim._Clar.	0.259 ug/l	1.37 ug/l	0.112 ug/l	2.82 ug/l	38.4 ug/l		0.666 ug/l	0.0101 ug/l	7.04 ug/l	5.19 ug/l
	Sludge										
	Detection_Limit	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	6.34%	Can't Do	Can't Do	71.63%	4.86%	Can't Do
Overall Removal Rate		Can't Do	Can't Do	70.65%	76.17%	81.56%	Can't Do	82.06%	95.96%	14.05%	28.76%
SAMPLE 5											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
9/10/2018	Influent	0.254 ug/l	1.06 ug/l	0.072 ug/l	0.89 ug/l	37.8 ug/l	ND	0.552 ug/l	0.0137 ug/l	5.75 ug/l	3.78 ug/l
9/11/2018	Effluent	0.239 ug/l	1.42 ug/l	0.042 ug/l	0.25 ug/l	7.23 ug/l	ND	0.087 ug/l	0.0004 ug/l	5.4 ug/l	2.43 ug/l
9/10/2018	Prim._Clar.	0.298 ug/l	0.96 ug/l	0.085 ug/l	1.06 ug/l	41.8 ug/l	ND	0.737 ug/l	0.0078 ug/l	6.37 ug/l	4.03 ug/l
	Sludge										
	Detection_Limit	0.02/0.009	0.30/0.10	0.02/0.008	0.10/0.02	0.10/0.02	0.005 ug/l	0.04/0.005		0.202/0.03	0.10/0.04
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	42.77%	Can't Do	Can't Do
Overall Removal Rate		5.91%	Can't Do	41.67%	71.91%	80.87%	Can't Do	84.24%	97.01%	6.09%	35.71%
SAMPLE 6											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
9/11/2018	Influent	0.206 ug/l	2.04 ug/l	0.075 ug/l	1.2 ug/l	40.9 ug/l	ND	0.668 ug/l	0.0344 ug/l	6.96 ug/l	4.21 ug/l
9/12/2018	Effluent	0.272 ug/l	1.91 ug/l	0.047 ug/l	0.3 ug/l	5.32 ug/l	ND	0.067 ug/l	0.0003 ug/l	6.44 ug/l	3.22 ug/l
9/11/2018	Prim._Clar.	0.249 ug/l	1.5 ug/l	0.06 ug/l	0.87 ug/l	36.1 ug/l	ND	0.494 ug/l	0.0116 ug/l	7.08 ug/l	3.97 ug/l
9/11/2018	Sludge	1.9 mg/kg	3.5 mg/kg	2.06 mg/kg		730. mg/kg		18.5 mg/kg		15.9 mg/kg	39.5 mg/kg
	Detection_Limit	0.02/0.009	0.30/0.10	0.02/0.008	0.10/0.02	0.10/0.02	0.005 ug/l	0.04/0.005		0.202/0.03	0.10/0.04
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	66.28%	Can't Do	Can't Do
Overall Removal Rate		Can't Do	6.37%	37.33%	75.00%	86.99%	Can't Do	89.97%	99.19%	7.47%	23.52%
SAMPLE 7											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
11/29/2018	Influent	0.259 ug/l	0.86 ug/l	0.099 ug/l	1.45 ug/l	29.7 ug/l	ND	1.22 ug/l	0.0082 ug/l	3.91 ug/l	3.02 ug/l
11/30/2018	Effluent	0.228 ug/l	0.91 ug/l	0.011 ug/l	0.31 ug/l	7.45 ug/l	ND	0.082 ug/l	0.0003 ug/l	3.73 ug/l	2.23 ug/l
11/29/2018	Prim._Clar.	0.23 ug/l	0.74 ug/l	0.045 ug/l	1.17 ug/l	27.4 ug/l	ND	0.456 ug/l	0.0072 ug/l	3.5 ug/l	2.84 ug/l
	Sludge										
	Detection_Limit	0.018 ug/l	0.2 ug/l	0.016 ug/l	0.04 ug/l	0.04 ug/l	5. ug/l	0.01 ug/l	0.008 ug/l	0.061 ug/l	0.08 ug/l
Primary Removal Rate:		11.20%	Can't Do	54.55%	19.31%	7.74%	Can't Do	62.62%	12.20%	10.49%	5.96%
Overall Removal Rate		11.97%	Can't Do	88.89%	78.62%	74.92%	Can't Do	93.28%	95.85%	4.60%	26.16%
SAMPLE 8											
Date:	LOCATION	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel
11/30/2018	Influent	0.19 ug/l	1.33 ug/l	0.057 ug/l	1.55 ug/l	33.9 ug/l	ND	0.427 ug/l	0.0085 ug/l	4.91 ug/l	3.71 ug/l
12/1/2018	Effluent	0.224 ug/l	1.39 ug/l	0.019 ug/l	0.35 ug/l	4.2 ug/l	ND	0.07 ug/l	0.0004 ug/l	4.62 ug/l	2.69 ug/l
11/30/2018	Prim._Clar.	0.205 ug/l	1.11 ug/l	0.047 ug/l	1.27 ug/l	31. ug/l	ND	0.399 ug/l	0.0058 ug/l	4.32 ug/l	3.36 ug/l
11/30/2018	Sludge	1.64 mg/kg	3.44 mg/kg	0.97 mg/kg	40.9 mg/kg	695. mg/kg		21.8 mg/kg	0.54 mg/kg	20. mg/kg	43.3 mg/kg
	Detection_Limit	0.018 ug/l	0.2 ug/l	0.016 ug/l	0.04 ug/l	0.04 ug/l	5. ug/l	0.01 ug/l	0.008 ug/l	0.061 ug/l	0.08 ug/l
Primary Removal Rate:		Can't Do	Can't Do	17.54%	18.06%	8.55%	Can't Do	6.56%	31.92%	12.02%	9.43%
Overall Removal Rate		Can't Do	Can't Do	66.67%	77.42%	87.61%	Can't Do	83.61%	95.41%	5.91%	27.49%

Camas WWTP

Sample Data									
SUMMARY DATA		Selenium	Silver	Zinc	NWTPH Gx	Sulfate	TDS	NWTPH Dx	Fluoride
Ave. Influent Conc.		1.853 ug/L	0.097 ug/L	62.963 ug/L	53.000 ug/L	175500.000 ug/L	750625.000 ug/L	4325.000 ug/L	3097.500 ug/L
Ave. Effluent Conc.		1.235 ug/L	0.009 ug/L	31.450 ug/L	#DIV/0!	169500.000 ug/L	927250.000 ug/L	1400.000 ug/L	2981.250 ug/L
Ave. Primary Removal		2.00%	22.79%	6.28%	#DIV/0!	9.39%	#DIV/0!	36.00%	4.64%
Ave. Overall Removal		12.22%	87.18%	50.95%	#DIV/0!	9.29%	#DIV/0!	72.00%	5.52%
Effluent Variation (COV)		0.53	0.42	0.43	#DIV/0!	0.29	0.06	#DIV/0!	0.12
Average Sludge Conc.		6.96 mg/kg	7.58 mg/kg	1,016.64 mg/kg	#DIV/0!	#DIV/0!	#DIV/0!	0. mg/kg	0. mg/kg
Ambient Receiving Water Conc.		0.270 ug/L	0.032 ug/L	3.610 ug/L					110.000 ug/L
AVE Industrial Conc.		2.465 ug/L	0.092 ug/L	4.2 ug/L		580841.7 ug/L	1745833.3 ug/L		8976.3 ug/L
SUMMARY (ABOVE)									
SAMPLE 1									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
3/5/2018	Influent	ND	ND	52.2 ug/l	ND	159,000. ug/l	621,000. ug/l	4,900. ug/l	2,990. ug/l
3/6/2018	Effluent	ND	ND	22.2 ug/l	ND	152,000. ug/l	900,000. ug/l	ND	2,730. ug/l
3/5/2018	Prim._Clar.	ND	ND	52. ug/l	ND	150,000. ug/l	633,000. ug/l	5,400. ug/l	2,800. ug/l
	Sludge								
	Detection_Limit	1.21 ug/l	0.101 ug/l	1.01 ug/l		5,000. ug/l	5,000. ug/l	250. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	Can't Do	0.38%	Can't Do	5.66%	Can't Do	Can't Do	6.35%
Overall Removal Rate		Can't Do	Can't Do	57.47%	Can't Do	4.40%	Can't Do	Can't Do	8.70%
SAMPLE 2									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
3/6/2018	Influent	ND	ND	49.6 ug/l	ND	204,000. ug/l	809,000. ug/l	4,700. ug/l	3,190. ug/l
3/7/2018	Effluent	ND	ND	23.9 ug/l	ND	177,000. ug/l	973,000. ug/l	ND	2,870. ug/l
3/6/2018	Prim._Clar.	ND	ND	52.8 ug/l	ND	186,000. ug/l	745,000. ug/l	5,300. ug/l	2,970. ug/l
3/6/2019	Sludge	7.16 mg/kg	2.81 mg/kg	1,192.56 mg/kg				0. mg/kg	0. mg/kg
	Detection_Limit	1.21 ug/l	0.04 ug/l	1.01 ug/l		5,000. ug/l	5,000. ug/l	250. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	8.82%	Can't Do	Can't Do	6.90%
Overall Removal Rate		Can't Do	Can't Do	51.81%	Can't Do	13.24%	Can't Do	Can't Do	10.03%
SAMPLE 3									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
5/16/2018	Influent		0.045 ug/l	80.1 ug/l	53. ug/l	132,000. ug/l	821,000. ug/l	3,700. ug/l	3,610. ug/l
5/17/2018	Effluent	1.02 ug/l	0.013 ug/l	57.6 ug/l	ND	113,000. ug/l	966,000. ug/l	ND	3,380. ug/l
5/16/2018	Prim._Clar.	0.8 ug/l	0.132 ug/l	114. ug/l	ND	114,000. ug/l	783,000. ug/l	4,600. ug/l	3,550. ug/l
5/16/2018	Sludge	5.74 mg/kg	2.41 mg/kg	808. mg/kg					
	Detection_Limit	1.21/.89	.04/.004	1.01/.32	50. ug/l	5,000. ug/l	5,000. ug/l	250. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	13.64%	Can't Do	Can't Do	1.66%
Overall Removal Rate		Can't Do	71.11%	28.09%	Can't Do	14.39%	Can't Do	Can't Do	6.37%
SAMPLE 4									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
5/17/2018	Influent	1.05 ug/l	0.256 ug/l	91.7 ug/l	ND	118,000. ug/l	790,000. ug/l	4,700. ug/l	3,520. ug/l
5/18/2018	Effluent	1.08 ug/l	0.013 ug/l	41.7 ug/l	ND	110,000. ug/l	983,000. ug/l	ND	3,470. ug/l
5/17/2018	Prim._Clar.	1.13 ug/l	0.159 ug/l	107. ug/l	ND	122,000. ug/l	783,000. ug/l	4,800. ug/l	3,440. ug/l
	Sludge								
	Detection_Limit	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l	0. ug/l
Primary Removal Rate:		Can't Do	37.89%	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	2.27%
Overall Removal Rate		Can't Do	94.92%	54.53%	Can't Do	6.78%	Can't Do	Can't Do	1.42%
SAMPLE 5									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
9/10/2018	Influent	2.14 ug/l	0.066 ug/l	60.2 ug/l	ND	127,000. ug/l	719,000. ug/l	3,900. ug/l	2,750. ug/l
9/11/2018	Effluent	1.96 ug/l	0.007 ug/l	30.2 ug/l	ND	156,000. ug/l	932,000. ug/l	ND	3,040. ug/l
9/10/2018	Prim._Clar.	1.75 ug/l	0.075 ug/l	81.8 ug/l	ND	130,000. ug/l	736,000. ug/l	4,600. ug/l	2,770. ug/l
	Sludge								
	Detection_Limit	0.61/0.44	0.02/0.002	0.5/0.16	250. ug/l	5,000. ug/l	5,000. ug/l	250. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do
Overall Removal Rate		8.41%	89.39%	49.83%	Can't Do	Can't Do	Can't Do	Can't Do	Can't Do
SAMPLE 6									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
9/11/2018	Influent	2.37 ug/l	0.125 ug/l	71.3 ug/l	ND	194,000. ug/l	791,000. ug/l	5,000. ug/l	3,410. ug/l
9/12/2018	Effluent	1.99 ug/l	0.01 ug/l	32. ug/l	ND	177,000. ug/l	923,000. ug/l	1,400. ug/l	3,230. ug/l
9/11/2018	Prim._Clar.	2.13 ug/l	0.09 ug/l	61.1 ug/l	ND	168,000. ug/l	722,000. ug/l	3,200. ug/l	3,160. ug/l
9/11/2018	Sludge	8.23 mg/kg	16.3 mg/kg	1,120. mg/kg					
	Detection_Limit	0.61/0.44	0.02/0.002	0.5/0.16	500. ug/l	5,000. ug/l	5,000. ug/l	250. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	Can't Do	Can't Do	Can't Do	13.40%	Can't Do	36.00%	7.33%
Overall Removal Rate		16.03%	92.00%	55.12%	Can't Do	8.76%	Can't Do	72.00%	5.28%
SAMPLE 7									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
11/29/2018	Influent		0.052 ug/l	48.9 ug/l	ND	213,000. ug/l	693,000. ug/l	4,000. ug/l	2,630. ug/l
11/30/2018	Effluent	0.72 ug/l	0.006 ug/l	21.7 ug/l	ND	235,000. ug/l	822,000. ug/l	ND	2,500. ug/l
11/29/2018	Prim._Clar.	0.93 ug/l	0.054 ug/l	44.2 ug/l	ND	194,000. ug/l	650,000. ug/l	3,800. ug/l	2,500. ug/l
	Sludge								
	Detection_Limit	0.89 ug/l	0.004 ug/l	0.32 ug/l	250. ug/l	5,000. ug/l	5,000. ug/l	500. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	Can't Do	9.61%	Can't Do	Can't Do	Can't Do	Can't Do	4.94%
Overall Removal Rate		Can't Do	88.46%	55.62%	Can't Do	Can't Do	Can't Do	Can't Do	4.94%
SAMPLE 8									
Date:	LOCATION	Selenium	Silver	Zinc	NWTPH Gx	Sulphate	TDS	NWTPH Dx	Fluoride
11/30/2018	Influent		0.039 ug/l	49.7 ug/l	ND	257,000. ug/l	761,000. ug/l	3,700. ug/l	2,680. ug/l
12/1/2018	Effluent	0.64 ug/l	0.005 ug/l	22.3 ug/l	ND	236,000. ug/l	919,000. ug/l	ND	2,630. ug/l
11/30/2018	Prim._Clar.	1.11 ug/l	0.036 ug/l	45.3 ug/l	ND	243,000. ug/l	767,000. ug/l	3,600. ug/l	2,600. ug/l
11/30/2018	Sludge	6.7 mg/kg	8.81 mg/kg	946. mg/kg					
	Detection_Limit	0.89 ug/l	0.004 ug/l	0.32 ug/l	250. ug/l	5,000. ug/l	5,000. ug/l	500. ug/l	200. ug/l
Primary Removal Rate:		Can't Do	7.69%	8.85%	Can't Do	5.45%	Can't Do	Can't Do	2.99%
Overall Removal Rate		Can't Do	87.18%	55.13%	Can't Do	8.17%	Can't Do	Can't Do	1.87%

Part I: GENERAL INFORMATION

Receiving Water Hardness (if fresh)	62.4
(M)arine, (F)resh, or (B)oth Discharges	F
Sludge: Class A (A) or (C)eiling level	A
Plant: (A)ctivated sludge or (O)ther	A

Pollutant:	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Zinc
Part II: PLANT DATA - OPEN AND CHANGE "BASICDATA.XLS" VALUES IF FLOWS CONTRIBUTING FOR A PARTICULAR POLLUTANT VARY													
Total Plant Flow (in MGD)	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD	2.74 MGD
Domestic Flow (in MGD)	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD	0.926 MGD
Industrial Flow (in MGD)	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD	1.814 MGD
Infiltration/Inflow (by subtraction)	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD	0. MGD
Acute Dilution Factor	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1	23. : 1
Chronic Dilution Factor	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1	121. : 1
Dilution Factor for HH Limits	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1	185. : 1
Digester Flow (in MGD)	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD	0.0411 MGD
Dry Sludge Production Rate (US Tons/day)	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D	3.428 T/D
Part III: CONCENTRATIONS LIMITING THE POTW DUE TO PASS THROUGH OR INTERFERENCE													
WQ Acute criteria, aquatic life (mg/L)	9. mg/l	0.36 mg/l	0.0023 mg/l	1.18 mg/l	0.0114 mg/l	0.022 mg/l	0.0448 mg/l	0.00247 mg/l	NA	0.95 mg/l	0.02 mg/l	0.0018 mg/l	0.0785 mg/l
WQ Chronic criteria, aquatic life (mg/L)	1.6 mg/l	0.19 mg/l	0.0009 mg/l	0.141 mg/l	0.0079 mg/l	0.005 mg/l	0.00175 mg/l	0.00001 mg/l	NA	0.1058 mg/l	0.005 mg/l	NA	0.0711 mg/l
WQ Chronic criteria, human health (mg/L)	0.006 mg/l	NA	NA	NA	NA	0.009 mg/l	NA	0.00014 mg/l	NA	0.08 mg/l	0.06 mg/l	NA	NA
Activated Sludge Inhibition Level	NA	0.1 mg/l	1. mg/l	10. mg/l	1. mg/l	0.1 mg/l	1. mg/l	0.1 mg/l	NA	1. mg/l	NA	0.25 mg/l	1. mg/l
Anaerobic Digestor Inhibition Level	NA	1.6 mg/l	20. mg/l	NA	40. mg/l	4. mg/l	340. mg/l	NA	NA	10. mg/l	NA	13. mg/l	400. mg/l
Class A Sludge standards (40 CFR 503)	NA	41. mg/l	39. mg/l	NA	1,500. mg/l	NA	300. mg/l	17. mg/l	75. mg/l	420. mg/l	100. mg/l	NA	2,800. mg/l
Sludge ceiling concentration for beneficial use	NA	75. mg/l	85. mg/l	NA	4,300. mg/l	NA	840. mg/l	57. mg/l	75. mg/l	420. mg/l	100. mg/l	NA	7,500. mg/l
Part IV: POLLUTANT CONCENTRATION ------ SUMMARY													
Estimated Average Industrial Conc.	0. mg/l	0.004 mg/l	0. mg/l	0.004 mg/l	0.018 mg/l	0. mg/l	0. mg/l	0. mg/l	0.014 mg/l	0.007 mg/l	0.002 mg/l	0. mg/l	0.004 mg/l
Ambient Concentration (receiving water)	0.0000 mg/L	0.0010 mg/L	0.0000 mg/L	0.0004 mg/L	0.0011 mg/L	0.0000 mg/L	0.0002 mg/L	0.0000 mg/L	0.0000 mg/L	0.0009 mg/L	0.0003 mg/L	0.0000 mg/L	0.0036 mg/L
Adjusted Domestic concentration	0.00021 mg/l	0.0011 mg/l	0.00007 mg/l	0.0016 mg/l	0.0318 mg/l	0.00167 mg/l	0.00064 mg/l	0.00002 mg/l	0.00549 mg/l	0.00392 mg/l	0.00185 mg/l	0.0001 mg/l	0.06296 mg/l
Typical Domestic Concentrations	0.003 mg/l	0.003 mg/l	0.003 mg/l	0.05 mg/l	0.061 mg/l	0.041 mg/l	0.049 mg/l	0.0003 mg/l	0.01 mg/l	0.021 mg/l	0.001 mg/l	0.005 mg/l	0.175 mg/l
Average Sludge Level (mg/Kg - Dry)	1.778 mg/kg	3.781 mg/kg	1.773 mg/kg	40.469 mg/kg	685.208 mg/kg	0. mg/kg	17.714 mg/kg	0.497 mg/kg	17.617 mg/kg	41.076 mg/kg	6.956 mg/kg	7.583 mg/kg	1,016.64 mg/kg
Average Influent Level (mg/l)	0.0002 mg/l	0.0011 mg/l	0.0001 mg/l	0.0016 mg/l	0.0318 mg/l	0.0017 mg/l	0.0006 mg/l	0. mg/l	0.0055 mg/l	0.0039 mg/l	0.0019 mg/l	0.0001 mg/l	0.063 mg/l
Average Effluent Level (mg/l)	0.0002 mg/l	0.0013 mg/l	0. mg/l	0.0004 mg/l	0.008 mg/l	0.0025 mg/l	0.0001 mg/l	0. mg/l	0.0053 mg/l	0.0028 mg/l	0.0012 mg/l	0. mg/l	0.0315 mg/l
Part V: REMOVAL RATES													
Average Primary Removal Rate	11.20%	2.00%	36.04%	16.27%	7.55%	27.00%	34.59%	41.63%	9.12%	8.78%	2.00%	22.79%	6.28%
Average Overall Removal Rate	7.09%	6.37%	60.24%	76.40%	75.51%	69.00%	85.31%	96.57%	8.17%	33.48%	12.22%	87.18%	50.95%
Reference Primary Removal Rate	11.20%	2.00%	36.04%	16.27%	7.55%	27.00%	34.59%	41.63%	9.12%	8.78%	2.00%	22.79%	6.28%
Reference 2d Decile Plant Removal	31.00%	31.00%	33.00%	68.00%	67.00%	41.00%	39.00%	50.00%		25.00%	33.00%	50.00%	64.00%
Reference Ave Plant Removal	7.09%	6.37%	60.24%	76.40%	75.51%	69.00%	85.31%	96.57%	8.17%	33.48%	12.22%	87.18%	50.95%
Reference 8th Decile Removal	53.00%	53.00%	91.00%	91.00%	95.00%	84.00%	76.00%	79.00%		62.00%	67.00%	88.00%	88.00%
Part VI: HOW TO CALCULATE LIMITS:													
Sampling Data Available (inf, eff, sludge) (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Credit present loading of existing sources (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N
Adjust for receiving water pollution	N	N	N	N	N	N	N	N	N	N	N	N	N
Use Observed Overall Removal Rate (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N
Use Observed Primary Removal Rate (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N
Part VII: LOCAL LIMITS CORRESPONDING TO THE CRITERIA ABOVE BASED ON COMPLIANCE WITH:													
Acute WQ Standards (in mg/l)	336.544 mg/l	13.357 mg/l	0.201 mg/l	173.7 mg/l	1.596 mg/l	2.465 mg/l	10.591 mg/l	2.501 mg/l	NA	49.7 mg/l	0.79 mg/l	0.489 mg/l	5.53 mg/l
Chronic WQ Standards (in mg/l)	314.758 mg/l	37.089 mg/l	0.396 mg/l	NA	5.881 mg/l	3.065 mg/l	2.17105 mg/l	0.064 mg/l	NA	29.07 mg/l	1.04 mg/l	NA	26.45 mg/l
HH Limits (in mg/L)	1.805 mg/l	NA	NA	NA	NA	8.112 mg/l	NA	1.14 mg/l	NA	33.605 mg/l	19.1 mg/l	NA	NA
Sludge Application Limits (in mg/l)	NA	0.265 mg/l	0.028 mg/l	NA	0.489 mg/l	NA	0.15 mg/l	0.008 mg/l	0.318 mg/l	0.513 mg/l	0.345 mg/l	NA	1.586 mg/l
Activated Sludge Inhibition (in mg/l)	NA	0.154 mg/l	2.362 mg/l	18.04 mg/l	1.618 mg/l	0.206 mg/l	2.309 mg/l	0.259 mg/l	NA	1.654 mg/l	NA	0.489 mg/l	1.58 mg/l
Anaerobic Digestor Inhibition (in mg/l)	NA	0.568 mg/l	0.752 mg/l	NA	1.184 mg/l	0.13 mg/l	9.03 mg/l	NA	NA	0.675 mg/l	NA	0.338 mg/l	17.76 mg/l

this says N/

Appendix C

Pollutant:	Antimony	Arsenic(T)	Cadmium	Chrome (T)	Copper	Cyanide	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Zinc	
Part VIII: SAMPLE QUALITY: COMPARISON OF LOADINGS AND REMOVAL RATES IMPLIED BY SAMPLE DATA														
Pollutants in Influent (per sampling)	0.005 lbs	0.025 lbs	0.002 lbs	0.036 lbs	0.727 lbs	0.038 lbs	0.015 lbs	0. lbs	0.126 lbs	0.09 lbs	0.042 lbs	0.002 lbs	1.439 lbs	
Pollutants in biosolids (per sampling)	0.012 lbs	0.026 lbs	0.012 lbs	0.277 lbs	4.698 lbs	0. lbs	0.121 lbs	0.003 lbs	0.121 lbs	0.282 lbs	0.048 lbs	0.052 lbs	6.97 lbs	
Pollutants in effluent (per sampling)	0.005 lbs	0.03 lbs	0.001 lbs	0.008 lbs	0.179 lbs	0.056 lbs	0.002 lbs	0. lbs	0.12 lbs	0.064 lbs	0.028 lbs	0. lbs	0.708 lbs	
% Influent load accounted for: (eff/inf)	366.57%	223.89%	780.49%	783.61%	671.14%	147.13%	849.48%	754.42%	191.82%	385.61%	178.25%	2350.52%	533.64%	
Current HW Load Implied by Sludge Data:	0.172 lbs	0.407 lbs	0.02 lbs	0.363 lbs	6.221 lbs	0. lbs	0.142 lbs	0.004 lbs	1.479 lbs	0.841 lbs	0.39 lbs	0.06 lbs	13.68 lbs	
PART IX: MASS BASED ANALYSIS														
Limiting MAHL (Dom Load + LL*IUflow)	27.30 lb/d	2.33 lb/d	0.42 lb/d	272.93 lb/d	7.64 lb/d	1.99 lb/d	2.27 lb/d	0.12 lb/d	4.86 lb/d	7.79 lb/d	5.23 lb/d	5.11 lb/d	24.38 lb/d	
Max. Allowable Industrial Loading	27.30 lb/d	2.323 lb/d	0.42 lb/d	272.92 lb/d	7.4 lb/d	1.97 lb/d	2.27 lb/d	0.117 lb/d	4.816 lb/d	7.76 lb/d	5.22 lb/d	5.11 lb/d	23.9 lb/d	
Pollutant:	**Antimony**	**Arsenic(T)**	**Cadmium**	**Chrome (T)**	**Copper**	**Cyanide**	**Lead**	**Mercury**	**Molybdenum**	**Nickel**	**Selenium**	**Silver**	**Zinc**	
Lowest Limit	1.805 mg/l	0.154 mg/l	0.028 mg/l	18.04 mg/l	0.489 mg/l	0.13 mg/l	0.15 mg/l	0.008 mg/l	0.318 mg/l	0.513 mg/l	0.345 mg/l	0.338 mg/l	1.58 mg/l	
With 0.% of MAIL reserved for future IUs	1.805 mg/l	0.154 mg/l	0.028 mg/l	18.04 mg/l	0.49 mg/l	0.13 mg/l	0.15 mg/l	0.008 mg/l	0.318 mg/l	0.513 mg/l	0.345 mg/l	0.338 mg/l	1.58 mg/l	
With 10.% of MAHL reserved for growth	1.624 mg/l	0.138 mg/l	0.025 mg/l	16.236 mg/l	0.438 mg/l	0.117 mg/l	0.135 mg/l	0.007 mg/l	0.286 mg/l	0.461 mg/l	0.31 mg/l	0.304 mg/l	1.418 mg/l	
With both reservations (MAIL and MAHL)	1.624 mg/l	0.138 mg/l	0.025 mg/l	16.243 mg/l	0.437 mg/l	0.117 mg/l	0.135 mg/l			0.459 mg/l		0.304 mg/l	1.418 mg/l	
Dangerous Waste Threshold:		5.00 mg/l	1.00 mg/l	5.00 mg/l			5.00 mg/l	0.20 mg/l			1.00 mg/l	5.00 mg/l		
Karcher Avg Monthly			0.07 mg/l	1.71 mg/l	2.07 mg/l	0.65 mg/l	0.43 mg/l			2.38 mg/l		0.24 mg/l	1.48 mg/l	Flow
Karcher Maximum Day			0.11 mg/l	2.77 mg/l	3.38 mg/l	1.20 mg/l	0.69 mg/l			3.98 mg/l		0.43 mg/l	2.61 mg/l	9,999 gal/d
Karcher Categorical max lb/d			0.000916483	0.023078698	0.028161011	0.009997992	0.005748845			0.033160007		0.003582614	0.021745633	
mg/L to subtract			0.00006	0.001525484	0.001861421	0.00066086	0.000379994			0.002191851		0.000236808	0.00143737	
			0.025 mg/l	16.243 mg/l	0.437 mg/l	0.117 mg/l	0.135 mg/l			0.459 mg/l		0.304 mg/l	1.418 mg/l	

Change 1 - Zinc inhibtion to 1.0 instead of 0.3
Change 2 - Karcher Local Limits are set at their current Categorical Limits, this is accomplished by subtracting their current max lb/d from the Mail before final calculation of limit using Uniform Allocation Method for all other industries
Change 3 - Karcher flow has been subtracted from total industrial flow entered on line 27 of the Basic Data Page
Note: All flows used in the calculations are the permitted flows not actual flows which are (espcially for the semiconductor industries) considerably less.

SPREADSHEET BASED On SHEET CREATED BY D. NUNNALLEE, REV. 1-92 BY G. SHERVEY, MOD BY D. Knight 8-02

FACILITY: mas, Washington

RUN DATE: 5/23/2019

WATER QUALITY CRITERIA CALCULATIONS (in ug/L unless otherwise noted)

Receiving Water: (F)resh, (M)arine, (B)oth	F
Hardness for Use in Calculations:	62.40

POLLUTANT	PRIORITY PLTNT?	CARCIN GEN?	ATER QUALITY STANDARD FRESH ACUTE	FRESH CHRONIC	FRESH Hhealth	MARINE ACUTE	MARINE CHRONIC	MARINE Hhealth	COMMENTS	TOTAL LIMITING ACUTE	TOTAL LIMITING CHRONIC
ANTIMONY (INORGANIC) 7440360 1M			9000.00	1600.00	6.00			90.00		9,000. ug/l	1,600. ug/l
ARSENIC (dissolved) 7440382 2M	Y	Y	360. ug/l	190. ug/l	10. ug/l	69. ug/l	36. ug/l	10. ug/l	WAC 173-201A	360. ug/l	190. ug/l
ARSENIC (inorganic) Deleted'	Y	Y			0.018 ug/l			0.14 ug/l	Gold Book	0. ug/l	0. ug/l
Aluminum	N	N	750. ug/l	87. ug/l					Gold Book	750. ug/l	87. ug/l
CADMIUM - Dependent on Hardness in B6	Y	N	2.22 ug/l	0.73 ug/l		42. ug/l	9.3 ug/l		WAC 173-201A	2.304 ug/l	0.8621 ug/l
CHROMIUM(HEX)	Y	N	15. ug/l	10. ug/l		1,100. ug/l	50. ug/l			15.2749 ug/l	10.395 ug/l
CHROMIUM(T) - Dependent on hardness in B6	N	N	372.9 ug/l	121. ug/l		10,300. ug/l	NA		WAC 173-201A,	1,180.1419 ug/l	140.6662 ug/l
COPPER - Dependent on Hardness in B6	Y	N	10.91 ug/l	7.59 ug/l		4.8 ug/l	3.1 ug/l	1,300. ug/l	WAC 173-201A	11.3662 ug/l	7.9021 ug/l
CYANIDE	Y	N	22. ug/l	5.2 ug/l	9. ug/l	1.0 ug/l	1. ug/l	100. ug/l	WAC 173-201A	22. ug/l	5.2 ug/l
LEAD - Dependent on hardness in B6	Y	N	38.5 ug/l	1.5 ug/l		210. ug/l	8.1 ug/l		WAC 173-201A,	44.792 ug/l	1.7455 ug/l
MERCURY	Y	N	2.1 ug/l	0.012 ug/l	0.14 ug/l	1.8 ug/l	0.025 ug/l	0.15 ug/l	WAC 173-201A,	2.4706 ug/l	0.012 ug/l
Molybdenum	N	N									
NICKEL - Dependent on hardness in B6	Y	N	949.7 ug/l	105.5 ug/l	80. ug/l	74. ug/l	8.2 ug/l	100. ug/l	WAC 173-201A,	951.649 ug/l	105.7943 ug/l
SELENIUM	Y	N	20. ug/l	5. ug/l	60. ug/l	290. ug/l	71. ug/l	200. ug/l	WAC 173-201A,	20. ug/l	5. ug/l
SILVER - Dependent on hardness in B6.	Y	N	1.5 ug/l			1.9 ug/l			WAC 173-201A,	1.8035 ug/l	0. ug/l
Thallium	Y	N			1.7 ug/l			6.3 ug/l		0. ug/l	0. ug/l
Tributyl Tin (TBT)	N	N	0.460	0.072		0.420	0.007			0.46 ug/l	0.072 ug/l
ZINC- Dependent on hardness in B6	Y	N	76.7 ug/l	70.1 ug/l	1,000. ug/l	90. ug/l	81. ug/l	1,000. ug/l	WAC 173-201A,	78.4742 ug/l	71.0774 ug/l
Arsenic (inorganic)	Y	N			0.018 ug/l			0.14 ug/l	National Toxics Rule	0. ug/l	0. ug/l
#REF!										0. ug/l	0. ug/l

Appendix D
Long Hand Calculation of Arsenic Local Limits

Camas, Washington

Long Hand Calculation of Local Limit - Arsenic

Allowable Headwork Loading (AHL) Based on Protection of Water Quality

Acute WQS, Chronic WQS, Human Health HH, and NPDES Permit Limits

POTW's are required to prohibit nondomestic user discharges in amounts that result in violation of water quality Standards and/or NPDES Limits.
Washington State Water Quality Standards have been used as calculated from the Ecology Spreadsheet
Federal WQ criteria are found at: http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
NPDES Limits are found in NPDES Permit # WA-0020249
The dilution factors applied are acute 23:1, chronic 121:1, Human Health (HH) 184:1

Hardness Utilized: 62.4

Arsenic

State WQS Acute =	340	340.0	µg/l
State WQS Chronic =	150	150.0	µg/l
Federal WQS Acute =		NA	µg/l
Federal WQS Chronic =		NA	µg/l
HH =	NA	NA	µg/l
NPDES =	NA	NA	µg/l

The Allowable Headworks Loadings in Table A are calculated using the following equation:

$$Lwqs = \frac{(8.34)(Ccrit)(Qpotw * Dilution\ Factor)}{(1-Rpotw)}$$

Where:

Lwqs = Maximum allowable headworks loading (lbs/day) based on NPDES permit limits or Water Quality Criteria
Ccrit= (NPDES effluent limits or WQ criteria expressed as mg/L)
Qpotw= (POTW average flow in MGD)
Dilution Factor = (1 is equivalent to no dilution factor)
Rpotw = (Overall Removal Factor as a decimal)

Table A

State Acute	State Chronic	Federal Acute	Federal Chronic	LA HH	NPDES
Arsenic	Arsenic	Arsenic	Arsenic	Arsenic	Arsenic
0.34	0.150				
2.74	2.74	2.74	2.74	2.74	2.74
23.00	121.00	23.00	121.00	185.00	1.00
6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
Water Quality Based AHLs		lb/d			
190.86	442.99				

Arsenic

Calculation of most Stringent WQS AHL

$$Lwqs = \frac{(8.34\ lb/gal\ X\ \ 0.34000\ \ mg/l\ X\ \ 2.74\ \ MGD\ X\ \ 23\ :1)}{1\ -\ 0.0637} = 190.86\ lb/d$$

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Allowable Headwork Loading (AHL) Based on Sludge Criteria **Arsenic**

Maximum headwork criteria to protect sludge quality are found in 40 CFR 503 in Table 3

The Allowable Headworks Loading in Table B are calculated using the following equation:

Lin = (8.34)(Cslcrit)(SGsldg)(PS/100)(Qsldg) / Rpotw

Where:

Lin =	Allowable Headwork Pounds per Day	Arsenic
Cslcrit =	Limiting sludge criteria (mg/kg)(Table 3)	41
SGsldg =	Specific Gravity of the Sludge kg/L	1
PS =	Percent solids in the sludge to disposal (%)	2
Qsldg =	Sludge flow to disposal (MGD)	0.0411
Rpotw =	POTW removal efficiency (as a decimal)	6.4%

The daily sludge flow and percent solids is not available

Values used are based on standard design estimation methods used in the Wasington Ecology spreadsheet.

Table B

40 CFR 503 Pollutant	Table 3 Clean Sludge (mg/kg)	Table 1 Ceiling Sludge (mg/kg)
Arsenic	41	75
Cadmium	39	85
Chromium	NA	NA
Copper	1500	4300
Cyanide	NA	NA
Lead	300	840
Mercury	17	57
Molybdenum	NA	75
Nickel	420	420
Selenium	100	100
Silver	NA	NA
Zinc	2800	

Sludge Quality Based AHL

4.41 lb/d

Arsenic

Lin = (8.34 lb/g X 41 mg/l 1 kg/L X 2% solids X 0.0 MGD = / 0.0637 = 4.41 lb/d

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Long Hand Calculation of Local Limit - Arsenic

Allowable Headwork Loading (AHL) Based On Inhibition **Arsenic**

Literature Values for inhibition are found in the EPA Local Limits Guidance 2004 Appendix G.
The criteria used to calculate inhibition are shown in Table C for: Activated Waste
The following equation was used to derive the allowable headwork loadings shown in Table C

For Secondary Treatment Inhibition the equation is:

$$Linhib2 = \frac{(8.34)(Ccrit)(Qpotw)}{(1-Rprim)}$$

Where:

Linhib2 = Maximum allowable headworks loading (lbs/d) based on inhibition of secondary process
Ccrit = Inhibition level (mg/l) for Activated Sludge
Rprim = Primary removal efficiency as a decimal, (if no primary - zero)
Qpotw = POTW average flow

Arsenic
0.1
2.0%
2.74

Note: When a range has been indicated the low range value has been selected.

Table C

Pollutant	Inihibition Secondary Activated Sludge	NItrogen Inhibition
Arsenic	0.1	1.5
Cadmium	1-10	5.2
Chromium	1-100	.25-1.9
Copper	1	.05-.48
Cyanide	0.1-5	.34-.5
Lead	1.0-5.0	0.5
Mercury	0.1-1	
Nickel	1.0-5.0	.25-.5
Selenium		
Silver		
Zinc	.3-10	.08-.5

Activated Waste Inhibition Based AHL
2.33 lb/d

Arsenic

$$Linhib2 = \frac{(8.34\ lb/gal \times 0.10\ mg/l \quad 2.74\ MGD)}{1 - 0.0200} = 2.33\ lb/d$$

For Anaerobic Inhibition the equation is:

Literature Values for inhibition are found in the EPA Local Limits Guidance 2004 Appendix G.
The criteria used to calculate inhibition are shown in Table D for: Anaerobic Digestion
The following equation was used to derive the allowable headwork loadings shown in Table D

$$Linhibdgstr = \frac{(8.34)*(Ccrit)(Qdig)}{Rpotw}$$

Where:

Linhibdgstr = Maximum allowable headworks loading (lbs/d) based on inhibition of Anaerobic Digestion
Ccrit = Inhibition level (mg/l) for Anaerobic Digestion
Qdig = Sludge flow to disposal (MGD)
Rpotw = POTW removal efficiency (as a decimal)

Arsenic
1.6
0.0411
6.37%

Table D

Pollutant	Inihibition Anaerobic Sludge
Arsenic	1.6
Cadmium	20
Chromium	130
Copper	40
Cyanide	4
Lead	340
Mercury	NA
Nickel	10
Selenium	NA
Silver	13
Zinc	400

Anaerobic Digestion Based AHL
8.606 lb/d

Arsenic

$$Linhibdgstr = \frac{(8.34\ lb/gal \times 1.6\ mg/L \times 0.041\ MGD)}{6.37\%} = 8.606\ lb/d$$

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Long Hand Calculation of Local Limit - Arsenic
Arsenic

Selection of Lowest AHL Representing Maximum Allowable Headworks Loading (MAHL)

The smallest of the above calculated values is selected as the MAHL

Selection of MAHL lb/d										
	State Acute	State Chronic	Federal Acute	Federal Chronic	HH	NPDES	Sludge Quality	Secondary Inhibition	Anaerobic Inhibition	Maximum Allowable Headworks Loading (MAHL)
Arsenic	190.86	442.99					4.411	2.33	8.6062641	2.332

Calculation of the Maximum Allowable Industrial Loading (MAIL)

The domestic (uncontrollable) sources and a safety/growth factor are subtracted from the MAHL to calculate the MAIL as follows:

MAIL = (MAHL)(1-SF) - L_{unc})

Where:

MAIL = Maximum available industrial loading, lbs/day

	Arsenic
MAHL = Maximum allowable headworks loading, lbs/day	2.332
SF = Safety and Growth factor, as a decimal	10%
L_{unc} = Loadings from uncontrolled sources	0.008

Using conservative approach L_{unc} has been established using (domestic flow =average plant influent-permitted industrial flow) and average influent concentration as follows:

L_{unc} = (average Influent concentration in mg/L)(average domestic flow to POTW)(8.34)

lb/d) X (1 -

Arsenic

L_{unc} = 1.1 ug/L./1000ug/mg X 0.93 MGD X 8.34) = 0.008 lb/d

MAIL = (2.332 lb/d X (1 - 10%) - 0.00848595 lb/d) = 2.090 lb/d

Calculation of Industrial Local Limit mg/l using Uniform Allocation Method

The uniform allocation method divides the MAIL by the industrial flow and a factor of 8.34 to convert to a concentration based limit using the following equation:

$$\text{Local Limit} = \frac{\text{MAIL lb/d}}{(8.34 \text{ X } Q_i)}$$

Q_i = Total Industrial Flow, MGD 1.815 MGD

Arsenic

Arsenic Local Limit = 2.090 lb/d divided by (8.34 X 1.815 MGD) = **0.138 mg/l**

Appendix E
Definitions

Definitions

Allowable Headworks Loading (AHL)	The estimated maximum loading of a pollutant that can be received at a POTW's headworks that should not cause a POTW to violate a particular treatment plant or environmental criterion. AHLs are developed to prevent interference or pass through.
Applicable Criteria	A regulation or standard that must be considered in the development of a local limit.
Best Management Practice	Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the U.S. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. (EPA definition)
Best Professional Judgment	Use of experience and technical expertise to determine a course of action for which a clear-cut direction is not available in statutory or research literature.
Biological Treatment	A treatment process that depends on use of microbiological processes to remove pollutants or render them to a less objectionable state.
Book Values	Numeric values that have been determined in research studies to apply to similar processes. Most information is taken from EPA's 2004 *Guidance Manual on Development of Local Limits* (EPA Publication EPA 833-R-04-002A). See also *Reference Values*.
Categorical User	Industry subject to a category listed in 40 CFR 405-471. By definition, Categorical Users are also listed as Significant Industrial Users.
Chemical Treatment	A treatment process that uses a chemical reaction to reduce pollutants, make pollutants easier to treat, or render them less objectionable. An example includes pH adjustment.
chemically enhanced	The addition of chemicals to the waste stream to enhance the actions of a treatment process that is already present in the system.
Cobalt (Pt/Co) Scale	The Cobalt (Pt/Co) scale is a measure of color is a scale where each unit of the scale is defined as the color induced by dissolving 1 milligram per liter (mg/L) of platinum in water using cobalt platinate as the solute.
composting	The process of adding vegetable matter and accelerating decomposition into a humus-like substance by various micro-organisms including bacteria, fungi, and actinomycetes in the presence of oxygen. The resulting product is used for soil amendment.
Concurrent Sampling	Sampling conducted at the same time, or with lag period approximately equivalent to the time that the flow is resident in any portion of the system. Concurrent sampling estimates how any given characteristic changes as flow moves through the system.
Conservative Pollutant	Pollutants that are presumed not to be destroyed, biodegraded, chemically transformed, or volatilized within the publicly owned treatment works (POTW). Conservative pollutants introduced to a POTW ultimately exit the POTW solely through the POTW's effluent and sludge. Most metals are considered conservative pollutants.
Control Efficiency	The percent capture of a pollutant that is removed by a control measure installed specifically to remove that pollutant.
Criteria	A regulation or standard that may be applicable to the development of a local limit.
Design Capacity, Design Flow	The theoretical capacity based on engineering studies. Capacity is typically engineered into the original design. Changes to the system based on the system actually built after design may differ if changes were made to the design during construction, which results in the final "As-Built Capacity".
Dispersion Factor	A factor that describes how air emissions mix with the ambient air after being emitted from the original source.
Domestic (L_{unch})	Domestic waste describes waste that is generated by residential use and light commercial. In practice, the calculations typically treat domestic waste as the flow that remains after all permitted industrial flow is removed from the waste stream which does not apply a factor for non-permitted commercial. See *Domestic Approximation.*

Domestic Approximation	Domestic sampling typically is taken from low-flow areas, as an alternative the test data from the influent is used to represent domestic contributions. This data consist of all dischargers including domestic, commercial and industrial. Use of the data is a conservative assumption.
domestic strength	Waste generated from residential use only varies appreciably between communities (for example, average biochemical oxygen demand [BOD] ranges from <180 mg/L to >300 mg/L). Using BPJ, the most typical concentration used in local limits and ordinances is 250 mg/L for BOD and for TSS.
Emission Standards	Emission standards are legal requirements governing air pollutants released into the atmosphere.
General Limit(s)	Limits that are taken from the Puerto Rico Aqueduct and Sewer Authority Rules and Regulations for Supply of Water and Sewer Services.
Guidance Document	Unless otherwise denoted, indicates the use of the U.S. Environmental Protection Agency Office of Wastewater Management. 2004. Local Limits Development Guidance. EPA Publication EPA 833-R-04-002A. July 2004.
Headworks	The point at which wastewater enters a wastewater treatment plant. The headworks may consist of bar screens, comminuter, wet wells, and/or pumps.
Headworks Analysis	The process of taking concurrent sample at the influent and the effluent of a plant as well as other key sites in the system to determine how much of a pollutant is removed by the treatment system. This information is then used to calculate the maximum quantity of each pollutant that can be received and still meet all applicable criteria.
Implementation	Specification of how Technically Based Local Limits will be applied and to which users will require routine monitoring.
Industrial test data	Monitoring data collected from the discharge point for each industry. For use in local limits, flow is also required to convert to the mass of pollutant contributed to the treatment system.
Industrial User	Any user who is involved in commercial business practice that discharges wastewater that was generated as part of the commercial process at a rate that sufficient exceeds domestic strength or volume so as to require regulation to protect the treatment process.
Industry Specific Limit	A limit established in individual industrial permits to limit discharge of pollutants which could interfere or use excessive capacity of the treatment plant. Industry specific limits are placed directly into the industrial permit as specified in the Guidance Manual Table 6-2 row three and are based on a non-uniform allocation of the capacity or MAIL available to industry. Limits may be based on a range of rationale between implementation of best management practices to requirements to install treatment equipment sufficient to protect the wastewater plant. Ultimately, the POTW will want to allocate pollutant loadings in a fair and sensible way that does not favor any one industry or group of industries, considers the economic impacts, maintains compliance with the NPDES permit, and otherwise achieves the environmental goals of the program.
Inhibition	Inhibition occurs when pollutant levels in a POTW's wastewater or sludge cause operational problems for biological treatment processes involving secondary or tertiary wastewater treatment and alter the POTW's ability to adequately remove BOD, TSS, and other pollutants.
Interference (positive/negative)	Laboratory test methods are based on attribute(s) of the pollutant being tested. Other materials or sample attributes can interfere with achieving an accurate assessment of the pollutant being tested. When the result that is obtained is higher than the actual value, this is referred to positive interference. When the results are lower than the actual value, the interference is referred to as negative.
land application	Land application is the process of spreading treated wastewater sludge onto land for agricultural purposes improving the lands nutrient and organic matter content. Land application is subject to regulatory requirements under 40 CFR 503.
landfill option	Disposal of sludge in an approved landfill. The landfilling of sludge is subject to regulations in 40 CFR 257.
Lower Explosive Limits (LEL)	The minimum concentration in air at which a gas or vapor will explode or burn in the presence of an ignition source.

Maximum Allowable Headworks Loading (MAHL)	The estimated maximum loading of a pollutant that can be received at a POTW's headworks without causing pass through or interference. The most protective (lowest) of the AHLs (see definition) estimated for a pollutant.
Maximum Allowable Industrial Loading (MAIL)	The estimated maximum loading of a pollutant that can be received at a POTW's headworks from all permitted industrial users and other controlled sources without causing pass through or interference. The MAIL is usually calculated by applying a safety factor to the MAHL and discounting for uncontrolled sources, hauled waste, and growth allowance.
Method Detection Limit (MDL)	The minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is present as determined by a specific laboratory method in 40 CFR Part 136, Appendix B.
non-conservative Pollutant	Pollutants that are presumed to be destroyed, biodegraded, chemically transformed, or volatilized within the POTW to some degree.
Non-domestic Discharge	Any discharge to the collection system from a permitted source.
Other Permitted User	A source of discharge which has been given a discharge permit but does not fit the definition of categorical or significant industrial user.
overall removal rate	The percent removal of a specific pollutant that occurs from the point of industrial waste discharge to the NPDES specified wastewater treatment plant discharge point.
Partition Coefficient	The percent of a specific pollutant removed across a process or the system, synonymous with "Removal Factor" and "Removal Coefficient".
Physical treatment	A treatment process that uses a physical process to reduce pollutants, make pollutants easier to treat, or render them less objectionable. Examples include settling of particles and shredding of rags and debris.
Plug flow	Plug flow is the flow of materials through a pipe or processes that do not appreciably mix contents with flow that occurred earlier or later in time.
Pollutant of Concern (POC)	Any pollutant that might reasonably be expected to be discharged to the POTW in sufficient amounts to pass through or interfere with the works, contaminate its sludge, cause problems in its collection system, or jeopardize its workers.
positive interfering material	A substance that causes a higher than accurate result in a laboratory tests.
primary removal rate	The percent removal of a specific pollutant that occurs from the point of entry to the point of exit from a primary clarifier(s). For a system with multiple treatment processes, the primary removal rate is used in the calculation of inhibition of biological treatment.
reference values (i.e. removal rate)	Numeric values that have been determined in research studies to apply to similar processes. Most information is taken from EPA's 2004 *Guidance Manual on Development of Local Limits* (EPA Publication EPA 833-R-04-002A). See also *Book Values*.
Removal Coefficient	The percent of a specific pollutant removed across a process or the system, synonymous with "Removal Factor" and "Partition Coefficient".
Removal Factor	The percent of a specific pollutant removed across a process or the system, synonymous with "Removal Coefficient" and "Partition Coefficient".
Scrubber equipment	Equipment installed specifically to remove a pollutant from the waste stream in the context of local limits scrubber equipment is used to remove metals from emissions from incinerated waste.
Significant Industrial User	As defined in 40 CFR 403.3, all users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR chapter I, subchapter N; and any other industrial user that discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, non-contact cooling and boiler blowdown wastewater); contributes a process waste stream 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 defined in 40 CFR 403.12(a) 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)].

Site (system) Characterization	A description of the wastewater system including size, capacity, unit processes used, and industries that discharge to the system and receiving stream. The purpose of the site characterization is to create a record of what was present at the time of the limits development for future comparison when determining if new limits are needed.
Sludge Disposal Option	The method selected to dispose of the solid materials removed from wastewater. The most frequently used options include but are not limited to burial in a landfill site, application to land for agricultural purposes, incineration, or conversion to commercial fertilizer.
Sludge Removal Step	Any step in a wastewater treatment plant that removes solid or semi-solid materials from the waste stream.
Standard Calculations	Calculations that follow exact equations specified in the EPA's 2004 *Local Limits Development Guidance* (EPA Publication EPA 833-R-04-002A) for each of the treatment processes found within a wastewater plant.
Surfactant	Surfactants are compounds that lower the surface tension between two liquids or between a liquid and a solid. Surfactants may act as detergents, wetting agents, emulsifiers, foaming agents, and dispersants. Surfactant may be anionic or cationic with the vast majority being cationic. Surfactant limits are based on methylene blue active substances, which are anionic and are chiefly in the wastewater stream from detergents.
Surrogate	A value adopted to complete a calculation when a true value is not available because the test data are below the MDL. EPA guidance indicates that the MDL, ½ of the MDL, or zero may be used. Unlike book values, surrogates are not based on previous studies or data and can cause very high differences in the removal rates calculated and consequently the final local limit. Surrogates are not used in this local limits derivation except when the effluent is below the MDL and the influent is high enough to indicate that a removal rate is present.
Time Weighted Average Threshold Limit Value (TWA-TLV)	The concentration to which a worker can be exposed for 8 hours per day, 40 hours per week and not have any acute or chronic adverse health effects (commonly accepted exposure limits identified by the ACGIH).
Total Metals	Total metals is a descriptor of metal content of a sample after all organic material has been digested using a vigorous acid digestion it does not include metals that are tightly bound inside inorganic particles, such as grit and sand.
Toxicity Leaching Procedure	A laboratory procedure designed to predict whether a particular waste is likely to leach chemicals into groundwater at dangerous levels. Details are provided in 40 CFR Part 261.
True Color	Color is the preferential reflection or transmittance of a specific light frequency within the visible light range. True color is the color of water after filtration to remove any colored solid or colloidal materials.
Uniform Allocation	A method of developing local limits in which the mass of a pollutant that is available to industry is first determined and is then allocated as the same concentration limit to all industries.